H. J. Denecke and R. Meyer

Plastic Surgery of Head and Neck

Volume I

Corrective and Reconstructive Rhinoplasty

Translated by L. Oxtoby
with technical assistance by G. B. Bienias

515 Illustrations

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Hans Joachim Denecke, Professor, Dr. med., Oto-Rhino-Laryngologist, Speyerer Hof Hospital, Heidelberg

Rudolf Meyer, Dr. med., Associate Professor for Plastic Surgery at the University Hospital, Lausaune

Lowell Oxtoby, M. A., Heidelberg — San Francisco

Gert B. Bienias, Dr. med., F. I. C. S., Private Hospital Dr. Gaertner Diakonissenanstalt, Munich

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Foreword

... fungar vice cotis, acutum
reddere quae ferrum valet exsors ipsa secandi
(HORACE, *Ars poetica*)

Era da prevedere che dopo parentesi assai lunga di silenziosa elaborazione, al grande sviluppo della chirurgia plastica ed al suo affermarsi come «specialità» generalmente riconosciuta, seguisse la fioritura di testi vari di mole e di intenzione a quella dedicati.

Lodevoli opere quasi tutte ma per la maggior parte riflettenti massima la preoccupazione degli autori di esibire i più brillanti risultati raggiunti anzichè indicare con sufficiente chiarezza e dettaglio i mezzi più idonei a conseguirli.

Ma ecco finalmente uscire per le stampe questi volumi splendidi di veste dove gli Autori, pur valentissimi chirurghi, quasi dappertutto rinunciano a far bella mostra di sè col fotografico sciorinamento di quanto pur sanno fare ed invece con modestia pari a quella dell'antico Poeta esporre ogni più riposto dettaglio di interventi fondamentali o meno comuni valendosi del sussidio di figure di rigorosa rispondenza e di insuperata artistica efficacia.

Opera questa destinata ad imporsi ed a rimanere proprio perchè di essa può farsi il raro elogio d'essere veramente strumento di lavoro cui tanti chirurghi non mancheranno di fare frequente ricorso onde affinare la propria esperienza proprio come Orazio pensava dovesse essere dell'opera sua.

Nobile fatica quella che sopratutto si propone di migliorarci in ciò che vogliamo apprendere e questo anche se a proposito di così difficile impresa bisogna pur richiamare il monito di un altro Poeta sollecito a ricordare che solo un tanto dell'Arte può essere insegnato, chè il resto è tuttavia l'Artista che se lo deve da solo imparare ...

... nur ein Teil der Kunst kann gelehrt werden:
der Künstler macht das Ganze!
(GOETHE)

Milano G. SANVENERO-ROSSELLI

After a rather long period of silent development of plastic surgery to a high level and to its establishment as a generally recognized specialty, it was to be expected that books varying in scope and tendency would follow.

Almost all of these works are praiseworthy, but for the most part they generally reflect the preoccupation of their authors with exhibiting their most brilliant results instead of showing the most ideal methods of accomplishing them with sufficient clarity and detail.

But at last a book of splendid format has been published in which the authors, although they are very talented surgeons, almost everywhere abstain from displaying their ability through photographic reproduction and instead, with a modesty comparable to that of the classical poet, expose every most obscure detail of basic and lesser known procedures using meticulously accurate illustrations which are of unsurpassed artistic efficacy.

This work is destined to find its place and retain it because it deserves the rare praise of being truly a tool to which many surgeons will have cause to resort in order to refine their own experience, in the same manner in which Horace thought his works should be used.

It is a noble goal which, above all, proposes that we improve ourselves in that which we want to learn, and this too, when one is confronted with such a difficult purpose, one must recall the advice of another poet whose intent was to remind us that only a part of art can be taught, and that the rest must be learned by the artist himself.

... nur ein Teil der Kunst kann gelehrt werden:
der Künstler macht das Ganze!

(Goethe)

Milan

G. Sanvenero-Rosselli

Preface

At the suggestion of practicing ear, nose and throat physicians, the two authors have recorded their experience in the field of corrective and reconstructive surgery of this and related areas. From the very copious literature on the subject they have chosen those surgical techniques knowledge of which seemed appropriate. Their starting point was the assumption that such a surgical text should present the technique to the reader in words and illustrations. In the selection of illustrative material artists' drawings were chosen, while photographic reproductions which considerably increase the cost of a book were omitted. Every surgeon has good and bad results, and the steps of an operation can not be seen in photographs.

This book should make it possible for the surgeon to orient himself before and during an operation without loss of time. Recent accident injuries which require immediate treatment often unexpectedly confront the less experienced surgeon with difficult problems of plastic surgery. If too little consideration is given to the later cosmetic result during the first operation, one can compensate for this omission only by more extensive plastic surgery. Even then it can be difficult to obtain passably good results. The best chances are thrown away in this manner.

The situation is similar in tumor surgery of the facial structures and of the neck. In extirpation of tumors the surgeon experienced in plastic surgery will obtain much more favorable results than the inexperienced surgeon. As a rule, in these cases as well, the reconstructive operation is made at an early date, immediately following the major operation, rather than later when scarring has occurred. In extensive tumors and serious injuries due to accidents affecting the nose and the nasal sinuses, one is involved with surgery of the dura and the adjacent parts of the skull. The orbit can likewise be affected and thus require plastic treatment.

In the region of the ear the situation is similar. More deeply seated processes may have affected the dura and adjacent parts of the skull. In addition to the surgery intended for healing the disease, plastic surgery may also be necessary.

With regard to the region of the larynx, the trachea, and the cervical part of the esophagus, the authors have begun their discussion of surgical techniques where general laryngological surgery can be considered to stop and plastic treatment begins. The standpoint of the authors remains unaltered that the original operation, which leaves the defect, and the plastic replacement should be done by the same person. The technique of general laryngological surgery can be found in other surgical textbooks.

Disfigurement can result from surgery in inflammatory processes which may in part be destructive to bone. For correction of such disfigurements the authors have attempted to present surgical methods with the greatest number of modifications. It goes without saying that much consideration is given to the correction of malformations such as cleft lip and palate, choanal atresia, microtia, fistulas, etc. — In the region of the nose, pharynx, larynx, trachea and esophagus, surgical techniques have been discussed which improve or restore the function of these organs. — Today the increase of radiation therapy in the region of the head and neck more often demands corrective and reconstructive surgery which must be done under difficult conditions in areas with disturbed nutrition. A position has been taken with regard to these problems as well as to the problems of plastic surgery in aging and senile patients.

What is presented here should not replace other surgical textbooks but rather supplement them in that it presents the now important field of plastic surgery from the standpoint of the otorhinolaryngologist. From the vast quantity which has been written on the subject in which entirely opposite views are often expressed, the authors bring to the reader that which they consider essential. Whereas in other authors' books on plastic surgery their own procedures have been discussed, in this book the tested methods of various surgeons are presented.

The material has been arranged in such a way that the first volume includes plastic surgery of the nose and some basic techniques of plastic surgery. In the second volume plastic surgery of the rest of the face, ears, and neck including the larynx, cervical part of the trachea, and the pharynx are presented.

The bibliography contains all the related literature of the world so far as it was available. It is found at the end of each volume, arranged according to chapters. — The index is as extensive as possible to enable the surgeon to look up individual surgical procedures and their steps more easily. The index was likewise compiled separately for each volume.

The authors express their recognition and thanks to Mr. Hans Brand, who made his illustrations in Germany, and to Mr. Horst Schumacher, who was able to work in Switzerland due to the generosity of the publisher. Both have created illustrations with great ability and unprecedented diligence. Indefatigably they have thought themselves into the often difficult anatomical relevance of the individual surgical procedures and in this way have created very impressive illustrations.

Dr. med. Maria-Ursula Denecke, specialist for diseases of the ear, nose and throat, was especially helpful in arranging and formulating the German text. The index was compiled by her. The authors express their most profound thanks for her talent in making the German text quite understandable and arranging it clearly.

Encouraged by the success of the German edition and upon the advice and request of many non-German-speaking readers, the authors and the publishers have decided to offer an English edition as well. We are aware that there are very excellent works in English on the same topic. The reader now has the opportunity to become more closely acquainted with many European procedures. These procedures are not so thoroughly known in other regions of the world because of language barriers and difficulty in procuring the literature.

The authors thank Mr. Lowell Oxtoby for translating the book into English. His translation was discussed with Dr. med. Maria-Ursula Denecke and was checked by Dr. med. Gert Bienias to assure accuracy of clinical expressions.

Our special thanks are due to the Springer-Verlag for the trust which they have extended to us and for the fine format of this volume.

Heidelberg/Lausanne H. J. Denecke · R. Meyer

Translator's note

The basic premise of the translator was to write an "American" English to be understood in as many parts of the world as possible. The requirements of this task were:

1. To translate in a simple style, without the use of many flowery phrases.
2. To minimize the use of synonyms and to use short words where they suffice.
3. To reduce the length of sentences to improve readability and clarity of the text.
4. To be consistent in the use of terms which designate an anatomical feature or describe a procedure and thus avoid confusion. With the approval of the authors, the terms "lower lateral cartilage", "upper lateral cartilage", and "septal cartilage," for example, are used in this text and are the same as "alar cartilage," "triangular cartilage," and "quadrilateral cartilage," respectively, which are also proper. The former were deemed more common.

My gratitude must be expressed to Dr. med. M.-U. DENECKE and to Dr. med. G. BIENIAS for their invaluable assistance in the struggle for logical, factual and clinical accuracy.

Heidelberg L. OXTOBY

Contents

A. History of rhinoplasty

The history of rhinoplasty is the most interesting of all areas of plastic surgery. It can be divided into three periods. The first goes back to the Stone Age, where the earliest records are to be found; the second includes the time from 1450 to 1860; and the third, the last hundred years. Plastic surgery of the nose was already performed in India and in Egypt between 2500 and 600 B.C. One finds records of this in ancient Indian writings as well as in Egyptian hieroglyphics. Over 2,000 years ago SUSRUTA SAMHITA described in his work, the Ayur-Veda, the method used at that time for reconstruction of the nose using skin from the forehead and cheek. The nose, ears, and lips were customarily cut off for particular offenses against law and morality, as well as among prisoners of war. The reconstruction of parts of the body lost in this manner was assigned to the Comaas; this was a caste of potters, who seemed to be predestined to perform this task, probably because of their sense of form and expression, together with their capability of creating sculptures. The Indians even used free skin grafts from the buttocks for the reconstruction of noses.

AULUS CORNELIUS CELSUS described amazing details from the Alexandrian school about operations of the nose, lips and eyelids. By way of Persia and Arabia this surgical technique came to Greece and Italy for the first time in the 15th Century. Around 1450 the father and son of the BRANCA family made outstanding accomplishments. They used the Indian method for nasal reconstruction. The son, Antonio, also began to use pedicled flaps from the upper arm, a method which was taken up again a century later by GASPARE TAGLIACOZZI. TAGLIACOZZI described this so-called Italian method in his famous work on plastic surgery. It is remarkable in what detail the procedure of TAGLIACOZZI corresponds to present technique, although his work was forgotten for hundreds of years. TAGLIACOZZI ist also responsible for the wise saying that reconstruction is not performed to please the eye, but rather to cheer the spirit of the one afflicted. At that time he had to fight desperate battles with the Church, whose standpoint was that deformities by birth or accident were willed by God. After his death his soul was damned, his body exhumed and buried outside of the cemetery. Today a bust in his honor stands at the University of Bologna. TAGLIACOZZI had only few disciples: a professor of surgery in Messina, CORTESI, who changed his methods somewhat; and GRIFFON, a surgeon in Lausanne, who, at the end of the 16th Century, is said to have performed successfully rhinoplasties on two girls. It is assumed that these two cases are the only such operations performed outside of Italy at that time. Other followers of TAGLIACOZZI were THOMAS FIENUS of Antwerp, who moved to Bologna and became his student, and MOLINETTI, who reconstructed a nose by plastic operation in Venice. Two centuries passed, the 16th and 17th, in which plastic facial reconstruction was forgotten. Legend and scorn surrounded the work of TAGLIACOZZI. In 1793 news of successful rhinoplasties arrived from India. In a newspaper from Madras appeared a description of a reconstruction: a surgeon near Kumar, in the Poona region, had reconstructed the nose of an Indian oxen-driver which had been amputated while the man was a prisoner of war. In 1814, the English doctor, JOSEPH CARPUE, who had studied this report about reconstruction using a forehead flap, successfully performed the same operation on an officer. Two years later in Berlin KARL FERDINAND VON GRAEFE used an arm flap to replace a soldier's nose, which had been cut off with a saber. Many imitators followed in France (DUPUYTREN, DELPECH, LISFRANC, LABAT, SERRE), Italy (SIGNORINI, BARONI, RIBERI), England (HUTCHINSON, SYME), Russia (HÖFFT, DYBECK), America (WARREN), and in Germany (BECK, BÜNGER, HEIDENREICH and ZEIS). The most important one was the Berlin physician JOHANN FRIEDRICH DIEFFENBACH, who not only perfected the Indian and Italian methods but also introduced other methods of nasal and facial plastic surgery. He is said already to have mastered the technique of tubed pedicle flaps as well (BÜRKLE DE LA CAMP). He was the only one of the pioneers of his time who, before his sudden death, saw the discovery of anesthesia and with all his progressive ideas saw the coming of the revolution in surgery that it would cause. He said that his own work would be compared to the results of the future "like rough lathe work to the work of a sculptor or like doll carving to CANOVA's masterpieces." It was also DIEFFENBACH, in his "Operative Chirurgie" (1845), who first spoke of a reduction of the nose, however without describing the technique. With this there was for the first time talk of corrective rhinoplasty, which developed further during the following decades with contributions of the Americans, ROE, INGALS, and WEIR. Reconstructive surgery of the nasal structure, as well as further development of the replacement of external nasal skin and of the mucosa, have their beginnings around 1860 as rhinoplasty of the modern times. At the turn of the century septum surgery begins with INGALS, KRIEG, FREER, and KILLIAN. The first total nasal reduction without external incision was performed and described by ROE in New York in 1897. Independently from him JACQUES JOSEPH performed the same operation in Berlin one year later. JOSEPH, the most important pioneer of present-day corrective rhinoplasty, created the foundations for the present methods. But his designations for the corrective operations ("Rhinomioplastik", "Rhinoorthoplastik", and "Rhinometaplastik") found no approval. GOODALE, SMITH, and MONKS are also among the pioneers of subcutaneous hump removal, while during the World War I GILLIES, BLAIR, DAVENPORT, THOMSON, ZIMMERMANN, SÉBILEAU and others have deserved well of plastic surgery. In 1931 JOSEPH published his "Nasenplastik und sonstige Gesichtsplastik", which is still a basic work for modern plastic surgery of the nose.

Further details of the historical development of operation methods will be discussed in the respective chapters.

B. Anatomy of the nose

For the surgeon thorough previous knowledge of nasal anatomy is an absolute necessity. The external nose consists of bone, cartilage, and muscles, is supplied with blood vessels and nerves, and is covered externally with skin. — According to DIEFFENBACH, the important pioneer of rhinoplasty, "the nose [is] Man's most paradoxical organ. It has its root above, its back in front, its wings below, and one likes best of all to poke it into places where it does not belong."

The *external bony nose* is formed by the maxilla, the nasal bones and, in part, the frontal bone. The nasal bones (ossa nasalia), the main constituent of the external bony nose, consist of an outer and an inner cortex, which can merge with each other. They exhibit the most diverse forms, from an irregular, oblong rectangle to an hourglass shape. The physiological variation in length of the nasal bones is between 8 and 33 mm. The upper width varies from 2 to 17 mm, and the lower width from 7 to 24 mm. These figures show the great variability of shape possible. The accessory nasal bones (ossa nasalia accessoria), which have been described by STRAATSMA, are situated at the piriform crest in the region of the lower lateral angle of the nasal bones. The so-called small subnasal bones of FIUMICELLI are only seldom encountered. — The nasal bones are joined to neighboring areas with sutures. The internasal suture runs approximately in midline, but it can show the most diverse asymmetries. In Fig. 1 the normal relationships of bone and sutures are represented approximately, whereas Figs. 2 and 3 show the most varying deviations, as collected by HOVORKA. The naso-frontal suture runs horizontally either in a straight line, in a curved line, or

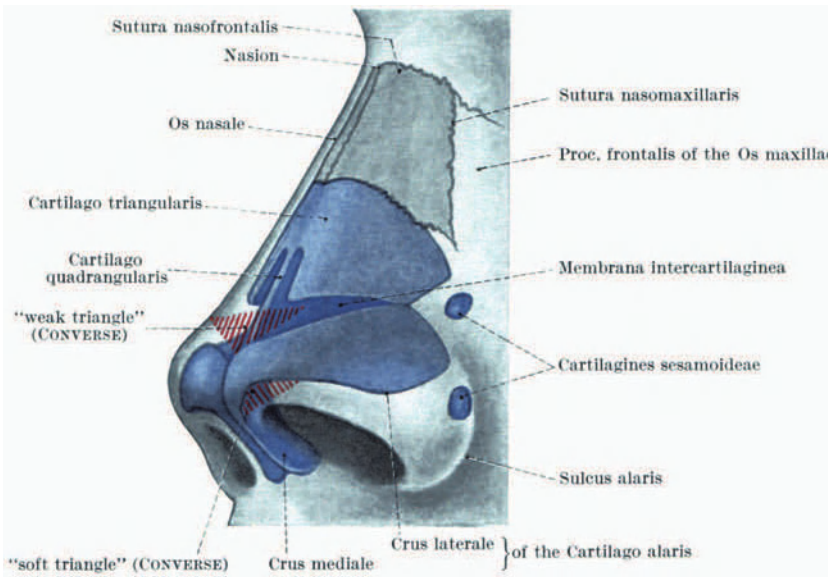


Fig. 1. Anatomy of external nose

jaggedly (Fig. 2, above). The nasal bones can be in the same plane as the frontal bone. But they often show a depression at their uppermost part, so that the saddle of the nose seems clearly marked. That is determined by the position of the nasal bones in relation to the frontal bone, as well as by the convexity of the glabella. The angle formed by the nasal bones and frontal bone displays all transitions from an almost straight line to sharp angling. It can be determined anthropologically that lower races have a shallow saddle in spite of a strongly convex glabella, while civilized peoples have a deep nasal saddle and a shallow glabellar convexity. In the Greek ideal, the forehead forms a plane with the dorsum.

The frontal sinuses can extend downward to above the suture and even to the center of the nasal bones. Difficulties then arise in corrective rhinoplasty when fracturing the nasal bones in hump removal and in narrowing the external nose, because the frontal sinuses must be opened. On the other hand the frontal sinuses can even be very small or completely absent. In the region of the nasion, i.e. in the region of the intersection of the midline with the nasofrontal suture, one then finds an especially thick, compact bone, which can likewise make osteotomies and bone realignment difficult. X-ray pictures give a clue to these anatomical conditions.

Laterally the nasal bones border on the frontal process of either maxilla, which similarly have a part in the construction of the external nose. The dividing

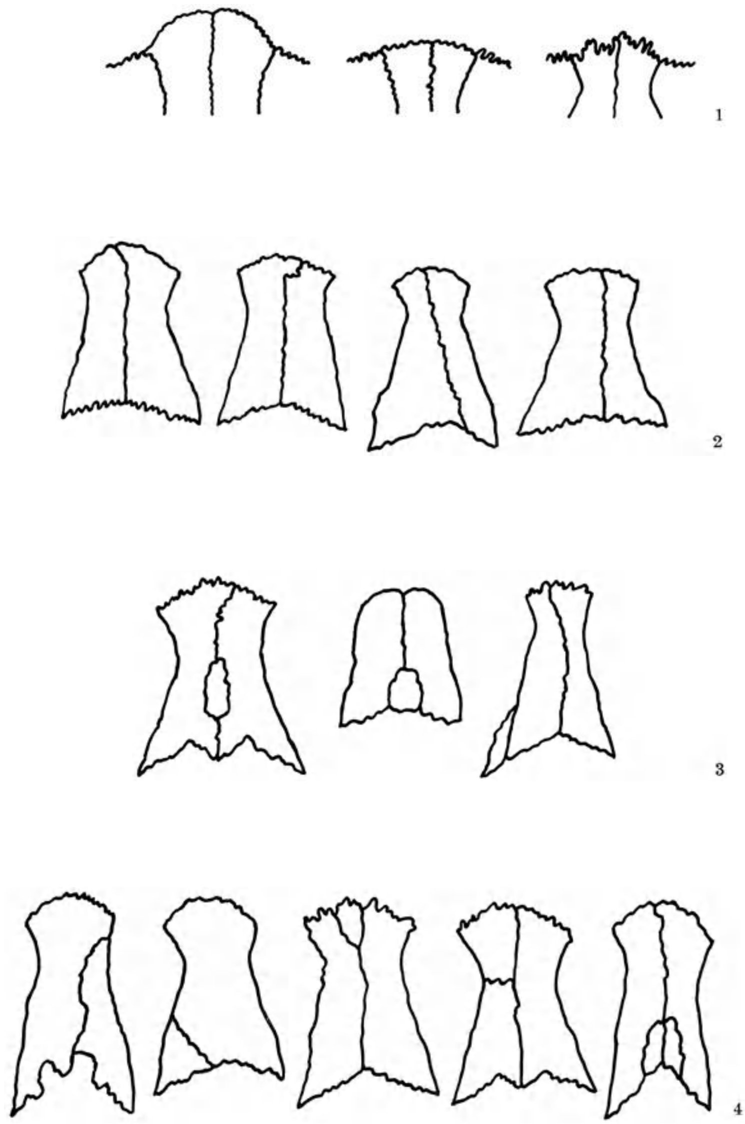


Fig. 2. Variations of normal bone and suture relationships according to HOVORKA. 1st row: naso-frontal suture. 2nd row: irregular line of internasal suture. 3rd row: sutural bones. 4th row: suture varieties

line is the nasomaxillary suture. In general the frontal processes of the maxilla are nearly as thin as the nasal bones themselves where they border on the nasal bones. In wide noses they are, of course, usually quite thick. This is rather an advantage when narrowing the nose after frontal osteotomy.

The process of the maxilla exhibits laterally the lacrimal sulcus (sulcus praelacrimalis), which is of great importance to plastic surgery. This forms the lateral border for the operative procedure, particularly for the so-called lateral osteotomy. Beyond this boundary, which LUONGO particularly pointed

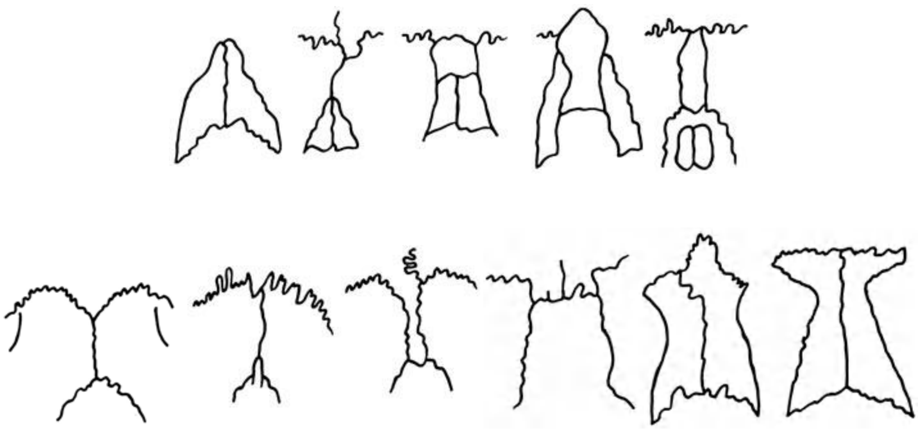


Fig. 3. Bone relationships deviating from the norm, according to HOVORKA

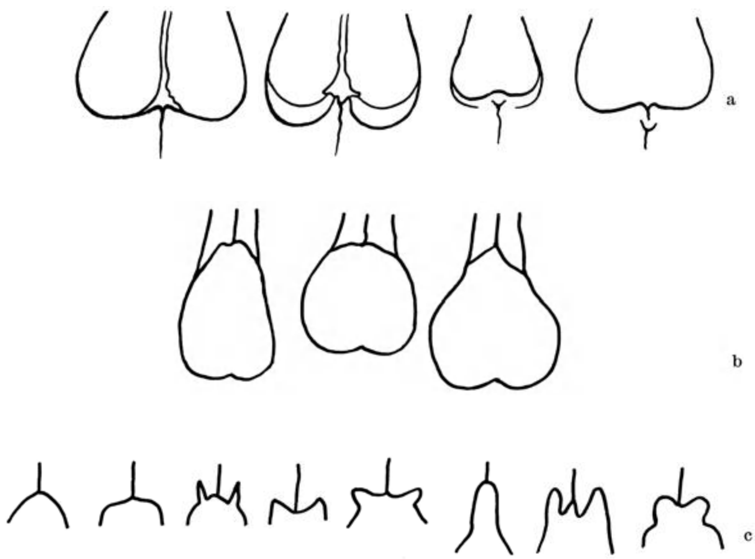


Fig. 4a—c. Variations of bone relationships according to HOVORKA. a Lower part of piriform aperture. b Various shapes of piriform aperture. c Upper part of piriform aperture

out and which can be palpated through the skin, are structures which must absolutely be protected.

Total fusion of the sutures — internasal suture, nasomaxillary suture and nasofrontal suture — is very uncommon. That the sutures do not ossify is of great importance in nasal fractures. At those places where there are sutures the nose is very elastic, and the frontal process of the maxilla and the nasal bones usually break next to the suture lines.

The perpendicular plate of the ethmoid can extend quite far forward and can help to determine the dorsal line in the region of the internasal suture of the nasal bones. This fact is of particular importance for the correction of deflected nose, because the perpendicular plate likewise must be infractured. As a rule, however, its anterior border is situated from several millimeters to 1 cm dorsally from the upper angle of the piriform aperture, as represented in practically all anatomy books. In this case, only, or almost only, the quadrangular plate of the septum is involved in a deflected nose. Crikelair has pointed out these variations and with regard to this has referred to anatomical studies by La Double.

The piriform aperture, the opening in the bony nose like a pear or a heart, can be quite variously shaped, as Fig. 4 shows. The maxillary spine, a formation

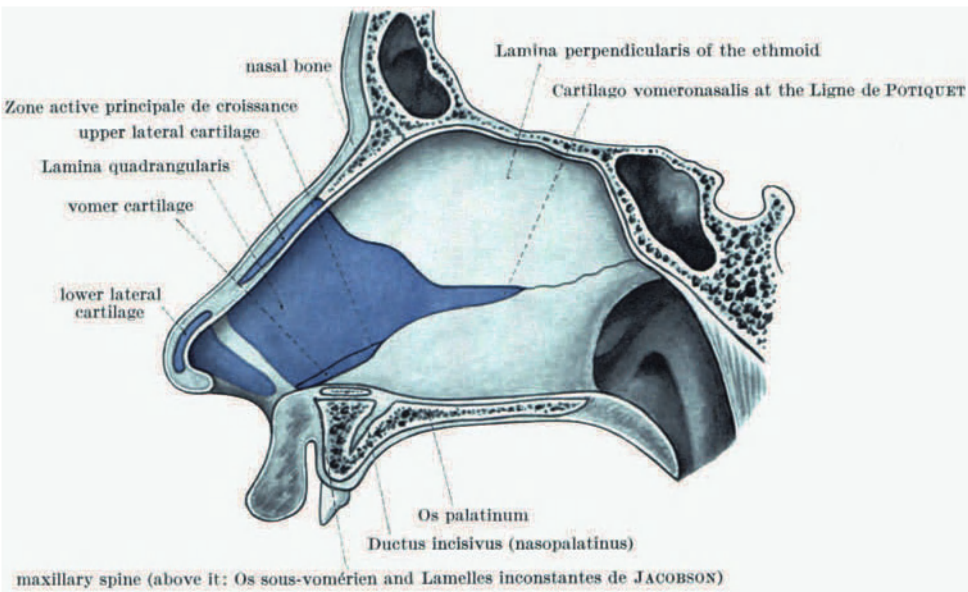


Fig. 5. Normal anatomy of nasal interior. View of septum

of the incisive bone is located in the middle of the base of this aperture, i.e. at the point of contact with the maxillary bones. Here, too, there is a great variability in shape. The spine can be large and be curved either upwards or downwards; but it can also be very small or be missing altogether. Europeans have the most highly developed nasal spine projecting farthest forward; Mongols and Negroes have the flattest. The more strongly developed the spine is, the more the soft nasal structure projects forward. The anthropologist, Broca, has studied these relationships quite closely.

The *nasal cartilages* form the largest part of the external nasal structure. They are necessary for the formation of its lower, anterior portion. The septal cartilage (cartilago quadrangularis) borders above and posteriorly on the perpendicular plate of the ethmoid, below and posteriorly on the vomer. The oblique anterior edge of the vomer at its border with the quadrangular plate of the septum is called the "ligne maîtresses des déviations de Potiquet". The cartilage is often dislocated along this line in fractures. The zone of active growth of the quadrangular plate of the septum ("zone active principale de croissance") comes into contact with this. A narrow cartilaginous plate which is situated between the vomer and the quadrangular plate of the septum is called the "cartilage vomérien", by the French. It can extend as far forward as the anterior nasal spine. In this area the French also recognize a sub-vomer bone ("os sous-

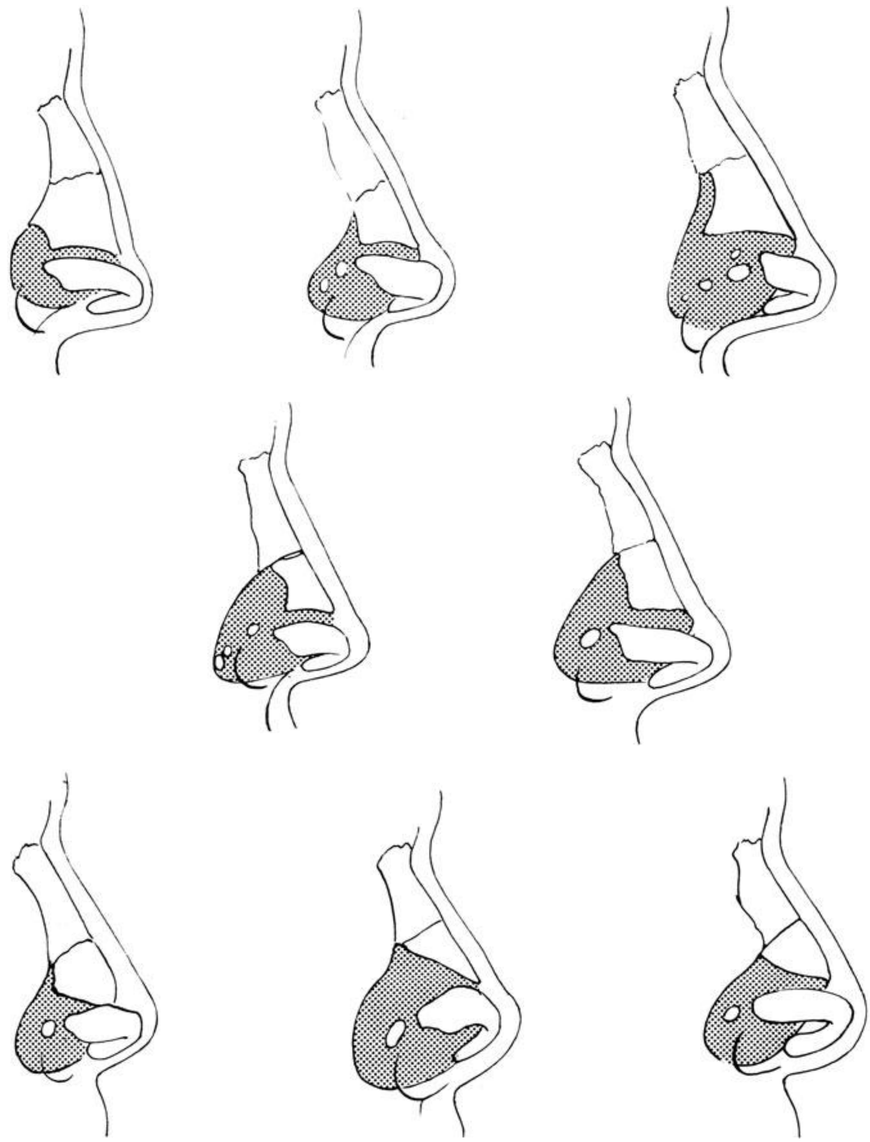


Fig. 6. Size relationships of upper lateral cartilage to lower lateral cartilage in whites and negroes (according to SCHULTZ). From upper left to lower right all intermediate nasal shapes from those of whites to those of negroes are shown

vomérien"), which lies forward on the median nasal crest of the maxilla (crista nasalis med. maxillae) (AUBRY). Laterally from the anterior nasal spine, the bony plates, the so-called "lamelles inconstantes de JACOBSON", can occur. In some cases one finds a strip-like wedge of cartilage extending upward and posteriorly between the perpendicular plate of the ethmoid and the vomer, as a tail-like extension of the septal cartilage; this is the so-called vomeronasal cartilage of Jacobson (cartilago vomeronasalis Jacobsoni) (Fig. 5). An imaginary joint between the anterior nasal spine and the nasion divides the anterior septum, which we regard to be a necessary support for the external nose, from the posterior part of the septum, which has no importance in this function.

The upper lateral cartilages (cartilagines nasi laterales or triangulares) form, to a certain extent, the caudal continuation of the nasal bones. They join like wings at the anterior edge of the septal cartilage. In general they are triangular, but they also show many deviations and variations in size when compared with the nasal bones; these relationships were studied by Schultz (Fig. 6). The junction of the upper lateral cartilages and the nasal bones is a side-to-side opposition and not a syndesmosis. According to B. R. Straatsma and C. R. Straatsma the overlapping of the cartilage on the bone can amount to from 2 to 11 mm. The two authors conducted histological examinations of this

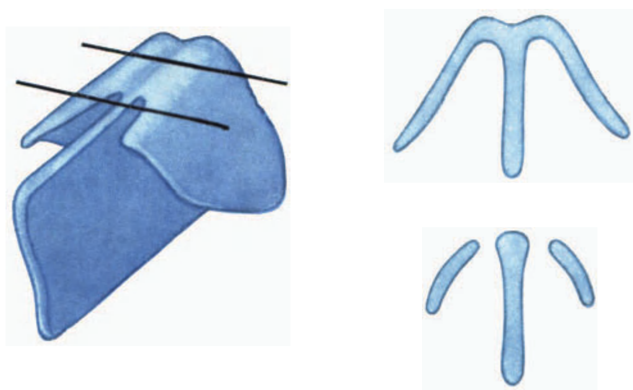


Fig. 7. Junction of upper lateral cartilage with septal cartilage, oblique view. The adjoining sketches show the cross-sections marked by the black lines

cartilage-bone apposition. The junction of the upper lateral cartilages with the septal cartilage was also studied in detail by them. In their the upper part the two cartilages merge directly with each other, while in the lower part they are separated from each other by a space filled with connective tissue. Fig. 7 shows these relationships in a general view and in two cross-sections. Only in rare cases is the space missing. The space is not mentioned in all the more recent anatomy books; only in the old work by Gegenbauer is it taken into consideration and illustrated.

The so-called lower lateral cartilages (properly: alar cartilages) (cartilagines alares) enclose the anterior part of the two vestibules like arches or pincers. They are situated in the substance of the alae and the columella. Their curvature in the nasal tip has two angles, a medial and a lateral one, at 2 to 3 mm distance from each other. The medial crus (crus mediale) is situated medially from these angulations, and the lateral crus (crus laterale) laterally from them (Fig. 8). Daley and Converse have particularly occupied themselves with the anatomy of the lower lateral cartilages. — At the so-called limen nasi, the intercartilaginous membrane (membrana intercartilaginea) forms the connection between the upper and lower lateral cartilage. This fold plays a special role in rhinoplasty. It forms the transition between the vestibular skin and the nasal mucosa. It is situated below and laterally from the piriform aperture, and at the base of the nose it merges into a fold at the border of this aperture. — The minor alar (also:

sesamoid) cartilages, several smaller round or irregularly shaped cartilage islands, are often scattered in this connective tissue. — The whole area of the lower lateral cartilage is very elastic, but in spite of this it remains difficult to model, because not only each part individually but also all parts together contribute to a uniform shaping of the nasal tip. As a rule, the minor alar cartilages cause no deformities.

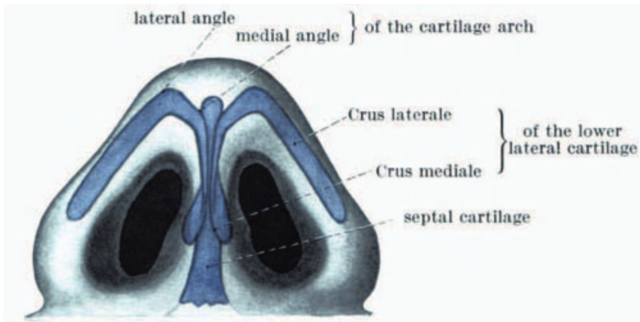


Fig. 8. Anatomy of nose, viewed from below

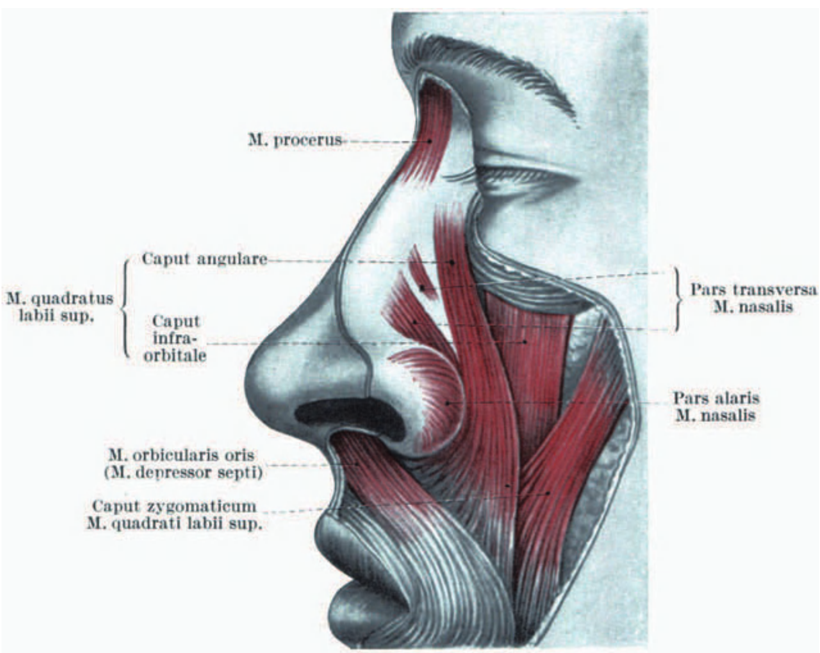


Fig. 9. Superficial muscles

The so-called "weak triangle" (Converse) a region filled with connective tissue, plays an important role in rhinoplasty for the formation of slight but undesired supratip depressions. Another somewhat tricky area is presented by the cartilage-free section of skin duplication at the vestibular rim in the area of the junction of ala and columella; this is the so-called "soft triangle" (Converse). Both triangles are illustrated in red hatching in Fig. 1.

The *muscles of the nose* are arranged in two layers, one superficial and the other deep; the layers overlap only partially. Griesman has dealt particularly

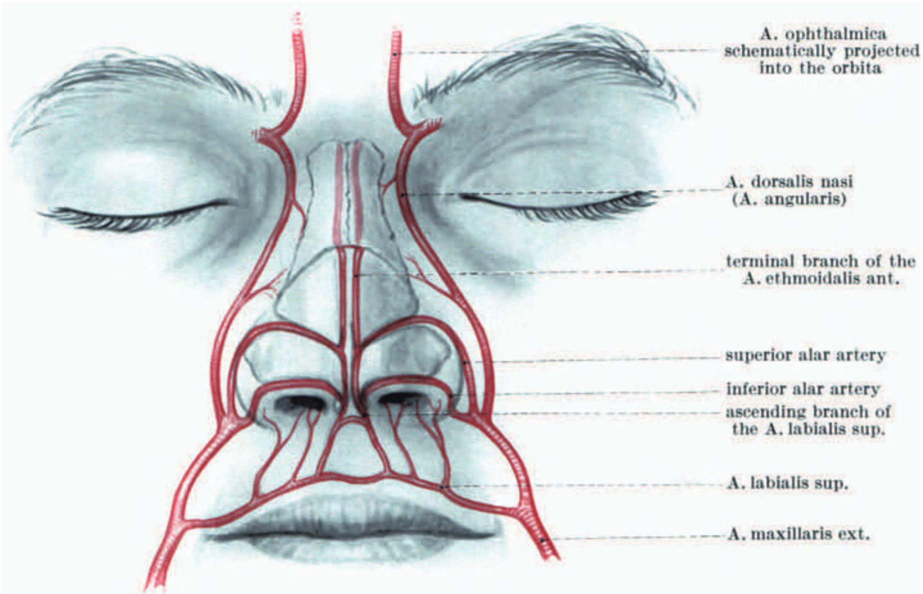


Fig. 10. Nasal arteries, front view

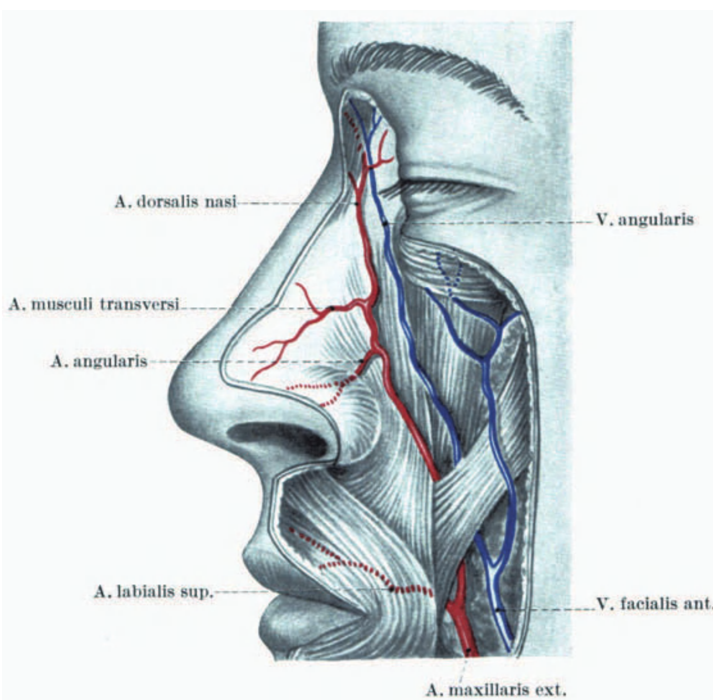


Fig. 11. Superficial blood vessels of nose

thoroughly with the anatomy of nasal muscles. The muscles important for rhinoplasty are primarily the elevators, which shorten the nose and dilate the nostrils. These are the M. procerus or pyrimadalis, which can be regarded as a continuation of the frontal muscle and which, according to VIRCHOW, is also called the Depressor glabellae, and the Caput angulare musculi quadrati labii sup. The Pars alaris musculi nasalis (M. dilatator) and the M. depressor septi nasi also are counted among the depressors which lengthen the nose but also dilate

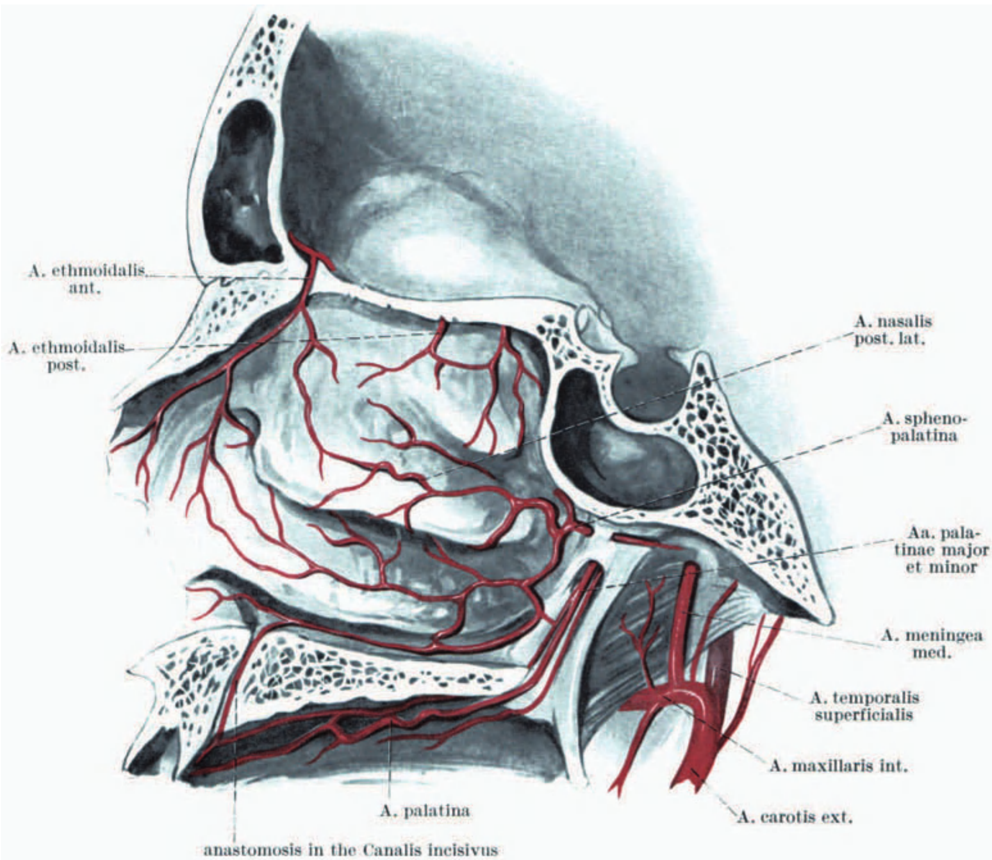


Fig. 12. Arterial supply of lateral wall of nasal cavity. (From LAUTENSCHLÄGER)

the nostrils. The only compressor which effects the compression of the nose, lengthens the nose and contracts the nostrils is the Pars transversa musculi nasalis (Fig. 9). The solid connection of the upper lateral cartilages with the septum assures that the nostrils normally remain open. The lower lateral cartilages and the dorsum can be raised vertically by the M. procerus. The valve-like action of the nostrils was examined especially by MINK and UDDERSTRÖMER.

According to GRIESMAN one should be as careful as possible of the M. procerus during the décollement of the dorsum through the intercartilaginous incision at the limen nasi. One should be equally careful of the Pars transversa musculi nasalis, the only muscle which compresses the inner side of the nostril and narrows the nasal vestibule. It is the antagonist of the M. procerus. All other muscles, which consist of delicate muscle bundles like the two just mentioned, should also be protected when possible, since their injury can cause postoperative restriction in the movability of the nose and can bring about a rigid appearance. Therefore in décollement, the whole muscular mantle with the periosteum and perichondrium is elevated from the lower structure.

The two or three sesamoid cartilages in the intercartilaginous ligament have the effect of a kind of ball-bearing mechanism in the valve-like action of the lower lateral cartilages. The lower lateral cartilages and the upper lateral cartilages can overlap each other more or less, depending on the width of the ligament.

Knowledge about the course of the *blood vessels* is of importance for plastic surgery. Arterial supply is achieved by the A. angularis, which branches off

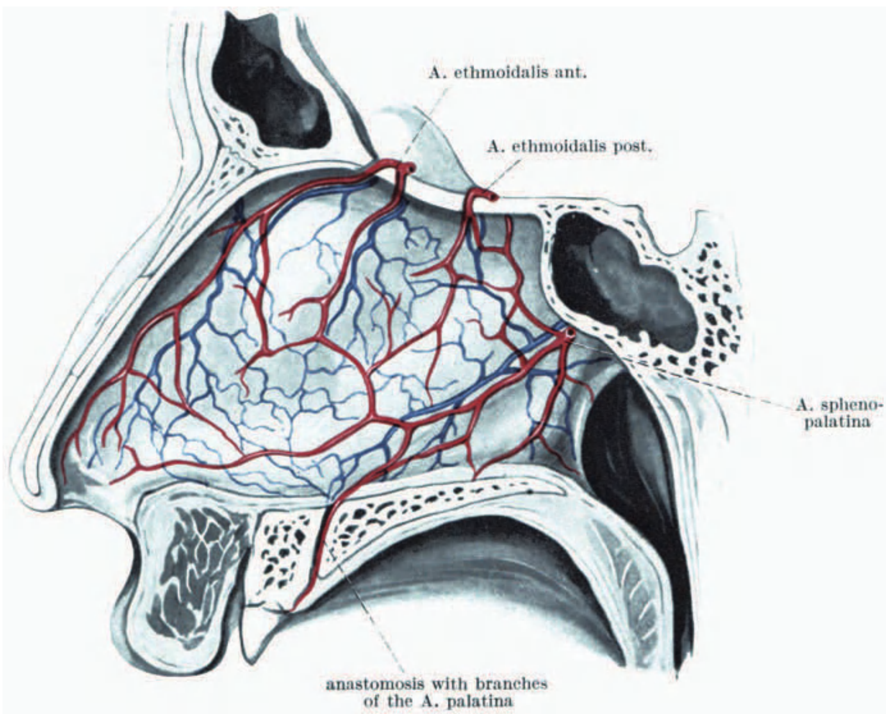


Fig. 13. Blood vessels of the septum. (From LAUTENSCHLÄGER)

from the A. carotis ext., respectively from the A. maxillaris ext. (A. facialis), and the A. dorsalis nasi, which comes from the A. carotis int., respectively from the A. ophthalmica. Also branching off from the A. maxillaris ext. are the A. labialis sup. with the small columellar artery, and the A. nasalis lat., the branches of which run along the upper and lower border of the alae. — The A. angularis runs upward along the lateral wall of the nose, supplies the dorsum, and becomes the A. dorsalis nasi. We find another anastomosis between the vascular area of the Carotis ext. and the Carotis int. between the upper alar artery and the Ramus terminalis of the A. ethmoidalis ant. (Figs. 10 and 11).

Venous drainage is achieved by the small Vv. nasales ext., which lead into the V. angularis and from there into the V. ophthalmica sup. and the V. ophthalmica inf., as well as into the V. facialis ant. The V. facialis ant. is connected by means of the V. facialis profunda with the Plexus venosus pterygoideus. The last is connected in turn with the V. ophthalmica inf. by anastomoses. Thus in addition to the communication over the V. angularis, a second connection exists here between the veins of the outer nose and the sinus cavernosus.

The larger vessels of the nose run laterally along the cartilage-bone structure, so that in exposure of the skeleton they need not necessarily be damaged.

Vessels of the inner nose are the A. ethmoidalis ant. and the A. ethmoidalis post. at the lateral nasal wall, both of which come from the A. ophthalmica; farther back are the Aa. nasales post. lat. and the Aa. palatinae majores and minores, which come from the A. maxillaris int. (Fig. 12). At the septum there are the A. ethmoidalis ant. and the A. ethmoidalis post., which come from the A. ophthalmica, as well as the Aa. nasales post. septi, which branch off from the A. maxillaris int. They anastomose with the A. palatina major (Fig. 13).

Of the veins of the internal nose one may mention the V. ethmoidalis ant. and the V. ethmoidalis post. as well as the branches of the V. sphenopalatina.

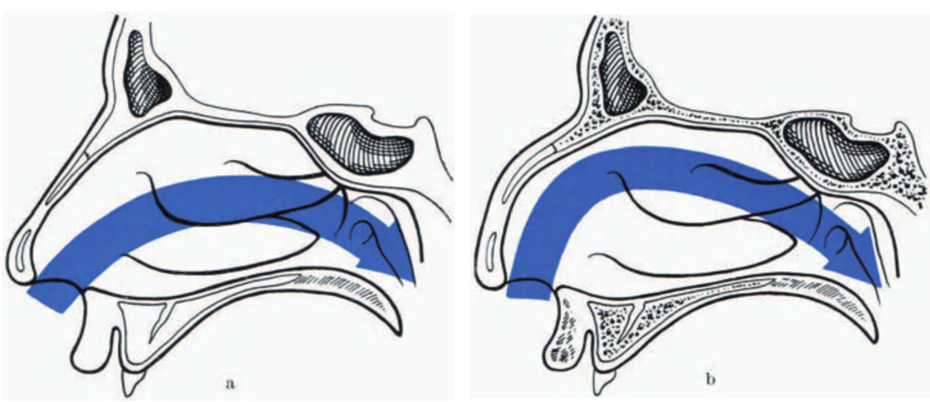
From the tissue spaces in the middle facial region the *lymph* reaches the following lymph nodes: parotidei profundi, faciales profundi, submaxillares, submentales, and from there flows into the Nodi lymphatici cervicales profundi superiores et inferiores. The lymph collects from this so-called Plexus jugularis in the Truncus jugularis.

Information in greater detail concerning the course of the finer arteries of the alae and the columella are to be found in an extensive article by THÉVENIN.

The *nerves* of the external nose are divided into the sensory and the motor nerves. The former branch off the N. trigeminus, the latter from the N. facialis. The Ramus nasalis ext. of the N. ethmoidalis ant. runs behind the nasal bone, reaches the surface between the nasal bone and the upper lateral cartilage and sends out branches to the dorsum and nasal tip. The alae and the lateral walls of the nose are supplied by the branching of the N. infraorbitalis of the second trigeminal branch. More detailed information is to be found in the chapter about local anesthesia of the nose.

C. Physiology of the nose

The nasal structure protects the entrance to the nose, which directs the inhaled air into a certain course. Through contact with the mucosa the air is tested, cleaned,



Figs. 14a—c. Air current conditions in nose, according to PROETZ. a With normal nasal shape. b With hump nose and drooping tip

approximated to body temperature, humidified or dried. To accomplish this the nasal passage must have a minimum size. With partial or complete loss of patency of the nose, the mouth is used vicariously as the air passage. The inhaled air is no longer prepared adequately, since the oral mucosa can not completely take over the function of the nasal mucosa. Obstructed nasal breathing is unhealthy and is considered annoying. In addition it creates a change in the sound of the voice. Even the most ideal shape of external nose can not satisfy the patient if it is purchased with the loss of nasal function. Therefore it is important to observe the physiological principles in rhinoplasty. On the other hand the air-flow conditions in the nose can be improved by external rhinoplasty even without enlargement of the nostrils. — Fig. 14 shows the dependence of the air current conditions on the shape of the external nose. PROETZ and MINK, especially, have dealt with the laws concerning the passage of air in the nose.

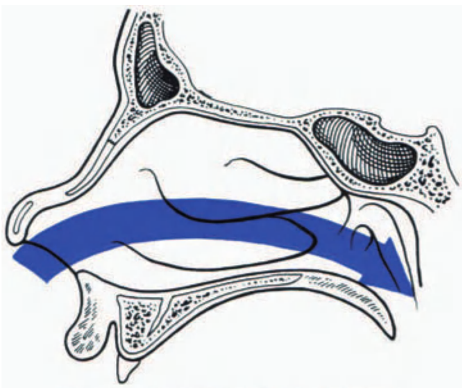


Fig. 14c. With protruding tip (stub nose)

The Rosenthal test is a trial for adequate passage of air through the nose; one must breathe normally twenty times through the nose without dyspnoe or increase of pulse rate occurring. Further experiments for investigation and evaluation of the physiological conditions in the nose are direct and indirect rhinometry (ZWAARDEMAKER), rhinohygrometry (ESCAT), athmorinometry (FOY), anterior rhinometry with the VON PESCH mask, posterior rhinomanometry with the BEYNE device, rhinomanometry as by SCALORI and by AZZI, and finally spirometry.

D. Shape, angle and size

The shape of the nose can be very diverse. The notations of the anthropologists, physiognomists, creative artists and plastic surgeons concerning this subject are well known. Great artists like POLICLITUS, MYRON, VITRUVIUS, MICHELANGELO, LEONARDO DA VINCI, DÜRER and later SCHADOW tried to set up laws and rules of construction according to which human beauty can be formed. A figure constructed according to such rules is called a canon. ALBRECHT DÜRER was the first to try to classify nasal shapes at all systematically. He arranged them on the basis of proportional differences. TOPINARD was one of the first in the 19th Century to deal with the subject of nasal shape. He determined five basic types: the eagle-nose, the straight nose, the stub nose, the Semitic nose and the hawk-nose. — Fig. 15 shows a comparison of nasal shapes which play a role in corrective rhinoplasty today. In numerical order they are as follows: 1. normal nasal profile, 2. saddle nose, 3. lorgnette nose, 4. flattened nose, 5. pointed nose, 6. saddle nose with prominent tip, 7. straight nose with protruding tip, 8. nose with hanging columella, 9. Greek nose, 10. Roman nose, 11. Semitic nose, 12. Assyrian nose, 13. Negroid nose, 14. Aztec nose, and 15. the so-called modern American nose. On the one hand this list contains nasal shapes according to the system of MARTIN, and on the other hand anatomical varieties from the viewpoint of the plastic surgeon, as they were classified by JOSEPH and by DUFOURMENTEL. Here this is only a matter of classification according to profile view. In addition to that there are the variations from the normal nose which one only sees in a full-face view, such as wide nose, narrow nose, dog-nose and double nose, wide nasal tip or potato nose, and partial or complete deflected nose. Further malformations of the nose are partial or complete defects

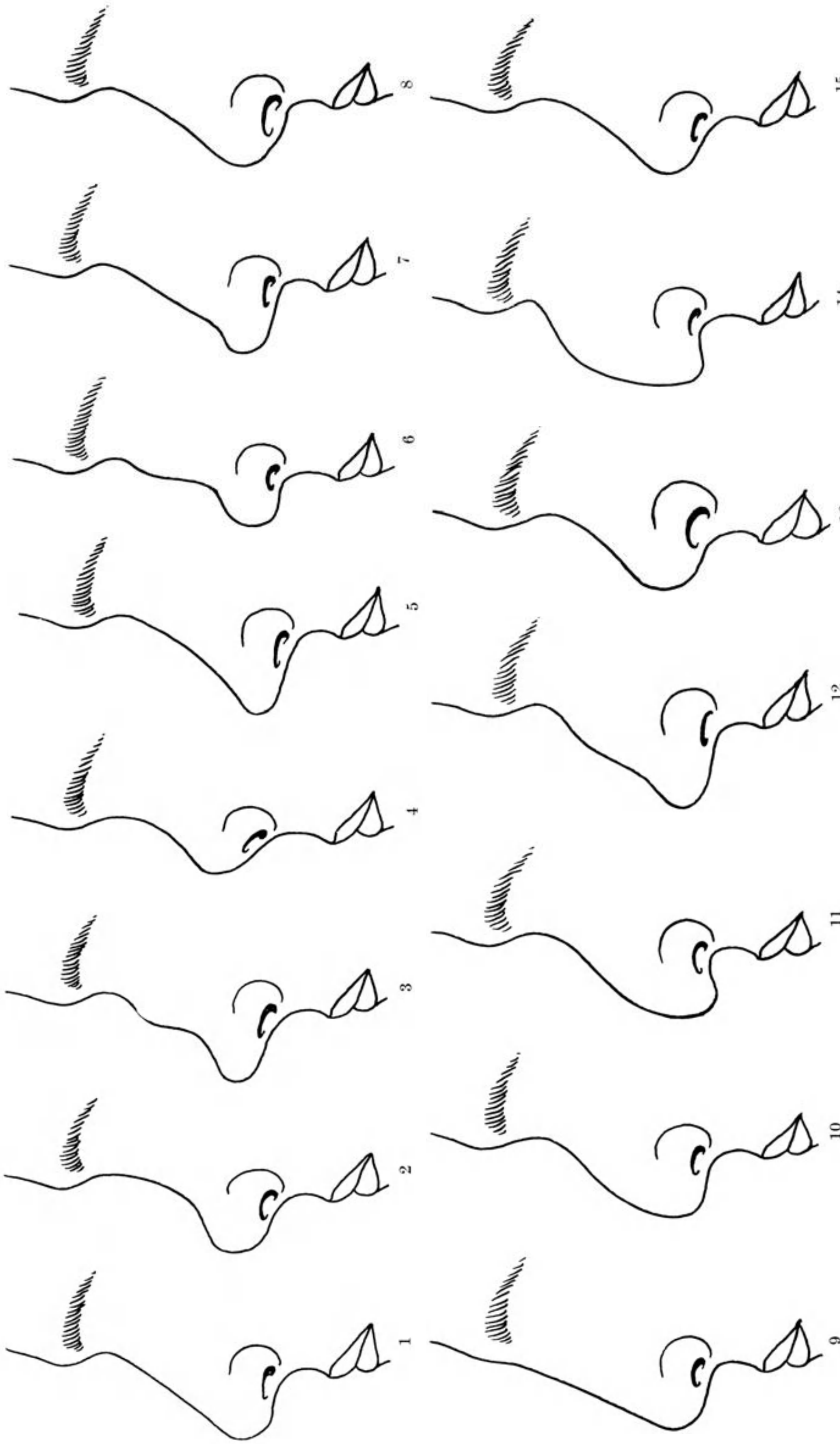


Fig. 15. Nasal shapes in profile (explanation see p. 14)

and nasal deformities of high degree which are described extensively in the respective chapters.

The proportions of the nose to the whole face play an essential role in rhinoplastic observations. Here, too, with our surgery we strive to reach certain ideal relationships. Oral surgeons likewise occupy themselves with such considerations. Their studies go back to ANGLE, SIMON and KANTOROVICZ. — A. M. SCHWARZ has developed the relationship principles valid today. The basis for opinion is the average face. In a manner similar to that used in the creative arts, one divides the face into different sections, by which the generally recognised reference points on the skin serve as aids. The profile is evaluated vertically and horizontally. The height of the forehead, nose and jaw should each be approximately

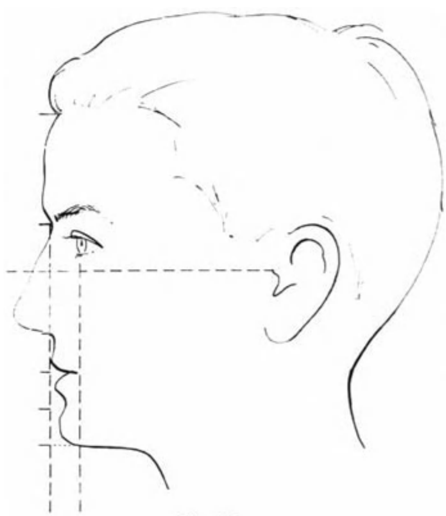


Fig. 16

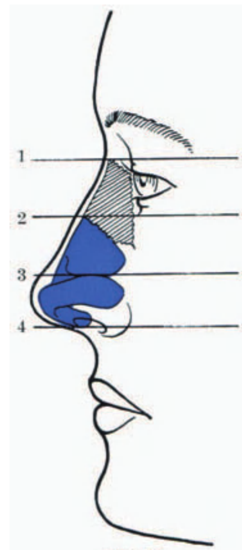


Fig. 17

Fig. 16. Cephalometric planes of reference in profile

Fig. 17. Division of nose into 3 sections of approximately equal size: component of bone between 1 and 2, of upper lateral cartilage between 2 and 3, of lower lateral cartilage including lateral and medial crura between 3 and 4

one third of the total facial height; the borders of these are determined by the hair-line, the upper nasal point, the lower nasal point, and the chin. With natural size of the face, the chin portion can be 5 to 10 mm larger than the third containing the nose without disturbing the good proportions of the features. A profile representing the norm is expressed cephalometrically by the oral surgeon in the planes of reference in the following manner: horizontally one connects the ear-point with the eye-point and obtains the ear-eye plane, from which one draws a vertical line downward from the eye, the so-called eye vertical, and parallel to that the nose vertical which intersects the nasion. The two vertical lines enclose the so-called jaw profile field, in which the average outlines of the oral area of an adult are situated (A. M. SCHWARZ).

The nasion plane transverses the sub-nasal point, the eye-vertical or orbital plane touches the angle of the mouth (Fig. 16).

According to GOTTFRIED SCHADOW the depth of the nasal tip in the profile view is one third of the length of the nose. The nose appears harmonius when it is half as long as the distance from the chin to the glabella and when the alae extend laterally to the line drawn vertically from the inner canthus of the eye.

From below, the nasal tip is seen as the tip of an equilateral triangle. In profile, the dorsum should run parallel to the longer axis of the ear. According to SCHADOW the width of the alae is the same as the distance between the inner canthi. The normal width of the nose is 70% of the length.

JOSEPH classifies the nasal shapes on the basis of three anatomical profile components, namely the nasal bone, septal cartilage, and lower lateral cartilage components. In his opinion these are in a ratio of 2:2:1. Compared with the sub-division by JOSEPH, Fig. 17 shows a variation which has proved its value in judgment of the nose: the ratio between the length of the nasal bone to the extension of the upper lateral cartilage and the region of the lower lateral cartilage is 1:1:1. One draws the dividing line (2) between nasal bone and upper lateral cartilage through the point on the dorsum where these parts meet. The middle

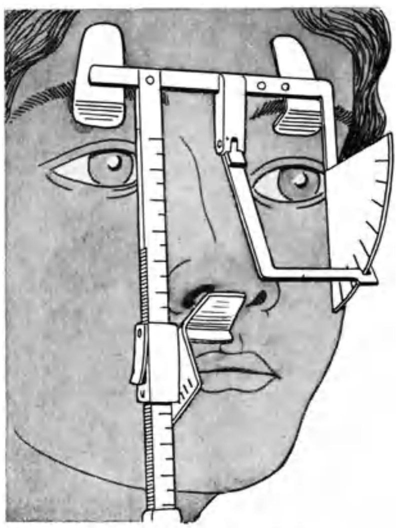


Fig. 18. Rhinometer by BERSON

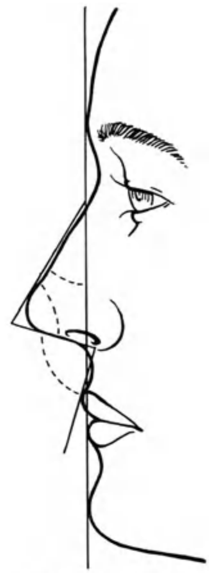


Fig. 19. Nasal angles

and lower nasal areas are divided by a line (3) which runs parallel to the upper line along the lower lateral border of the upper lateral cartilage and the upper border of the lateral crus of the lower lateral cartilage. The lower third of the nose is separated from the upper lip by a line (4) running along the lowest point of the medial crus of the lower lateral cartilage.

Compared with the "approximate" subdivision by JOSEPH in which the lower lateral cartilage is divided at some indefinite point on its lateral crus, the lower nasal third encloses a larger area, the middle a somewhat smaller one, in the subdivision shown here.

Since the naso-frontal angle is not always identical with the upper medial suture (see Fig. 2), the upper third can be subject to respective variations. One or two of the components can either protrude or recede. In the same profile, some components can be prominent and the others retruded, so that a wavy line occurs. In this way we possess a series of thirty profile images after JOSEPH, which agree in part with those shown above.

DUFOURMENTEL has likewise set up a practical classification of the various nasal shapes, which are arranged according to the diversity of the different components of the nose.

In the profile view the esthetic profile angles are measured with the profile gauge or profilometer, as constructed by JOSEPH and modified by BERSON (Rhinometer of BERSON, Fig. 18).

The dorsum forms an angle of 30° with the forehead-chin line. A difference of 7° either way is still esthetically permissible. According to JOSEPH profiles already appear ugly when the profile angle is a few degrees more than 37° or less than 23°. According to many authors a profile angle of 35 to 36° is ideal. The nasal tip angle or septo-dorsal angle, formed by the dorsal line and the columella line, is about 75°, but it varies considerably, especially in the modern concept of nasal beauty.

The nasolabial angle or the septolabial angle is formed by the columella line and the line of the upper lip. It should be 90° (Fig. 19), but according to many contemporary ideals of beauty it can be up to 120°.

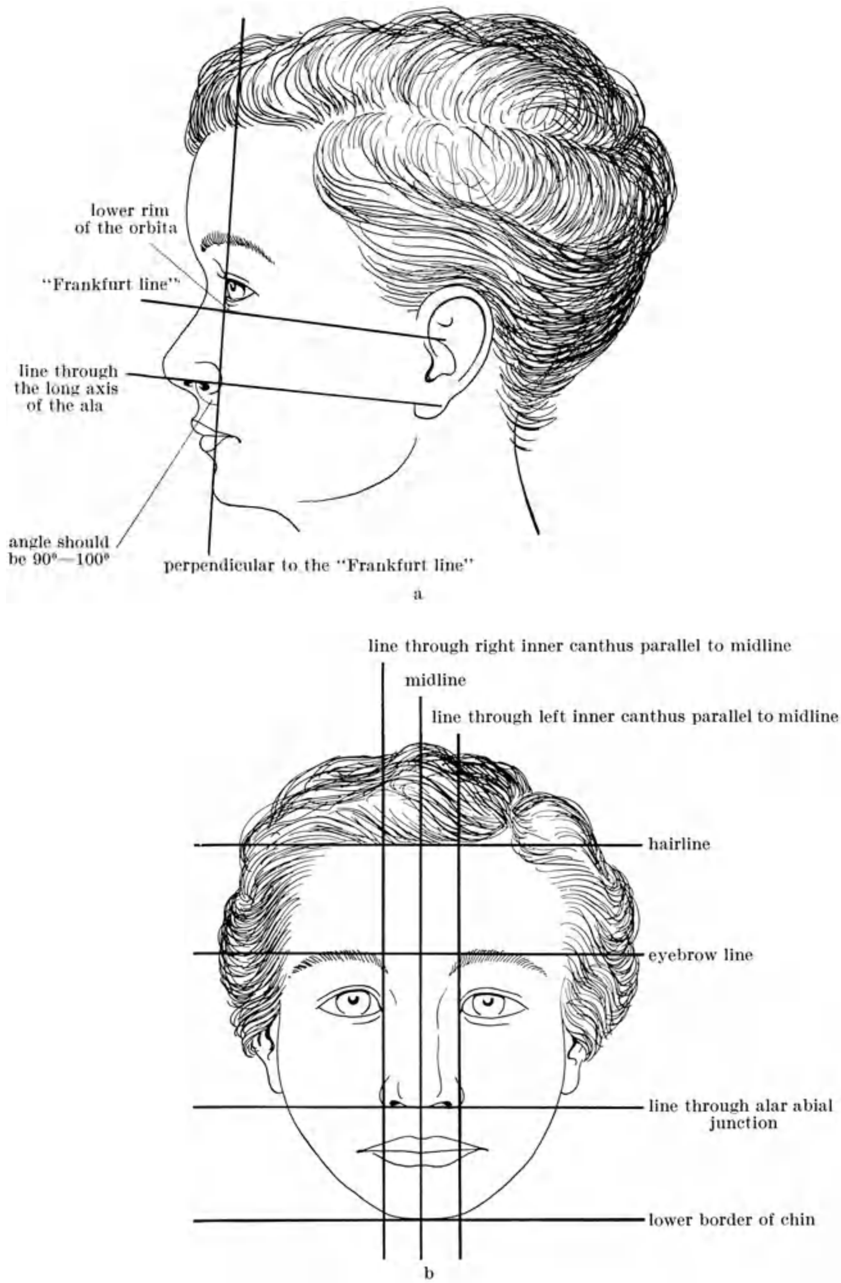
Several American authors use a photometer, a Plexiglas plate marked with degrees of angle, which they place over the profile photograph in order to measure the various angles. In the book by GALTIER on rhinoplasty such a photometer is illustrated.

From all of this information we see that there are thoroughly suitable rules which, in conjunction with absolute esthetic feeling and artistic understanding, are highly significant for surgery of the human physiognomy. We find a confirmation of these old rules in the more recent rules of proportion as they are given for plastic operations on the face by BROADBENT and MATHEWS.

Judgment of shape and size of the nose, however, remains for the most part individually esthetic, whereby the rules have value only as guides. Essential for corrective rhinoplasty is that the nose to be corrected is brought into harmony with the esthetic anatomy and facial physiognomy.

E. Documentation

Next to an exact case record, the documentation of findings with photography and motion pictures is most essential in corrective and reconstructive surgery of the head and neck. Very many varied suggestions have been made as to how the pre- and postoperative findings can be best recorded for comparison. For normal corrective surgery of the head and neck, and especially for cosmetic rhinoplasty and face lifting, black-and-white photographs generally suffice. But for tumor surgery with reconstruction, as well as for surgery of the skin with reconstruction, and usually also for traumatological surgery with reconstruction, the photographs should be taken in color if possible. The reason for this is that with improper lighting the black-and-white process can conceal or emphasize too strongly one injury or another. One can set up a small photographic studio in the hospital or in the office. A standardized camera angle, equal exposure and a constant size ratio on the negative are important. It is up to the surgeon how many views of the head and neck should be taken. With the nose one should take two oblique profile pictures of less than 45° in addition to profile and anterior views. A further picture showing the view from below with the columella and nostrils is also recommended. AUFRICHT even advises up to eight photographs for the nose: profile from both sides, front view, view from below, and all four views at rest and laughing. We make a full face photograph, a profile photograph of the left side or, in case of asymmetries, from both sides, and an axial photograph from below; we usually do without the half-profile views. In ear corrections one generally needs four views: one from the front, one from each side, and one from behind. The hair must be held aside with clips, if necessary. In surgery of the trachea,



Figs. 20a—c. Division of face with lines (by FOMON)

larynx or pharynx, one can do with one photograph, as a rule. Camera angle and the area to be photographed depend upon the findings. The distance of the camera from the object depends on the size of the area to be photographed as well as on the focal length of the lens. For the ear, neck, larynx, pharynx and trachea, the standard distances of 20, 30 and 50 cm have proved to be sufficient.

For the nose and face one should choose greater distances with long-focus lenses in order to avoid distortion and inaccurate views.

The camera must be simple and easy to use and should have automatic parallax compensation. One can use either a 35 mm camera with a long-focus lens, a $2^1/_4 \times 2^1/_4$ inch camera or an old plate or cut film camera with a good lens. As light sources electronic flash, photoflood lamps (for example two 500-watt lamps in diffuse reflectors) are suitable. Use of electronic flash has the advantage that the f-stops of the lens can always remain the same and that no mistakes due to inconsistent lighting occur. One also adapts oneself more quickly to a routine with this than with continually changing lighting conditions.

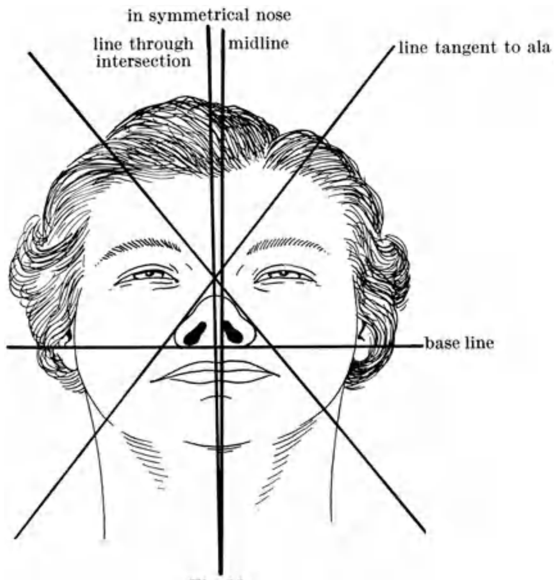


Fig. 20c

One plastic surgeon or another works along the lines of photometry, which have been used in oral surgery for a long time. With photometry it is possible to make measurable photographs before and after treatment for purposes of comparison. Photostat constructions (Simon, Korkhaus and others) are complicated and expensive. Güntert suggests using a large angle on the wall and applying the principle of photometry in the ortho-radial positioning of the head.

Photography can also become a part of planning the operation and be drawn into the preoperative discussion with the patient. On a piece of tracing paper laid over the photograph one can draw the desired profile as well as the desired nasal tip and nostril shapes; thus one can see whether these new contours harmonize with the rest of the face. O. Becker draws the profile outline on the back of the photograph. Thus he can show the patient the appearance after correction. The profiloscope of Wodak serves a similar purpose. It is a mirror device in which the patient sees his profile as well. Fomon charts the photos with lines (Figs. 20a—c) which aid in analysis and planning of the correction. In this way otherwise unnoticed facial asymmetries sometimes become apparent. It can show, for example, that the horizontal line of the eyes does not run parallel to the horizontal line of the mouth. Thus, in pronounced cases a slight deflection of the nose remains after nasal correction, because the nasal line can be perpendicular to only one of the two lines or must assume a position somewhere in between.

The stereo technique has proved its value for making photographs of the pharynx, oral cavity, and open larynx and trachea. In recent years it has been developed to such an extent that any layman can quickly learn a dependable photographic technique with commercial cameras.

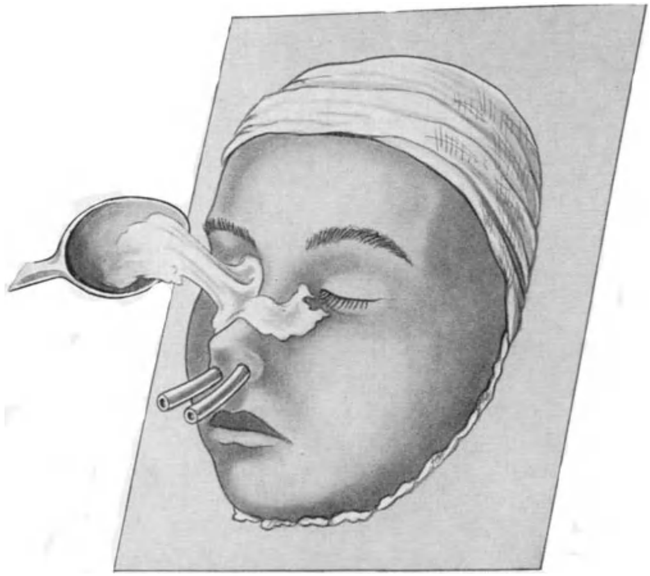


Fig. 21a. Preparation of facial mask. Rubber tubing in nose, ointment over closed lids

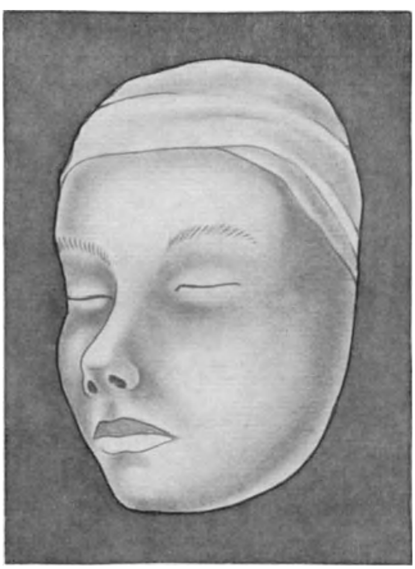


Fig. 21b. Facial mask of wax or plaster of paris (positive)

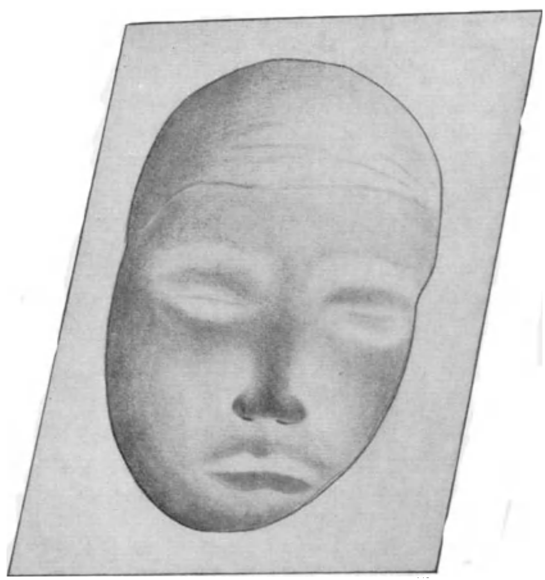


Fig. 21c. Facial mask of plaster of paris or Negokoll (negative)

Certain plastic operations, especially those which are supposed to improve the function of an organ, are best recorded with motion pictures. At the same time one must consider that the resolution of 8 mm film hardly suffices for scientific purposes and that one works best only with 16 mm material.

The X-ray of course is essential for documentation. In injuries to the face caused by accidents it is often important for planning and assessing corrective or reconstructive surgey. A procedure worth mentioning is the side-view X-ray with a contrasting representation of the profile. The contrast representation is achieved by applying gray mercury ointment to the midline before making the X-ray (E. SCHMID). In the region of the larynx and trachea, preoperative X-rays reveal information about the location and extent of destruction or displacement. After surgery the X-ray with contrast can show the result of the surgery performed. The conditions in the region of the pharynx and the cervical part of the esophagus are similar. Here the single X-ray picture is less important compared with X-ray motion pictures, because it does not show motility as clearly as the latter does. — X-rays in nasal fractures are discussed in a special chapter.

The preparation of facial masks before and after nasal operations is a further method of documentation. This method is used widely in the U.S.A. (SELTZER, BERSON, BROWN, MCDOWELL, FOMON, etc.). It makes it possible to perform the desired changes on the model and to evaluate them technically by measurement. The mask may be made of plaster, wax, or plastic. The face is framed with a cloth. Rubber tubing is placed in each nostril to maintain nasal breathing, and the nostrils packed around the tubing. The eyebrows are greased with vaseline. A little boric ointment is applied to the eyes. One needs about four cups of plaster of paris for preparation of the mask. This viscous mass is poured over the face. As soon as the plaster of paris has set, it is carefully removed from the face. In this way one obtains the negative from which the positive of wax or again of plaster of paris may be molded (Figs. 21a—c). Wax masks can be modelled afterward more easily. One can color them and give them a shine resembling the surface of the skin. — Materials also used are Negokoll and Himinite, for negative and positive, respectively (NÜRNBERGK, SCHMALIX, et al.). Negokoll, an elastic molding compound of Swiss manufacture, has hydrocolloidal properties; it is advantageous because it becomes firm but remains elastic when it cools. At body temperature the stirred mixture is applied with a finger to the face. After a few minutes the compound is firm. — Today new plastic material for molds is praised again and again and tested by plastic surgeons (OGURA et al.). We do not prepare facial masks routinely but only in special cases. The mask is then cut in two precisely along mid-line, as BYARS does. This is more favorable for the planning of the operation and offers the best opportunity for comparison when a preoperative half and a postoperative one are placed side by side.

F. General indication for corrective and reconstructive surgery

Modern life with its unrelenting competition often places special demands on the appearance of the professional person. Thus it is that people often wish to have corrections performed on disfigurations und functional disturbances in the area of the head and neck. This desire is referred more and more to physicians. In addition traffic, industry and war, with their great numbers of injured, leave facial disfiguration or cervical scars which necessitate correction or reconstruction. One can not ignore a patient's wishes, especially when functional disturbances are present or the danger of psychic injury exists in addition to an external disfiguration. — With congenital malformations and after traumas in early childhood the question arises *at what age* these deformities should be eliminated. It is quite certain that one should correct most disfigurations before school age, so that the children do not suffer an emotional injury due to the teasing of their schoolmates. Even benign, disfiguring tumors in the facial region should be removed as early as possible, even after the child is 3 months old, so that the parents are soon released from the psychic trauma. In the detailed section of this textbook we have indicated certain deformities which require correction at a very early age. But on the other hand, there are also deformities, e.g. of the nose, which should not be corrected during childhood, when the bony structure of the face is still growing. This is also discussed in the main part of the book. In later years, depending upon the patient's good health, practically all deformities are operable at any time. With man's increasing life-span, the question confronts us more and more often to what extent one should also attempt corrective or reconstructive surgery on aged patients. As a result of the improvement in medical care of patients well up in years, especially with regard to their circulatory system, can agree more and more to plastic surgery in the aged. The desire of a patient over 70 to have X-ray ulcers removed from the head or neck is understandable. One should not refuse to perform the surgery if no contraindication exists from the medical standpoint. The same applies to the correction of a sizable rhinophyma, especially when it disturbs the function of the nose. It has been shown that one can make use of tubed pedicle flaps from the trunk to the face on patients 75 years and older; it has also been shown that one can successfully transfer skin grafts from the upper arm at this age. In numerous cases we have performed plastic surgery on patients over 70. This is done with a specialist of internal medicine as standby observing the patient's general condition. In the majority of cases we have obtained the same results as with younger patients.

However, one should be cautioned against agreeing to every wish of the patient. *Slight changes* which can hardly be called deformities should only be made surgically if the profession of the patient requires it, for example if the patient is an actor. With a somewhat practiced eye one can allow himself to be directed by the first impression one has before the patient expresses his desires. If one finds nothing disturbing, one should also have the courage to turn down the operation. One will hardly be able to make patients happy who insist upon the correction of very minor deformities, for instance, of the nose. One can be rather certain that they will be dissatisfied only a short time after surgery and will want to have another correction made. Such persons belong in a psychiatrist's office rather than in that of a plastic surgeon. The situation is different when *psychically disturbed patients* approach the surgeon for a correction. In such cases refusal of the operation can have serious consequences, and consultation with the psychiatrist treating the patient is recommended before this decision is made. For example if a patient with schizophrenia should commit suicide after refusal of the desired surgery, the patient's relatives can blame the surgeon who made the refusal. If the mental disturbance is discovered during hospitalization after the operation, one should notify the relatives at once and advise psychiatric treatment.

The number of people who need plastic surgery is steadily increasing. This is due to the considerable increase in traffic and industrial accidents, to more frequent surgery of large tumors of the head and neck, and to the increase of high dosage radiation therapy. The question as to *who should perform the reconstructive and corrective surgery* is answered in various ways. For example after tumor resections, some surgeons leave the plastic treatment of the defect to a colleague versed in plastic surgery of this area. We are of the opinion that a tumor surgeon must also manage plastic closure of the defects. Therefore he should also have adequate experience in the applicability and use of tubed pedicle flaps and other grafts. With the combination of tumor surgery and plastic reconstruction, good results can be obtained, for example in the area of partial resection of the larynx. The situation is similar with tumors of the face and maxilla. When the surgeon performing the tumor operation must also carry out the reconstructive surgery, he will view the operation during removal of the tumor quite differently from a surgeon who is not so well acquainted with the difficulties of plastic reconstruction, because he is accustomed to having another surgeon perform this part of the operation. If he has to perform the reconstruction himself, he will save some portions of tissue in the skin, mucosa, cartilage, bone, or muscle, in order to have them available in the following plastic operation. Of course the radical excision of the tumor thereby remains the prime rule. Experience has shown that due to an unfavorable choice of approach, tissue is sacrificed which can be important later for the reconstruction. The most various branches of surgery (rhinology, general and emergency surgery, oral and facial surgery, head and neck surgery) have made essential contributions to reconstructive and corrective nasal surgery. None of these operations should impair the function of the nose. It goes without saying that every surgeon who performs corrective and reconstructive surgery of the nose must know the examination methods as well as the operation techniques of the rhinologists with respect to the sinuses. This also means that one know how to use the headlight, so that the interior of the nose can be observed at every moment. In this connection one must also consider that profuse nosebleeding after accidents and plastic operations can frustrate even experienced clinicians. In surgery in and around the nose such bleeding is always possible; therefore it is necessary for the surgeon to have the proper equipment for hemostasis and that he has learned the necessary therapy. Therefore plastic operations should never be performed by inexperienced surgeons. — Plastic therapy of skin damage after radiation burns, especially at the neck, requires extensive ability and knowledge. When one considers that in radiation not only the external skin, which should be corrected by plastic surgery, but also the underlying tissue, like vessels, cartilage, etc., are damaged, one will realize that these operations belong in the hand of an experienced surgeon. The surgeon must be able to control everything from erosion hemorrhage from the large vessels of the neck, perichondritis of the larynx, cellulitis and necroses of the cervical fascia, to the mediastinum. In the area of the ear and frontal sinus, a knowledge of dural surgers is necessary. — From what has been said here, it follows that experience in special anatomical regions, along with knowledge of plastic surgery, is required in reconstructive surgery performed in the head and neck area.

G. Psychological aspects and legal considerations

For all plastic operations, and particularly for nasal surgery, *psychological preparation* is of great importance. Above all the patient should be enlightened about what will happen to him, and in doing so one should never promise him too much. There are patients who can not be satisfield, even with the best operation, and who always have new complexes after the operation. Patients who are unhappy because of small defects even expect the most. The emotional behavior of patients with facial deformations, especially nasal ones, is just as various as their reaction after a surgical correction. In many cases today psychotherapy is necessary in support of surgical treatment. Naturally one can not go so far as Robin, who asks for previous psychological examination prior to every cosmetic operation. Fomon divides patients into three groups. Patients who undergo an operation with no worry have hypoesthetic reactions. Orthoesthetic reactions are had by people with the proper attitude toward blemishes or defects in beauty. People who place too much value on the defects have hyperesthetic reactions, and paraesthetic reactions appear in the mentally ill, such as in schizophrenics. An impressive example for the last ist the tragic case of ALEXANDER, who was shot to death by a psychopath on whose nose he had operated (KRAUS).

With the great number of plastic operations that are performed today it is inescapable that, on the one hand, in a certain percentage of cases failures occur, and on the other hand, that a number of patients with a good result are dissatisfied. Thus in the present day *legal consequences* are not uncommon between physician and patient. One should mention the excellent treatise, "Operation und Recht", by H. J. GOLDBACH in KIRSCHNERs *Operationslehre*, Vol. 1, since the same laws apply to plastic surgery. In plastic surgery, too, an intent to heal is present, even if it serves to eliminate a so-called beauty defect which distrubs the mental-physical balance of the patient. The indication of surgery must be incontestable In the light of the operation results, the plastic surgeon stands in a much more unpleasant position in relation to his patients than his colleagues in purely curative surgery. As KRAUS aptly writes, the reason for this is that the plastic surgeon deals with physically healthy people who want to be at least as healthy after the operation. The success of his operation is not only known by the patient but is also placed open to the public and can be examined critically. He can not close the abdomen over his work, as McINDOE says. He builds his monument and digs his grave in public. The only physician who should operate is the one who has dealt with the basic consept of surgery, in particular, of plastic surgery, and who can work in accordance with the principles of art (see p. 23).

One should ask for a *declaration of consent* by the patient, and with patients under 20 years of age, the parents' consent. Patients should be informed beforehand about the findings and about the expected extent of the operation. Eventual complications and possible unfavorable consequences of the operation should be explained, since many patients have no idea of the pathology and the required surgery. Some surgeons have the patient sign a reciprocal obligation about the explanation (SELTZER, CLAOUÉ, PERRET). THIELEMANN and MAURER even go so far as to have it certified before the operation that they have informed the patient that the nasal shape desired can not always be attained. One is not legally obligated to discuss extremly uncommon complications with the patient. On the other hand it is recommended that one make the patient aware of the possible necessity of a follow-up second operation in difficult cases (COHEN).

Since corrective surgery must also be regarded as a part of medicine in legal questions, the principles of responsibility are the same as those which are otherwise valid in medicine. The risk of the surgery must stand in a certain relationship to the goal which can be reached. One must be particularly cautious in the surgical correction of very slight deformities, since the suspicion of a strong psychogenic overlay exists with these patients.

In general no danger is attributed to most plastic surgery, but one should always realize that every small operation, in the area of the nose as well, can bring on serious complications at some later time. Therefore it is recommendable to perform surgery only when the patients are in good general condition. In cases which are not pressing, one should under no circumstances be induced to operate on patients whose general state of health is endangered. If one has decided upon operation in a hospital, the patient should be admitted on the afternoon before surgery, so that temperature, blood pressure, pulse, and function of heart and lungs may be checked, laboratory examination of urine and blood samples carried out, and premedication started.

H. Operating room and light sources

Naturally only a room which meets surgical requirements should be used as an operating room. General requirements of equipment can not be discussed in detail here, since it would extend beyond the scope of this book; they are discussed very well in the leading texts on general surgery. We refer hare to the general and specific surgical text by M. KIRSCHNER, Vol. I (HEGEMANN). — A smaller operating room suffices for minor surgery of the auricle and the nose. In major surgery a complete operating room should always be at one's disposal. In plastic surgery of the nose, mouth, pharynx, larynx, trachea and esophagus, suction devices which function well are to be kept at hand for immediate use. Because of the illumination of the operative field with the headlight, rheostat, and adapter,

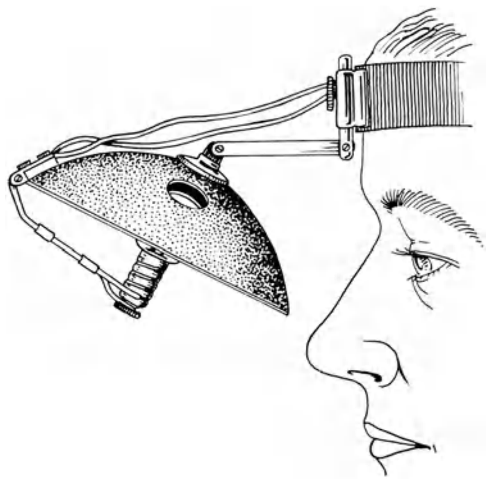


Fig. 22. CLAR lamp with considerable parallax

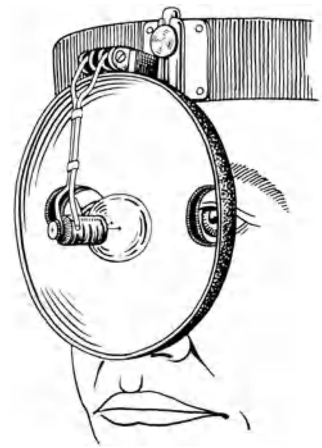


Fig. 23. CLAR lamp, lowered in front of eyes for almost parallax-free viewing

sufficiently long electric cords must be available so that the surgeon can move freely at the operating table. Since many surgeons like to perform long operations on the head and neck while sitting, the operating table should be constructed in such a way that the surgeon's knees will be comfortable as he sits at the upper end of the table. In addition, a hydraulically regulated seat with variable height is desirable for the surgeon in certain operations, especially on the trachea and esophagus. The same requirement also applies to the operating table, so that changes in the patient's position are also possible, especially in surgery of the trachea. The operating room must be capable of being completely darkened, so that endoscopies can be performed at any time during the operations on the trachea and esophagus. Fluorescent lighting should not be used in the endoscopy room. Normal lighting provides instant light and shows skin color naturally. When using the headlight one works best in a half-darkened room.

It is inherent in the nature of reconstructive and corrective surgery of the head and neck that the normal *operating lamps* do not guarantee the surgeon the best vision. As long as the operation site remains on the surface, conventional operating lamps are sufficient. But even within the nose, the sinuses, the mouth, the external auditory canal, and especially in the pharynx, larynx, and the trachea, these lamps provide insufficient light, and vision is very much restricted. Therefore even at an early date surgeons changed over to the use of the *headlight* in plastic surgery of the head and neck. The headlight has a 60-year history and has been perfected to a considerable degree in recent years. The French schools generally prefer the Clar lamp (Figs. 22 and 23), while in German-speaking areas those lamps which function on the Kirstein principle are used more often. Since the Clar lamp has large reflector, it provides excellent light. The Brünings-Perwitzschky lamp (Fig. 24) also has the advantage of the reflector, but both lamps have a relatively large parallax. Some plastic operations, for example on

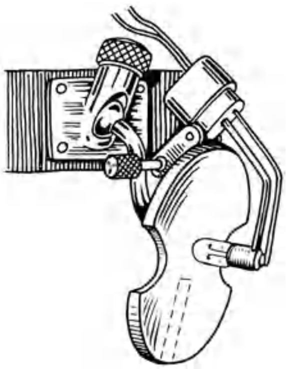


Fig. 24. Headlight by Brünings-Perwitzschky with lateral notches in mirror for use as with Clar lamp. Dotted line on mirror: slit for direct,

Fig. 25. Headlight of light metal by Denecke. It works according to the Killian-Kirstein principle. (From H. J. Denecke)

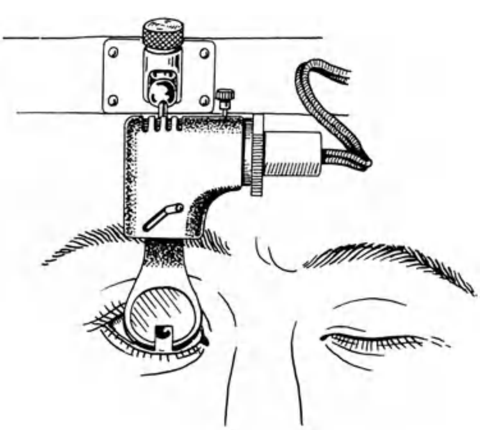


Fig. 26. Headlight of Denecke in monocular use

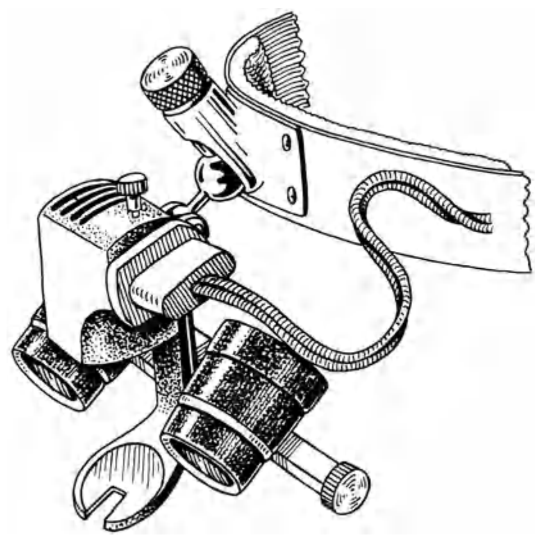


Fig. 27. Headlight of Denecke. The hinged magnifier is swung upward

the nose and the trachea, require parallax-free lighting. In one particular position (Fig. 23) the Clar lamp makes vision possible along the axis of light coming from the reflector, since it has two holes in the reflector as far apart as one's eyes. In spite of this, lighting at greater depths is insufficient due to the scattering of the rays. In addition it is disadvantageous in this position for the surgeon, since the reflector obscures a part of his field of view. It is thereby hardly possible to look

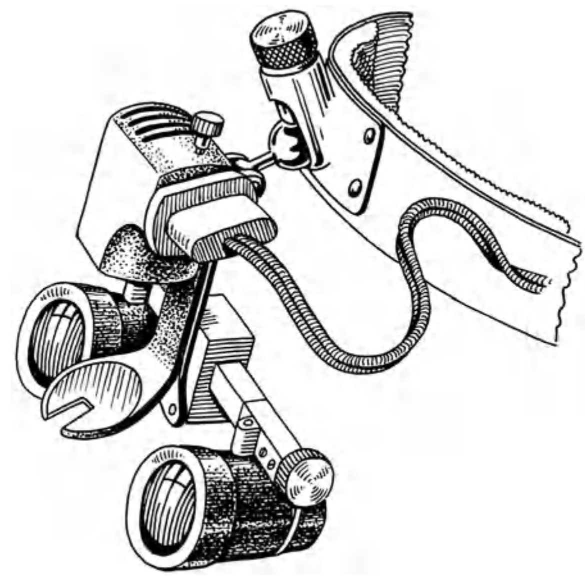


Fig. 28. Headlight of DENECKE. The hinged magnifier is swung down into position for use

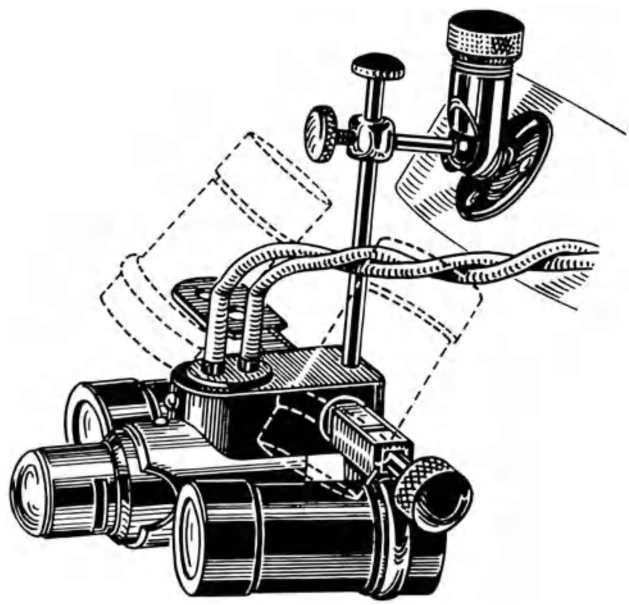


Fig. 29. Headlight with hinged binocular magnifier by KASCHE. (From H. J. DENECKE)

past it, for example at the instrument table. The BRÜNINGS-PERWITZSCHKY lamp (Fig. 24), which has a relatively small reflector, has notches around the edges at eye level so that the restriction of the field of view is eliminated to a great extent; but in spite of this one still has good brightness at the site of operation. The conditions with respect to depth illumination are considerably more favorable with the DENECKE lamp (Figs. 25 and 26), built according to the KILLIAN-KIRSTEIN principle. In this lamp the light rays can be directed parallel or be made to converge, depending upon the position of an adjustable lens. The possibility is provided of reducing or enlarging the illuminated area of the operation site. For binocular vision the remarkably light lamp (50 g) can be worn in the area of the nasal root; the small mirror which reflects the light thus does not disturb the surgeon's vision at all. As a variation, the lamp can also be placed in front of one eye. The surgeon then looks through a small slit in the lower section of the mirror on the same axis as the beam of light. Thus he has excellent light at great depth, which has proved its value even for endoscopies. This type of illumination has asserted itself more and more in recent years for plastic surgery of the head and neck with their narrow routes of approach. Through the development of the incandescent bulb into the spotlight, the brightness, which was formerly far behind the reflector lamp, has been decidedly improved. One can also modify the lamp with a magnifier which makes more precise work possible (Figs. 27 and 28). Since the magnifier can be swung into position or out of the way during the operation, it is possible to work with normal vision or with magnification as desired, without loss of time due to the change. The KASCHE lamp (Fig. 29), which is however considerably heavier, also has this advantage.

In plastic surgery one seldom needs to use the operation microscope, except possibly for epilation, in the external auditory canal and at the eardrum. The method of placing lamps behind the surgeon might be considered only for motion picture purposes, since the annoyance of heat and the use of space are unpleasant. Besides, experience shows that with this kind of lighting the depth illumination is totally inadequate in narrow routes of approach. Whoever has learned to work with the headlight will not want to do without this illumination in plastic surgery, at least in the nose, larynx, trachea, and pharynx. Only with quite superficial operations, such as skin flap advancements, should one operate with the large operation lamps. Recently cold light sources have been added to headlights.

J. General notes on anesthesia and medication

In hospitals with a department of anesthesia headed by a professional anesthetist, the type of anesthesia is determined in consultation between the surgeon and the anesthetist. Under present conditions in smaller hospitals, and especially in private ones, the surgeon himself generally decides upon the *choice of anesthesia* and assumes the responsibility for it. In the decision whether one should employ local or general anesthesia, knowledge of both procedures is important, just as is the critical deliberation of advantages and disadvantages for the operation and for the patient. Without doubt sufficient reasons can be found to justify surgery under local anesthesia or nerve blocking, without the necessity of general anesthesia having to be discussed at all. Lack of personnel or of equipment should play no role today, even in private hospitals.

The surgeon should follow the wishes of the patient as far as possible. Many people, especially women, have a deeply rooted dislike toward local anesthesia. They would like to experience nothing of the operation and to wake up when it is all over. There is little sense in wanting to talk a very nervous patient into agreeing to local anesthesia. — But today, in general, corrective nasal surgery is done under local anesthesia, especially in the U.S.A., while in England general anesthesia is preferred. According to TAMERIN and DE POLO a poll of patients in the U.S.A. is said to have shown that of those patients who could choose the type of anesthesia and had formerly undergone surgery with local anesthesia, 75% again asked for local anesthesia, whereas 75% of the new patients chose general anesthesia. On the whole the trend is more and more toward general anesthesia, but indeed less for medical reasons than in the sense of a concession to the desires of the patient. In rhinoplasty and in other plastic surgery of the face the surgeon is, if anything, hindered by general anesthesia, because bleeding is considerably more profuse when agents are not introduced for the reduction of blood pressure. The same is true for plastic surgery of the pharynx and trachea. Operative conditions with general anesthesia are generally better than with local anesthesia only when one deals with nervous or unreasonable patients who continually disturb the course of the operation.

In this question we generally compromise when we perform plastic surgery with local anesthesia on adults and young people over 12 years of age. The anesthesia is potentiated by a so-called *lytic cocktail*, so long as no contraindication exists with regard to the cardiovascular system, liver, or kidneys. The cocktail is a matter of a potentiated anesthesia, as by LABORIT und HUGUENARD, an associated application of various pharmaco-dynamic agents which, among other things, effect a reduction of the basal metabolic rate. Body temperature and metabolism are decreased, and the life-processes are slowed down, a condition named "hibernation" by the authors just mentioned. By the combination of the agent causing this condition with an anesthetic a sufficiently deep sedation will be obtained. In so doing one can achieve this with a dosage which would otherwise be inadequate. For the potentiated anesthesia we use the lytic mixture used by LABORIT, consisting of a chlorpromazine (Largactil, Megaphen, Thorazine), a promethazine derivative (Phenergan, Atosil), and a synthetic morphine derivative (Demerol, Dolantin, Dolosal, Diparcol). Demerol acts analgesically and vagolytically, while Phenergan and Thorazine have an acetylcholinolytic, sympathicolytic, histamolytic and hypothermic effect.

Many favorable empirical reports by otorhinolaryngologists are available about preparation for surgery using potentiated anesthesia. These reports are by DANERS, KOST and SCHROEDER, REICHEL, REINKE, WALTER, WIRTINGER, ECKEL, ORSO and others. Along with reducing pain, a considerable decrease in shock danger by blockade of ganglia, and a reduction of blood pressure are the advantages of the medications listed above for surgical purposes. Intubation anesthesia can be potentiated as well with the above premedication. It is employed either intravenously or intramuscularly, or in a combination of both. Because of its acid reaction, it is best to dilute the mixture with normal saline.

Usually on the evening before surgery 12.5 mg Largactil, 12.5 mg Phenergan and 25 mg Demerol, i.e. half an ampule of each, is injected intramuscularly. In some circumstances twice the amount is given to strong patients. Two hours before the operation the same dose is given again intramuscularly. When the patient is on the operating table, the cocktail is added to a continuous intravenous infusion of normal saline solution. Here we must be sure that the Largactil is the one marked for intravenous injection and not for intramuscular use. A quarter of an hour before the operation, that is before the application of local anesthesia, we give 0.5 cc of the mixed solution by means of the I. V. infusion, then perhaps another 0.5 cc five minutes later; following that another part of the cocktail is given in 15 minutes, 30 minutes, or an hour or later, as needed. Instead of being given in continuous I.V. infusion, the mixed injection can be diluted with 20 or 40 cc of normal saline solution and be given very slowly as an intravenous injection. Most important is that the solution reaches the veins heavily diluted, so that no endothelial irritation with subsequent phlebitis occurs. In more minor surgery we are satisfied with the intramuscular application. In many cases administration in the operating room of 0.5 or 1 cc of the mixed injection twice before the local anesthesia is sufficient. With restless patients we have to give from 1 to 10 additional injections. Thus the great variance of the effect requires a careful adjustment to the particular conditions of the individual patient. With older patients, delicate women and with adolescents we administer less from the beginning. In general patients with this preparation act in a restful, indifferent, disinterested, sleepy manner during the operation. They are somewhat insensitive to pain. Breathing is slow and deep. The pulse rate rises at first and later reaches normal rates. The blood pressure is lower or unchanged. Because of a danger of an orthostatic collapse due to the lesser capability of the circulatory system to react, the patient is not permitted to leave his bed after the first medication on the evening before the operation. We check the blood pressure on the eve of the operation, in the morning, and on the table before each administration of the cocktail. In case the blood pressure falls below 90 mm Hg, the administration is discontinued; if it falls below 80 mm Hg, the patient is given caffein. To correct the blood pressure the head can also be placed low. Usually the blood pressure and pulse curve show only slight fluctuations, because as a result of the vegetative sedation, lack of oxygen, accumulation of carbon dioxide, reflexes and operative trauma cause no changes or only very slight ones.

Experience shows that *young people between 16 and 25* need the strongest doses. Up to now we have never used potentiated anesthesia on *children under 12*. This however, is practiced by some authors (Eckel, Orso). E. Schmid uses another combination of medications for potentiated anesthesia. He gives Megaphen, S. E. E. (Scopolamin, Ephetonin, Eukodal) and Luminal. With this kind of lytic cocktail he goes considerably farther than we do, in that he uses the cocktail in proportional dosage even on *babies* for the primary repair of cleft lip, maxilla and palate.

In our practice the dosage plan mentioned above has proved its value. We have never met with serious complications except for occasional subconscious conditions of excitment in the patient which could be relieved by increase of the dosage.

Other dosages and combinations with Luminal, Sevenal, Scophedal, Nembutal and other preanesthetics are described, too, by many authors. Instead of Phenergan or Atosil, other Phenothiazine derivitaves are given, like Equanil, Fargan, Pacatal, and Siquil, among others. In place of the Chlorpromazine, Largactil and Megaphen, one can also use Prazine (Promacinhydrochloride), named Sparine in America. We give it in patients who already have a low blood pressure, because its effect of lowering blood pressure is less than that of Largactil. It can also be replaced by Hexamid, a neuroparalytic which does not reduce the blood pressure as much, but which has with that a weaker and, above all, shorter effect. In short operations Hexamid can even be slowly injected intravenously in a dosage of from 50 to 100 mg (2 to 4 cc) about 3 minutes before beginning the operation. Further medications which are suitable for the preparation of small operations are, among others, Nembutal, Luminal, S. E. E., Scophedal, and Morphine + Scopolamin. The exact dosage is not given here, since they can vary according to age and weight of the patient; they can be found in the tables concerning the respective medications.

For *short, very painful phases of the operation*, for example during work in a very cicatricious area, Pentothal (= Thiopental) can deepen the anesthesia. It should be injected intravenously very slowly. Epontol is also used for 2—3 min.

Topical anesthesia is applied to the mucosa a few minutes before the injection of the local anesthetic or before scrubbing in; a cotton pledget soaked in a 2% solution of Pontocaine (= Tetracaine hydrochloride) is placed into the nose bilaterally, or the Pontocaine solution is sprayed into the nasal cavity or oral cavity with an atomizer. Instead of Pontocaine one can also use a 10% cocaine hydrochloride solution or a 1% Novesine solution.

The following medications are most frequently used as *local anesthetics:* 0.5% Xylocaine (= Lidocaine) or 1% with epinephrine, 2% Xylocaine with norepinephrine, 1% novocaine with adrenaline or suprarenine, 1% novocaine with noradrenaline, 0.5% procaine with epinephrine or with norepinephrine. The addition of norepinephrine or noradrenaline is intended for patients sensitive to adrenaline. With the Swedish preparation, Xylocaine (Lidocaine) the size of the anesthetized area is said to be greater, the anesthesia lasts longer, and the latency period is shorter than with other agents. The required addition of epinephrine for vasoconstriction is only one sixth of the amount necessary with procaine. Some surgeons like Sanvenero-Rosselli and Schuchardt use 2% novocaine solution with addition of adrenaline or suprarenine. — A delayed adrenaline effect is had by the agent Adrenoritard (Muscato di adrenalina), formerly Asmaritard, which is used today as an additive by various Italian surgeons. After many years of experience with the combination of the lytic cocktail and local anesthesia as described above, we have come to the conclusion that this is the method of choice for rhinoplasty and for plastic surgery of the head and neck of long duration. Especially in cases where one must operate in cicatricious or irradiated areas, this method has great advantages, for local anesthesia only is completely inadequate. In surgery right next to the facial nerve, in which the function of the nerve must be able to be tested at all times, the use of the lytic cocktail permits a very sparing superficial infiltration anesthesia.

The disadvantage of local anesthesia is the necessary swelling of the tissue which sometimes makes a finer dissection more difficult. Contours become indefinite, and shape and size relations are slightly changed.

Postoperative edema is considered by patients as more or less annoying, according to their mental constitution. The extent of edema depends upon the duration and intensity of damage to tissue as well as on the particular reaction of the vascular and neuro-humoral control system. Under some circumstances edema can even affect the result of surgery. For the past ten years already, antihistamines have been given pre- and postoperatively to counter these edemas. In addition the antihistamines have favorable effect of inducing sleepiness. In 1953 the Finn, Kivimaki, recommended giving an antihistamine before the operation and daily for five days afterward, each time with a dosage of 100 mg. Goldman and his colleagues and later Gidoll have successfully administered cortisone orally for the reduction of edema and suffusion accumulation after rhinoplasty. On the evening before one should give 25 mg of cortisone, at the beginning of the operation or immediately after the beginning 50 mg, and then 25 mg seven times more once every 6 hours. — α-Chymotrypsine was recommended by Moore for lessening postoperative swelling in plastic surgery. Lyophilized α-Chymotrypsine is sold under the name Chymar in England and Chymoser in Italy. It has a fibrinolytic, mucolytic, anti-inflammatory and anti-edemic effect. In 1959 Moore reported good successes among a large number of plastic operations. He even said that the agent revolutionizes certain aspects of plastic surgery. According to Dufourmentel, Mouly and Préaux, who have likewise tried it, the agent is said to be especially good in rhinoplasties, since it holds back postoperative vein and capillary thromboses and thereby makes the tissue less sensitive to irritative reactions. According to CARLIER and CARON it also proves to be useful against fresh post-traumatic swelling in fractures of the facial bones. — In 1958 STUTEVILLE and his colleagues recommended the proteolytic enzyme, Trypsine, for the reduction of the tendency toward swelling as well as toward inflammation in the soft tissue. Trypsine was also recommended as therapy in addition to antibiotics in acute and chronic inflammatory affections in the facial and cervical region. — An anti-edematous and anti-inflammatory effect similar to that of α-Chymotrypsin is also ascribed to Varidase (Streptokinase — Streptodornase), which is used in the same manner (WEGENER, HYSON, etc.). The advantage of this agent is the buccal application. One tablet is given four times daily over a period of five days. The patient must place the tablet between the gums and the cheek and let it dissolve. Every tablet contains 10,000 units of Streptokinase and 2,500 units of Streptodornase. — KEMPF has also indicated Irgapyrin as an effective agent against postoperative swelling.

In order to counteract the disadvantage of the distention of the tissue by infiltration with local anesthetic and to prevent postoperative swelling, Hyaluronidase can be added to the anesthetic solution. The name Hyaluronidase generally refers to a fermentation complex which is capable of splitting the main components of the basic substance in connective and supportive tissue, in particular, hyaluronic acid. An increase of permeability and an accelerated fluid exchange in the tissue runs parallel to the resulting decline in viscosity. Hyaluronic acid normally acts as a barrier to the diffusion of substances in the tissue. Hyaluronidase enzymatically hydrolizes the acid. Thus it does away with this barrier and provides better diffusion of the anesthetic agent here. This enzyme was successfully tested by COTTLE as an anesthetic additive in the elimination of facial creases and in rhinoplasty, especially in later corrections of nasal deformities already surgically treated. We inject it occasionally even later, if considerable edema of the lids and of the cheeks occurs. Hyaluronidase is on the market under the names Permease, Kinetin, Apertase and Luronase. We use the agent, Permease, in the local anesthesia of very cicatricious tissue and add one ampule to 30 to 40 cc of anesthetic. An ampule of Permease contains 25 viscosity units Cilag. Other Hyaluronidase preparations have still other unit-measures like the TRU of Vidase.

Tanderil (GEIGY) is another new agent which decreases the local postoperative reactions, primarily swelling. It is a synthetic substance, an oxyphenylbutazone which has another antipyretic effect, along with the effect of lessening edema and retardation of inflammation. Three times daily we administer 2 dragees (600 mg per day) on the day of the operation and on each of the two following days.

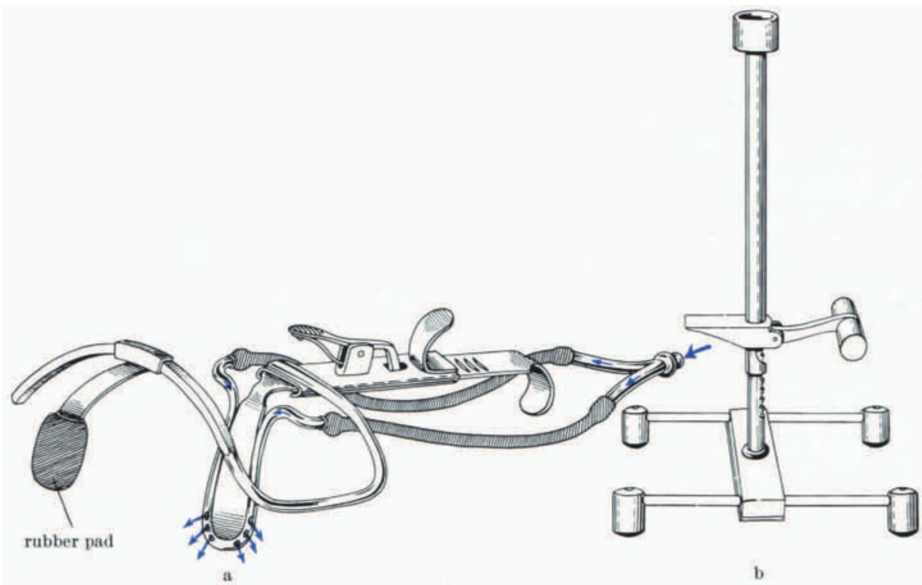
Some authors like GIDOLL recommend vitamin K as a *prophylaxis against a bleeding tendency*, during and after the operation. With use of the potentiated premedication in conjunction with the local anesthetic, the tendency to bleed is slight anyway.

Today *antibiotics* are given in plastic surgery routinely. Wide-action antibiotics are generally preferred.

As already mentioned above, in England and also in Scandinavia, plastic surgery, especially rhinoplasty, is being performed more and more with *intubation anesthesia*. Here as well tends toward intubation anesthesia more often for minor surgery as well, because the patients, especially very sensitive women, demand it. We decide to do this only occasionally. There is supplementary infiltration of the nose with a local anesthetic to reduce the bleeding tendency. As is well-known, bleeding is considerably greater with general anesthesia.

After intubation either the rubber cuff in the trachea is inflated, or the pharynx and rhinopharynx are packed, to eliminate the danger of aspiration. Use of a tube reinforced with a metal spiral or a so-called Oxford non-kinking tube is recommended. Then the packing can be tighter. In children and in older patients the plastic tube is suitable. — The introduction and technique of intubation anesthesia is not to be discussed here in greater detail.

As mentioned above, the disadvantage of general anesthesia compared with local anesthesia lies in the increased bleeding during surgery. In adults one can compensate for this disadvantage with the application of agents which block the ganglia in combination with an inclined position of the patient. By this the loss of blood is reduced and a meticulous dissection in a relatively dry operation site



Figs. 30a and b. General anesthesia device with mouth gag and holder by DAVIS-MEYER. a Mouth gag with attached anesthetic tube. b Stand

is made possible for the surgeon. But for this an experienced anesthetist is needed. After a premedication with morphine-atropine or the like, the general anesthesia with barbiturates is induced intravenously.

Under the influence of muscle relaxants intubation is performed and during the operation breathing is artificial. The analgesia can be maintained with nitrous oxide and oxygen or with further administration of barbiturates. Hexamethonium bromide, pentolinum tartrate and the ultra-short-acting and easily controllable Arfonad can be used to lower blood pressure. Here the addition of adrenaline is contraindicated. McINDOE was a great proponent of this type of anesthesia. In every plastic operation his anesthetist brought the blood pressure to a level of from 60 to 90 mm Hg. — One must wait to see whether this method which is practiced much in England today will assert itself to this extent in other lands as well. Continental anesthetists are skeptical.

Of course plastic surgery of the nose and face *in children and babies* is performed under general anesthesia. In nasal operations it is usually a matter of traumatic nasal deformities or of malformations with bad spatial relationships following cleft lip and palate surgery. Here it is a question of either the orotracheal intubation anesthesia with the use of an AYRES T-piece or a double valve by LEIGH, or else the *mouth gag anesthesia* of NEGUS. With patients above 10 years of age we consider intubation anesthesia more suitable because of its better control. We often operate on smaller children, even babies, under mouth gag anesthesia with the DAVIS-MEYER mouth gag (Figs. 30 and 31). Thereby the child lies on the operating table in the TRENDELENBURG (recumbent) position with an inclination of from 10^0 to 30^0. The head is set at a lesser or greater angle and height. This position, combined with regular suctioning of mucous and blood, provides the most effective protection against aspiration. The possibility of keeping the upper air passages continuously free, and in view, if necessary, gives us a great deal of security. After premedication with morphine-atropine, or sometimes Nembutal, general anesthesia with chlorethyl or divinylether (Vinithen,

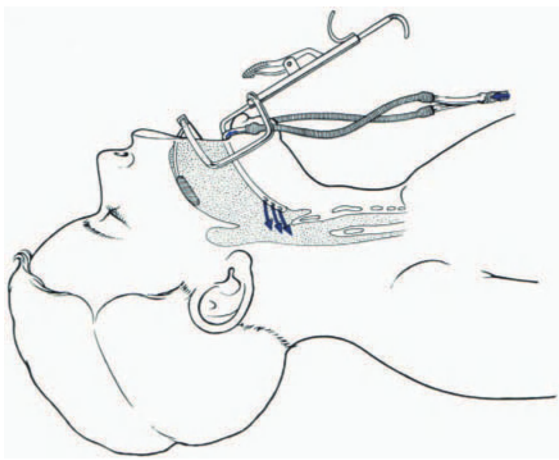


Fig. 31. General anesthesia device by DAVIS-MEYER in place. Blue arrows show direction of anesthetic flow

Vinidan), in larger children perhaps with Pentothal (Thiopenthal). With Thiopenthal the tendency toward spasms of the glottis is said to be greater. Barbiturates of short action can also be used rectally to induce general anesthetia. With babies as HEGEMANN and others have also recommended, we use ether exclusively, because it is best tolerated. When a sufficient depth of anesthesia has been reached, with good relaxation and lack of reflexes (stage III_2), then the mouth gag is introduced and one changes over to insufflation anesthesia. The gag, which should suit the size of the child, is connected to the anesthesia machine before its introduction. The correct choice of gag size is important, because a gag which is too small pushes the base of the tongue in front of the laryngeal opening; too large a gag can press against the opening of the larynx. The DAVIS-MEYER mouth gag and mouth gags of similar construction are suitable for all operations in the mouth and epipharynx as well as for nasal and labial surgery. A saddle-shaped, rubber-padded support, which rests flat against the palate, is added to the solid, curved mouth gag. For surgery on the palate, in the nasopharynx and the pharynx, the palate support is replaced with two adjustable, similarly rubber-lined supporting arms which grasp the upper jaw. The mouth gag, which is connected to the anesthesia machine with rubber tubing, rests on a metal frame or on a chest support, or it can be suspended in the correct position by a taut cord tied from above, or by an assistant. Similar anesthetic mouth gags for cleft surgery have been developed by BARTON and by RUSSEL-DAVIS.

— The insufflation is continued with ether-oxygen, ether-oxygen-nitrous oxide, or ether-air. It is carried out either continuously or discontinously with observation of the depth of anesthesia and with assurance of free breathing passages.

K. Technique of local anesthesia in rhinoplasty

For the basic rules of local anesthesia one should refer to the various anesthesiological texts and the corresponding volumes in the large texts on general surgery (Frey, Hügin, Killian, and others). As far as special requirements for the operations cited here are concerned, these are to be found in the respective chapters. Only *local anesthesia of the nose for corrective surgery* is to be presented here in more detail.

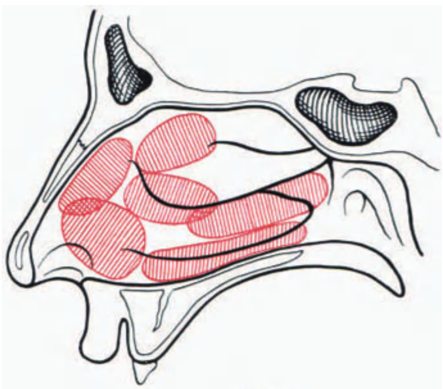


Fig. 32

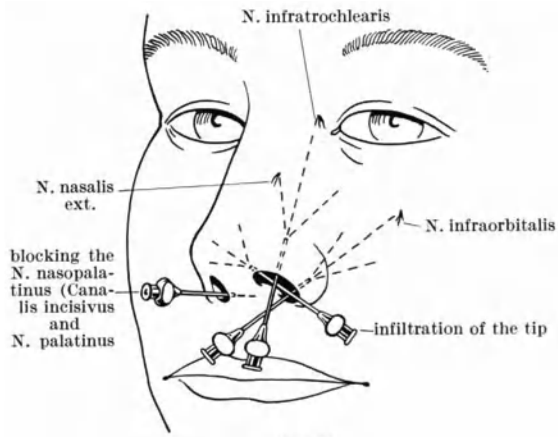


Fig. 33

Fig. 32. Topical Pontocaine anesthesia of nasal cavity with cotton pledgets. Red hatching shows points of contact of Pontocaine-soaked cotton

Fig. 33. Anesthesia of external nose

A few minutes before the injection, best before scrubbing in, cotton pledgets soaked in 2% Pontocaine solution are placed into the nasal cavities. This anesthesia of the mucosa can also be effected with 10% cocain or 1% novesin. The topical anesthetic also be sprayed into the nasal cavity. Many surgeons use a cotton applicator which has been soaked with Pontocaine for anesthesia of the mucosa. It is applied to the area of the N. nasociliaris, to that of the Ggl. sphenopalatinum and sometimes even to that of the N. nasopalatinus. In contrast to this we pack the whole anterior part of the nasal cavity with Pontocaine-soaked cotton, which we leave in for 10 to 20 minutes (Fig. 32).

Proper local anesthesia of the nose requires good knowledge of its internal and external nerve system. One must consider the N. nasalis internus, the N. sphenopalatinus, the N. nasalis posterior in the nasal interior and the N. nasalis externus, the N. nasolobularis and the Rami mediani of the N. infraorbitalis. The first injections should be made with the finest needle (No. 18 or 20) at the places where the tissue is loose, such as just medially from the alar attachment at the nasal base of the vestibule. Now one waits a few seconds and presses deeper with the needle in the direction of the exit point of the N. infraorbitalis, until, with continuous pressure on the plunger of the Luer-lock syringe, the bone is reached, where a deposit is made (Rami mediani of the N. infraorbitalis). After this bilateral nerve-block anesthesia the base of the columella is infiltrated, and then the mucosa at the plica nasi in the vestibule. From here one can penetrate further in an upward direction with a longer needle to infiltrate the lateral portions of the bony nose (N. nasalis externus) as well as the glabella and the middle of the dorsum. Following this one infiltrates the tip (N. nasolobularis), the upper and anterior crest of the septum, and the agger nasi. When a septum resection is to be included, the whole septum must be anesthetized as well. Finally the needle is introduced at the base of the columella and guided horizontally past the spina nasalis anterior in order to block the Nervus nasopalatinus farther back at the Foramen incisivum and the N. palatinus anterior (Fig. 33).

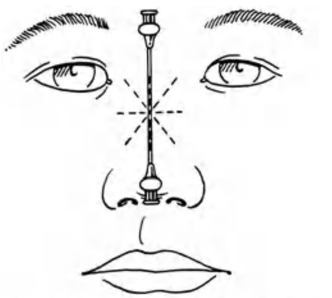


Fig. 34. Anesthesia, cheek approach by Frühwald

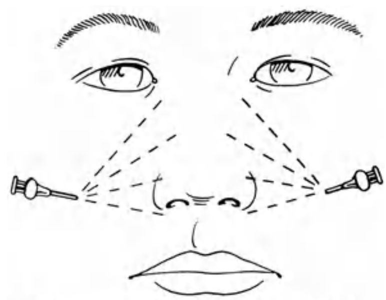


Fig. 35. Anesthesia, nasal tip approach by Sheehan

Fig. 36. Anesthesia, nasal root approach by Kazanjian

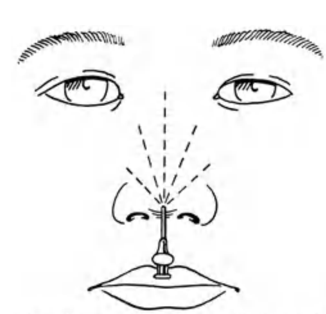


Fig. 37. Anesthesia, dorsal approach by Schuchardt

Fig. 38. Anesthesia, nostril approach by Barsky

Every surgeon has his own technique of injection. Fomon and his colleagues proceed as described here, while Berson injects at the upper lip next to the ala and in the middle at the base of the columella. Brown and McDowell infiltrate the base of the nose in the vestibule anteriorly from one point of puncture laterally next to the alar attachment. They carry out the nerve block anesthesia of the Nervus infraorbitalis from a puncture point in the cheek directly over the exit point. Frühwald does the same, whereby he then infiltrates the whole nose from the glabella to the columella from this lateral puncture point (Fig. 34). Sheehan performs the infiltration in a fan-shaped pattern from the nasal tip (Fig. 35). Kazanjian proceeds in the opposite direction from the glabella downward, but still externally (Fig. 36), while Converse chooses to make all puncture points endonasal. Schuchardt chooses the middle of the dorsum (Fig. 37) or the glabella as the point of puncture; he injects further at the vestibule, laterally at the base of the ala, and medially at the columella. Barsky calls his method of infiltration from four endonasal points of injection the "cross-fire method" (Fig. 38).

L. Instruments for rhinoplasty

Among the instruments for rhinoplasty are generally various specula, hooks, forceps, knives, scissors, rasps, mallet and chisels, saws and files. There is no customary instrumentarium, since the techniques and the special desires of surgeons are too varied. Unfortunately there are already far too many instruments for rhinoplasty on the market, and new ones are always being invented. Very often these new instruments do not simplify a manipulation but rather make it more complicated. Some authors like SELTZER have a special instrument for every manipulation; others, like SAFIAN, keep the number of mechanical aids to a minimum and resist a technicalization which goes too far. This is a matter of viewpoint; we do not want to add anything by making recommendations or critical warnings. In this chapter we can only discuss the most general instruments, such as specula, knives, scissors, hooks and elevators; specialized instruments for particular phases of the operation in corrective or reconstructive rhinoplasty are discussed in the corresponding chapters.

The short speculum, as well as the long ones of KILLIAN-HALLE (Figs. 163, 164, 165), the JOBSON-HORNE speculum derived from the latter, and the asymmetrical one for rhinoplasty of O. BECKER (U.S.A.) can be used in plastic surgery of the nose. Along with these, self-holding specula like those of THUDICHUM and others are used. The specula of AUFRICHT and KILNER aid in inspection of the dorsum beneath the skin (Fig. 46). As retractors for the alae we use a blunt and a sharp one of JOSEPH (Figs. 45, 58b, 94), and along with this, dermal hooks after GILLIES or KILNER. The ala-retractors of DESMARRE, of KILNER, and of SHEEHAN, and the large nasal tip retractor of JOSEPH (Figs. 102, 105, 107, 108, 124) are also much used.

Today the knife with interchangeable blades of BARD-PARKER is used most. This knife has found copies in many countries, like those of GILLETTE, DURAY-THACKRAY, BEAVER, A.S.R. New York, etc. There are various blade shapes which are numbered; of these No. 15 (Fig. 99) and No. 11 are the most used in rhinoplasty. There are also many shapes of knife handles: narrow and flat, wide and flat, knobby like that of BARON, etc. For the septum the knives of BRÜNINGS and FREER are still used. To the septum knife of FREER (Fig. 162), SELTZER has attached a metal director which is supposed to prevent the deep penetration of the blade through the septal cartilage and an injury of the mucoperichondrium on the opposite side. For internal incisions in the nose double-bladed knives like that of JOSEPH (Fig. 41) and a modification of this with a blunt point by FOMON may be used. There are four shapes of button-end knives: straight (Fig. 44b), curved on the flat (Fig. 44a), angled single-edged (Fig. 48), and angled double-edged. The last aids in removal of fine strips of cartilage. The first three were invented by JOSEPH, the fourth by MALTZ. Double-edged knives as well as the button-end knives are available today also with interchangeable blades by GOLDMAN and FINEBERG.

Here only the most important of the multitude of scissors are to be mentioned: the fine, pointed (Fig. 45), slightly curved scissors; the fine dissection scissors, straight and slightly curved, with blades triangular in cross-section after AUFRICHT (Fig. 95); and the small slightly curved scissors with flat blades after METZENBAUM, KILNER, MCINDOE (Fig. 101) or GILLIES. In addition, one can mention the angular nasal scissors of MUCK or KNIGHT (Fig. 105) sharply curved on the flat, the less curved ones of MAYO and FOMON, and the little, blunt-end, curved scissors of MCINDOE.

The most common bone-cartilage scissors are those by KAZANJIAN and their modification by EITNER, COTTLE, ROWLAND, ECKHOFF, BARTON, GOLDMAN, MCINDOE and LANE. We use those of ROWLAND. They have a double joint like the forceps of ZAUFAL-JANSEN (Fig. 94) and blades like the LISTON bone forceps (Fig. 53). Compared with those of KAZANJIAN these scissors have the advantage that the blades are closed with the same pressure along their whole length.

The following elevators and rasps may be mentioned: the blunt ones of FREER, BALLENGER (Fig. 103, 118) and SÉBILEAU, those of JOSEPH and MCKENTY with sharp edges for the periosteum, and the more spoon-shaped ones of SÉGOURA and HOWARTH (Fig. 42). RONGETTI has described a spoon-shaped elevator behind the point of which is a suction opening; by means of this one can constantly use suction while working with the elevator. This kind of suction-elevator has already shown its value in tonsillectomies. We have likewise constructed such a one and use it for décollement of the dorsal skin together with the periosteum. With ours, the slit-like suction opening is located on the slightly concave surface, about 3 mm from the forward edge.

Of the various types of files and rasps we have these in our instrumentary: straight ones of JOSEPH and of BARSKY (Fig. 73) as well as the one of MALTZ, which are curved backward slightly. The hollow rasps of SCHMID are also to be recommended. Here too, according to PEER and WALKER, there are interchangeable file-blades with varying degrees of fineness or coarseness which can be attached to a solid handle. — Mosquito clamps and suction units need not be described here. — Chisels and saws are discussed in the chapter on bone removal.

A. Corrective rhinoplasty

I. Incisions

The basic incisions today are performed endonasally when possible. The endonasal approach was introduced by ROE in 1887 and propagated later by JOSEPH; before that time only *external incisions* were used, with the exception of DIEFFENBACH (quoted from FRITZE and REICH, 1848). Today in purely corrective rhinoplasty an external incision is necessary only in rare cases. Of these we know the glabella incision, the incision through the eye brows, or at

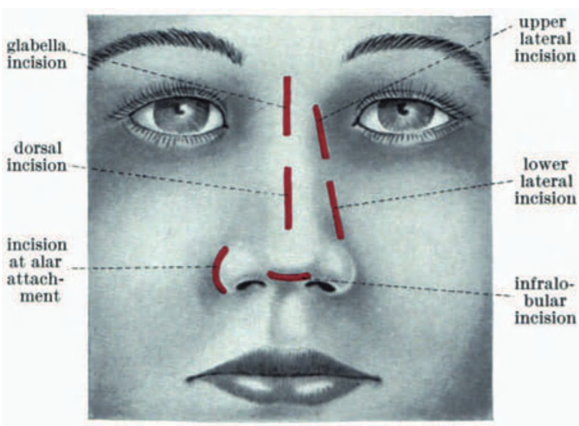


Fig. 39a. External incisions on nose, seen from front

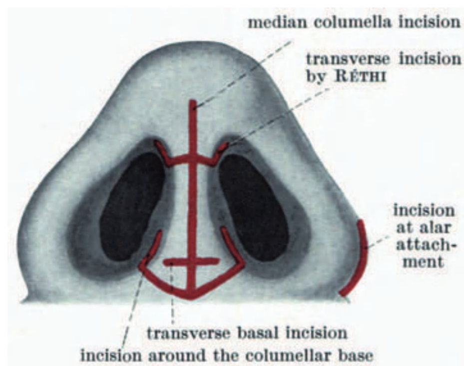


Fig. 39b. External incisions on nose, seen from below

its edge (Fig. 70) the upper and lower lateral, the dorsal and the infralobular incisions (Fig. 39a). In addition to these, there are the median columellar incision, the transverse basal columella incision, the transverse incision of RÉTHI between the anterior and middle thirds of the columella, and the incisions at the base of the alae (Fig. 39b) which are usually coupled with excisions.

The sub-labial incision in the gingivolabial fold is another nasal approach which is especially suitable for dorsal implants or implants in the nasal base or at the columellar base (Fig. 40a).

For raising the whole columella we make an incision at the base of the columella extending to the philtrum (Fig. 39b).

Among the *endonasal incisions* we differentiate between the incision at the border of the vestibule, the intercartilaginous incision in the plica nasi between lower and upper lateral cartilages, and the intracartilaginous incision between these two incisions. In addition there is the so-called transfixion or trans-septal incision as an extension to the septum of the intercartilaginous incision. The incision at the piriform crest is in the lateral angle of the nasal vestibule (Fig. 40b).

Variations of the intercartilaginous incision are to be found with KAZANJIAN and with MIR Y MIR in the chapter on nasal tip corrections.

II. Décollement of dorsum and lateral nasal walls. Transfixion

For every correction of the bony nasal structure the soft tissues of the nose with the nasal tip and columella, including the lower lateral cartilages, must be separated from the more solid structures, that is from the nasal bones and from the septum; when one does this, of course, the soft upper lateral cartilages remain together with the solid structures. This process is called *décollement.*

Fig. 40a. Sublabial incision

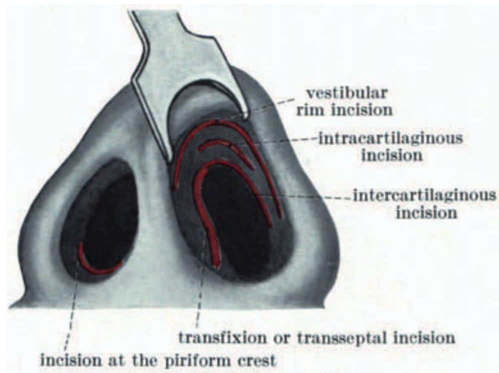


Fig. 40b. Endonasal incisions

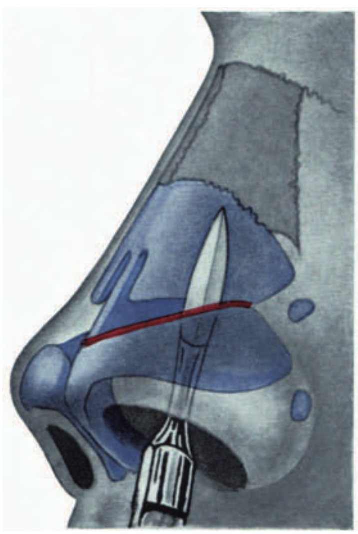


Fig. 41. Intercartilaginous incision and method of locating border of bone

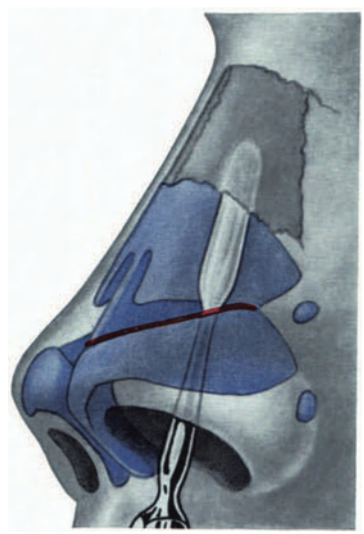


Fig. 42. Subperiosteal décollement. The sharp elevator loosens the periosteum over the nasal bone

To accomplish this the skin of the vestibule is incised between the upper lateral cartilage and the lateral limb of the lower lateral cartilage, that is, at the plica nasi (intercartilaginous incision, Fig. 40b). The connective tissue lying between these two cartilages, the so-called intercartilaginous membrane (membrana intercartilaginea), is likewise severed. With the tip of the knife one thereby reaches the external surface of the upper lateral cartilage where the latter is overlapped by the upper border of the lower lateral cartilage. Here one exchanges the customary knife (BARD-PARKER No. 15) for the double-edged knife of JOSEPH (Fig. 41), for a dissection forceps, or for a blunt scissors; with this instrument one presses upward to the lower border of the nasal bone, keeping flat against the external surface of the upper lateral cartilage. At the edge of the bone one slits the periosteum (Fig. 42). Now one uncovers the soft parts over the dorsum from the bone subperiostially with a sharp elevator. By doing this the periosteum

Fig. 43. Décollement at the "weak triangle" using the TRÉLAT elevator and approach from intercartilaginous incision. Red hatching = total décollement

Fig. 44a. Transition of the décollement of the "weak triangle" to the transfixion incision with the curved Joseph button-end knife

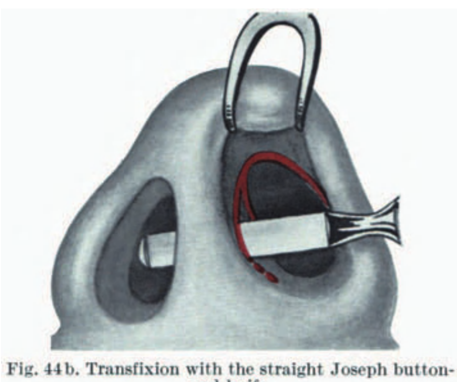


Fig. 44b. Transfixion with the straight Joseph button-end knife

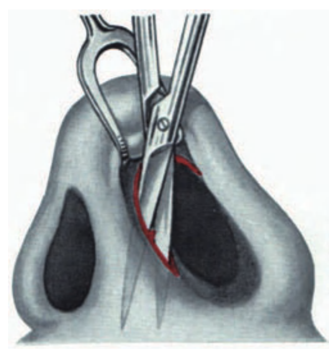


Fig. 45. Mobilization of the base of the columella as far as the maxillary spine with severing of the M. depressor septi nasi

is elevated from the mid-line to beyond the glabella and laterally beyond the frontal process of the maxilla. One does the same on the other side.

Some American surgeons, such as BROWN and MCDOWELL, SAFIAN, CONVERSE, KAZANJIAN and BAMES, stay epiperiosteal, that is, they do not separate the periosteum from the bone; later they remove the bony hump together with the periosteum. They cut the periosteum with the elevator along the line of planned hump removal and push it against the ridge of the hump so that it can be removed together with the bone. Laterally they leave the periosteum on the bone. SAFIAN states that leaving the periosteum makes later bone regeneration possible. Since the periosteum is not elastic like the overlying tissue it will naturally tear here and there in the sub-periosteal procedure. These lacerations are an argument against this procedure. We think they are irrelevant and consider the protection of the M. procerus to be more important; this protection is afforded only by subperiosteal décollement. Thus we uncover subperiosteally in general and make an exception, as FOMON does, only with very thick dorsal skin.

We use the curved elevator of TRÉLAT (Fig. 43) for the complete décollement of the soft parts in the cartilaginous region and for blunt separation of disturbing tissue strands forward toward the tip into the area of the "weak triangle" of CONVERSE (Fig. 1) between the upper and lower lateral cartilages in the midline; this instrument belongs more properly to the instrumentary for cleft palate surgery (Fig. 43). With the point of this instrument one is able to reach the intercartilaginous incision of the opposite side; the Trélat elevator is then replaced by the curved button-end knife of JOSEPH. One guides the latter around the anterior corner of the septal cartilage into the membranous part of the septum (Fig. 44a), which is severed as far as the spina nasalis. In doing this one keeps just in front of the border of the septal cartilage. The posterior part of this intraseptal incision, the so-called *transfixion incision*, is performed best with a straight button-end knife (Fig. 44b). The transfixion, called "incision transfixiante" by the French or the transfixing incision, is extended with a few fine scissors cuts behind the base of the columella and just in front of the spina nasalis ant. The fibers of the fan-shaped M. depressor septi nasi are thereby severed (Fig. 45).

III. Correction of bony nose

1. Hump removal

The removal of a hump is actually an easy operation. More difficult is the subsequent narrowing of the bony nasal structure by infracturing, which is necessary in almost every case. One can not say, however, that the beginner should remove humps only in small noses in which the difficult narrowing is not necessary. One can hardly judge ahead of time whether the nose will be narrow enough after the reduction on the dorsum.

At the start of the operation one can draw on the skin with gentian violet to indicate the new profile desired, as AUFRICHT and GATEWOOD recommend. In special cases with very large hump noses the contours of the lower lateral cartilages are marked in addition, as CONVERSE suggests.

For removal of the hump, as with every other operation on the bony nasal structure, décollement (see p. 41) *with the transfixion incision* (see p. 42) must be performed. After adequate mobilization of the soft parts with the enclosed lower lateral cartilages, one is able to raise the soft dorsal tissue adequately from the more solid cartilaginous and bony nasal structure. The raising of the skin for inspection and for possible severing of remaining strands of connective tissue is done with the speculum of AUFRICHT (Fig. 46). In very large humps one runs the risk of injuring the mucosa just under the bone and cartilage with the sawing. In such cases the mucosa must previously be loosened with an elevator along the duplicative fold from the septum to the upper lateral cartilage and to the nasal bone. This is not necessary more laterally.

After the preparatory exposure of the nasal bones and the upper lateral cartilages, the actual hump removal can take place. This is done in various ways: with the saw, chisel, drill, or with bone forceps. There is still a controversy all over the world as to which instrument is most suitable. There are always reports of the advantages of one instrument over another.

According to data of EITNER the hump is said to have been removed formerly even with sharp spoons and with punches (LEXER and BALSINGER). The obsolete

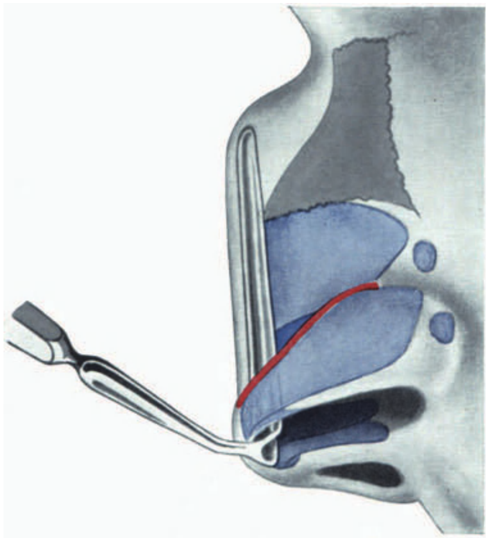


Fig. 46. Method of viewing the bony and cartilaginous structures using the speculum by AUFRICHT

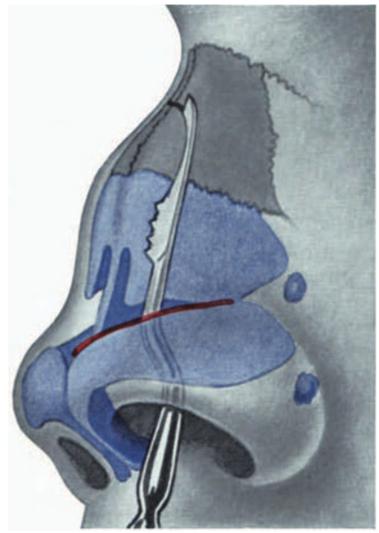


Fig. 47. Hump removal with bayonet saw. Instrument introduced through intercartilaginous incision

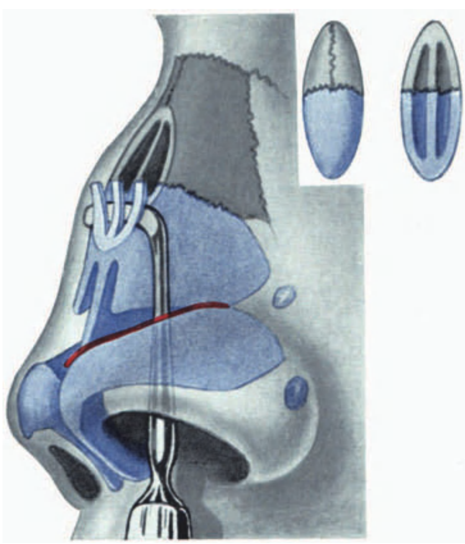


Fig. 48. Removal of remaining cartilaginous hump using sickle knife

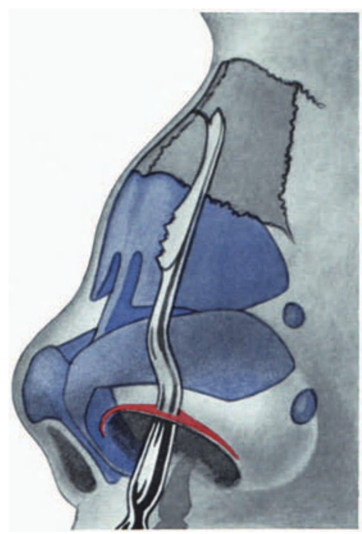


Fig. 49. Vestibular rim incision as approach for hump removal by F. SMITH

method of hump removal with the LUER forceps through an external median incision at the dorsum goes back to LEXER.

French pioneers in plastic surgery have used the chisel more, while JOSEPH, LINDEMANN, ROY, EITNER, FRÜHWALD et al. have introduced the use of the saw. The saw is used by the following contemporary surgeons: SAFIAN, KAZANJIAN, Berson, Brown, McDowell, Sanvenero-Rosselli, Matthews, Converse, Seltzer, Fomon, Malbec, as well as by most Germans. We use either the saw or the drill, but we do not consider the choice of the instrument for hump removal to be very important. After all, it depends more upon the correctly mastered manipulation of one of the various instruments. In 1955 Safian emphasized the advantages of the Joseph saw as opposed to the chisel in rhinoplasty. The saw is said to work more quickly and accurately, and the line of separation is supposed to be straighter.

In *hump removal* not only the bony part can be sawed; the cartilaginous part of the hump can also be removed *with the saw*. However it can be separated from the remaining cartilaginous structure with the knife, with scissors, or with forceps. It is recommended not to saw the hump from both sides. It should be sawed completely through from one side, best from the left (Fig. 47). Thus the danger hardly exists that the skin on the opposite side of the nose will be injured. The saw is introduced from the left nostril into the pocket formed there; the hump is removed in such a way that a good profile line results. Only a few authors saw in from both sides to the mid-line.

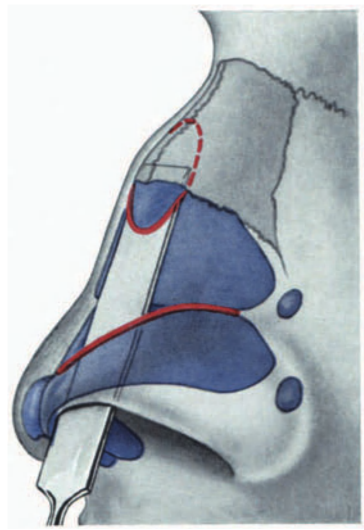


Fig. 50. Removal of hump using the chisel by Gatewood

To avoid occurrence of saddle nose, one should not remove too much of the hump toward of the nasal tip. One must also consider the glabellar angle. Especially with receding forehead care is advised in hump removal. Forehead and dorsum should not form a straight line.

As soon as one has completely severed the hump with the saw, one removes the saw and then retrieves the little boat-shaped piece of cartilage and bone (Fig. 48) with a hemostat. Now one checks the newly formed profile by palpation and corrects irregularities. In the area of the bony nasal structure this is done with the bone rasp; in the area of the cartilaginous dorsum this is done with a sickle-shaped knife (Fig. 48), with a small scissors, or with the bone-cartilage forceps of Rowland or Kazanjian. As a saw we use the bayonet-saw of Joseph with a solid handle. Hildmann recommended a variation of the usual saw, in which the teeth are replaced by a specially ground edge. In this case it is more a matter of a knife than of a saw. As a result of the peculiar shape of the blade, this knife is capable of cutting through very thin bones, but it is more suitable only for the cartilagionus part of the dorsum. It has not proved its value with us. Mootnick likewise indicated a saw-knife in 1950. We consider such an instrument to be far more dangerous than the saw, since we believe that it can damage the skin easily should it slip. — If one has proceeded supraperiosteally in the décollement of the dorsal skin, the bone and cartilage piece must be taken off and removed together with the periosteum. — F. Smith performed the skeletonization and the sawing off of the hump not from an intercartilaginous incision, but from the incision at the rim of the vestibule (Fig. 49), which we consider to be impractical.

The English, primarily, and also some Americans, are believers in the chisel technique (Fig. 50). Gatewood described it in 1947. Barsky, Straatsma, Aubry, May, Cohen, Portmann and many others work *with the chisel.* Portmann guides his chisel to the nasal dorsum through an external infralobular incision just below the nasal tip. Since we regard a transfixion incision in the membranous

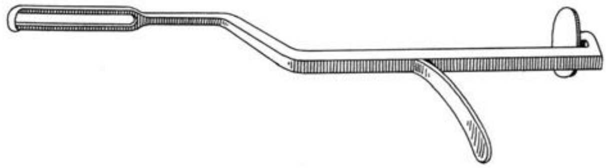


Fig. 51. Retrograde plane by Moulonguet

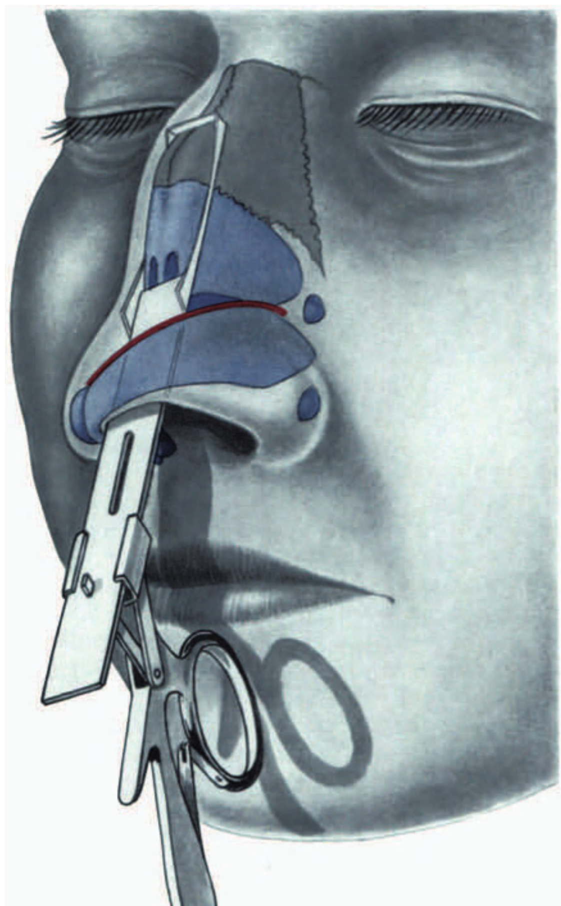


Fig. 52. Hump removal using the guillotine by Aubry and Palfer-Sollier with the handle of the Sluder tonsillotome

part of the septum and a correction of the lower soft nasal parts at the same time to be important, we feel that this external incision is unnecessary.

In 1953 and 1956 Cohen wrote about the advantages of the chisel over other instruments. He emphasized that one can take off chips with better control and remove small hump remainders more easily. The chisel is said to be especially suitable if one has to plane off bone on the hump just below the glabella to form a depression at the naso-glabellar angle. This is the place on the nasal bone where we, too, use the mallet and chisel. When doing this we generally choose flat chisels of size 8—16 without a director, as COHEN and STRAATSMA do. MCINDOE used a special flat chisel for hump removal, the cutting-edge of which is concave and the corners blunt.

Most French surgeons remove the hump *with the retrograde planing knife* of MOULONGUET (Fig. 51) or with a guillotine-shaped plane of PALFER-SOLLIER and of AUBRY (Fig. 52). The latter has the handle of the SLUDER tonsillotome. The blade of the plane can be pressed like a guillotine against the upper edge. It is supposed to produce an exact removal of the bony and cartilaginous hump without the slightest danger of injury to the surrounding soft tissues.

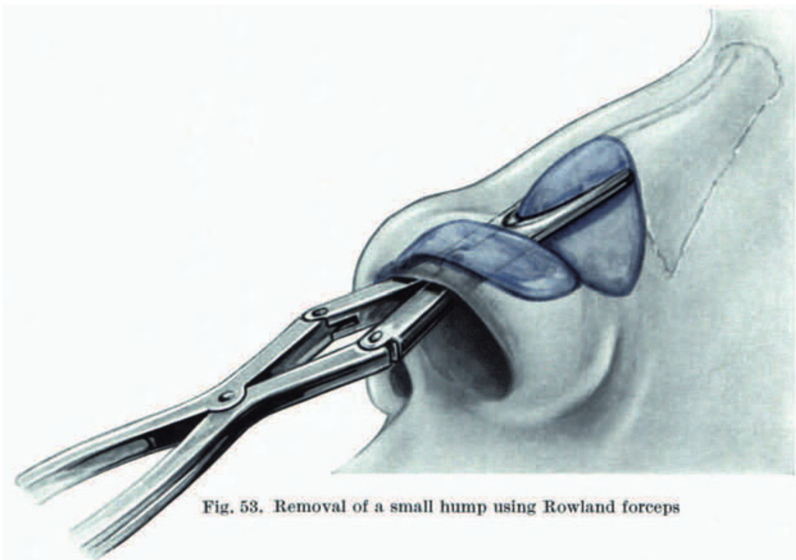


Fig. 53. Removal of a small hump using Rowland forceps

A further method, already mentioned above, is hump-removal *with the bone-cartilage forceps*. KAZANJIAN and ROWLAND proceed almost exclusively in this way and have constructed their own forceps (Fig. 53). Other forceps bear the names of EITNER, BARTON, COTTLE, ECKHOFF, GOLDMAN, MCINDOE and LANE. They are all derived from the KAZANJIAN bone forceps. We use the ROWLAND forceps for the removal of smaller humps (see p. 64).

The hand instruments, like the chisel and saw, for the removal of the bony nasal hump, have been variously replaced by motor-driven instruments. These must be constructed as small as possible in order to make fine work on the bone possible. With use of motor-driven instruments, extensive loosening of the soft tissues from the cartilaginous and bony structure is necessary; however, we consider this to be recommendable in every case. By doing so postoperative asymmetrical distensions of the soft tissues are more easily avoided. A difficult problem in the use of motor-driven instruments is presented by the protection of the surrounding soft tissue. In 1950 SELTZER described a burr with which he works on the nasal bone, but which is not suitable for hump removal. It is electrically driven and has a small protective shield attached. We will come back to this instrument below.

For the removal of small humps and irregularities, in which there is a danger of removing to much with the bayonet saw, a cylindrical or pear-shaped metal or diamond burr may be used. Over this one holds a roof-shaped, stainless steel instrument for raising the overlying soft tissues and thereby protecting them (R. MEYER). The electrically-driven dental drill is guided by its handle through one nostril and through the intercartilaginous incision to the dorsum, while the protective shield is introduced through the other nostril and intercartilaginous incision and is held in its position (Figs. 54a and b).

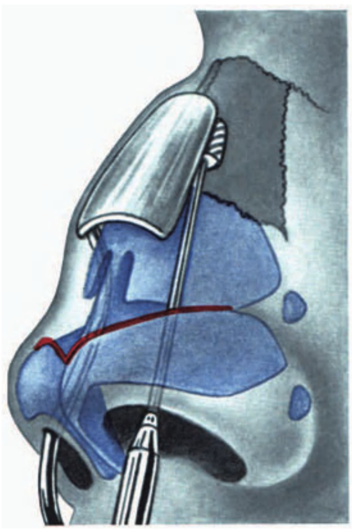


Fig. 54a. Removal of a small hump using metal or diamond burrs under the protective shield of R. MEYER which is introduced from the contralateral side

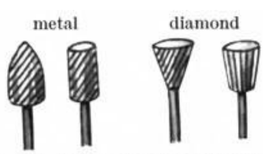


Fig. 54b. Metal and diamond drills

This method was published in 1951. In 1950 GÜNTERT developed a roller-shaped dental burr with a long shaft and with an interchangeable protective shell, which can be sterilized, for hump removal on the dorsum. The shell half protects the burr in order to avoid secondary injuries. In 1955 MÜNDNICH demonstrated a similar electric bone saw with a firmly mounted soft tissue shield, which can be used for cutting bone and for rasping away nasal humps and other bone prominences. We consider the latter two instruments to be to coarse for a fine, controlled and measured removal of chips. In addition, work with the burr can never be done under direct vision which, in our procedure (R. MEYER), is practically always possible, because the skin can be raised quite considerably with the protective shield. This method is really not new, for as early as 1908 KOCH had removed nasal humps with the rotating burr, but of course this was done by the open method with a median incision at the dorsum. EITNER tried it in 1912 and abandoned it.

The proponents of the chisel technique blame the formation of disturbing bone dust on drilling and on sawing. In our experience the amount of sawdust or drilling dust is very slight, and thus it is unimportant. The dust is suctioned away together with the blood; this can be aided by irrigating the operative field with normal saline.

The drilling heat, to which GERSTMEIER calls attention, can in our opinion also be regarded as unimportant if one works quickly and purposefully and does not drill around at the same place longer than necessary. On the contrary, we consider the perforating burr without protection, as indicated by GERSTMEIER, to be too dangerous, and would never like to be without the protective shield constructed by us (R. MEYER) when working with the drill. The danger of injury to the neighboring tissue is greater with the use of metallic perforating burrs than it is with diamond burrs. Sometimes the inner nasal periosteum can be injured by drilling. But this is also possible even with the other instruments, and should hardly be of great relevance.

As one can see, there is no method for hump removal which is generally recognized as best. It is more a question of which instrument proves to be the most suitable in the hands of the surgeon. We perform the removal of the hump in large hump-noses with the saw. With average-sized and small hump-noses which are wide noses with thick bones as well, and on which the saw easily slips tangentally, we prefer the use of the drill; for small humps with thin bones the ROWLAND forceps have proved to be best in our hands (see p. 64).

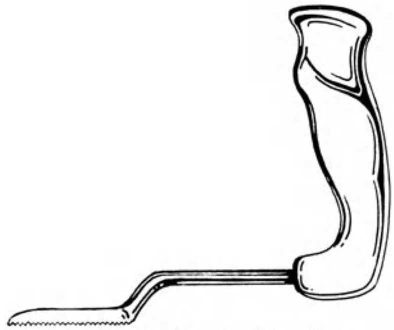


Fig. 55a. Nasal saw by CONVERSE

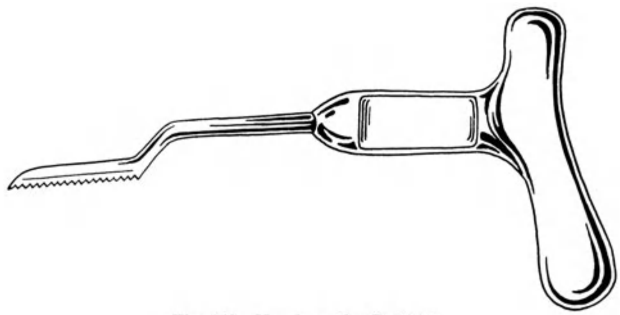


Fig. 55b. Nasal saw by RAGNELL

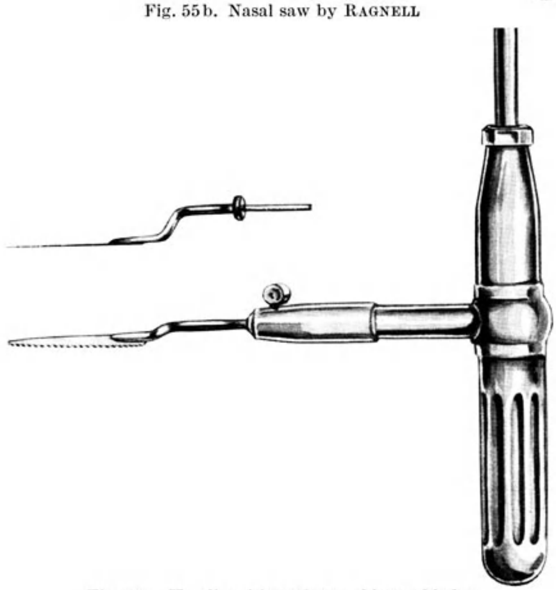


Fig. 55c. Handle with exchangeable sawblades

As already mentioned, the nose generally appears too wide after removal of large humps, so that *additional narrowing* becomes necessary. To achieve this the bone at the lateral slope of the nose must be severed approximately vertically at the frontal process of the maxilla, and horizontally in the area of the nasofrontal suture. Then both fully mobilized bony plates should be repositioned in midline, that is to say, they should be shifted toward each other, so that the two anterior edges come in contact in midline while lying against the similarly prepared anterior border of the septum. This median luxation of both nasal bones and both frontal processes of the maxilla, also called "infracturing", is practically always necessary. It must be performed in such a way that the bones can not separate again afterward. Thus the roof of the bony vault may never remain open. In 1954 COTTLE described a "syndrome of the open nasal roof" with headaches, attacks of dizziness and sensitivity to coldness in the nose, which could occur in such cases if the overlying soft tissues sink into the two bone gaps. DUFOURMENTEL, PIERCE, LATHROP and EITNER, who were the first to combine a narrowing of the nose with hump removal, simply broke the open bony rim inward after the reduction of the dorsum without osteotomizing the lateral base.

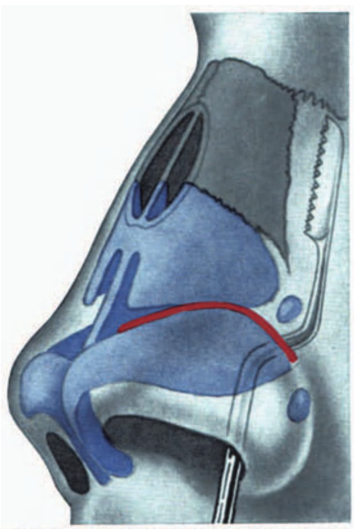


Fig. 56. Lateral osteotomy with the saw with approach from the intercartilaginous incision extended laterally

Like hump removal, the *severing of bone at the frontal process of the maxilla or lateral osteotomy* cand be effected in various ways: with the saw, chisel, with an electric instrument, and even with a bone punch.

JOSEPH performed the lateral osteotomy *with the saw* and constructed a special saw with an angulated handle for this purpose. CONVERSE and SELTZER have improved the saw model by making the handle more massive (Fig. 55a). We find these right-angled saws under the names MOULONGUET and MALTZ-JOSEPH as well. SELTZER has constructed an electric saw for this purpose which he uses under a special director.

For lateral osteotomy we use the saw of RAGNELL, which was made for severing the lower jaw in surgery of the prognathic jaw (Fig. 55b). There are also handles with interchangeable saw blades (Fig. 55c).

One can make a small additional incision quite laterally in the nasal vestibule just in front of the piriform crest as an approach for placing the saw blade against the bone. This incision is not joined with the intercartilaginous incision at the plica nasi. JOSEPH also proceeded in this way. The intercartilaginous incision can also be extended laterally (Fig. 56), as we usually do, since we are not afraid of the disadvantages of increased lateral décollement. This extension of the incision of course necessitates décollement over the entire nasal pyramid, from one frontal process of the maxilla to the other. Many authors do not use this procedure. They prefer to perform the décollement separately, that is, at the ridge of the dorsum and on both sides laterally above the frontal processes of the maxilla, without paramedian connection; the décollement is done this way whether subperiosteally or supraperiosteally. Thus they leave the skin over the bone of the lateral nasal wall unelevated on both sides. LEVIGNAC points out the danger of the formation of a cicatricous contraction ring at the threshold of the nasal cavity and at the limen nasi due to the lateral extension of the intercartilaginous incision. We are of the opinion that such a cicatricious narrowing of the lumen at the transition of the vestibule to the nasal cavity can be avoided by careful dissection. — We are very careful in our extended décollement of skin that the caput

Fig. 57a. Narrowing the nose as by JOSEPH. Under the protection of the grooved director, the bone saw is introduced and the bone is sawed through along the dotted red line. (From H. J. DENECKE)

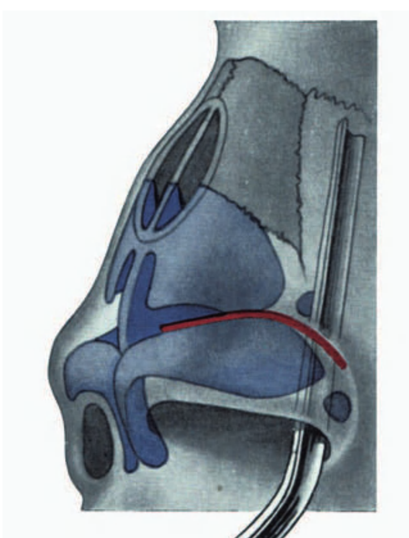


Fig. 57b. Grooved director by SELTZER in place

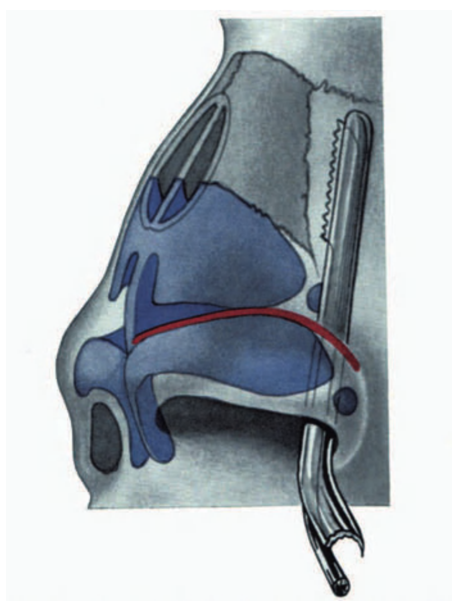


Fig. 57c. The grooved director is turned 180° and is now used to introduce the saw

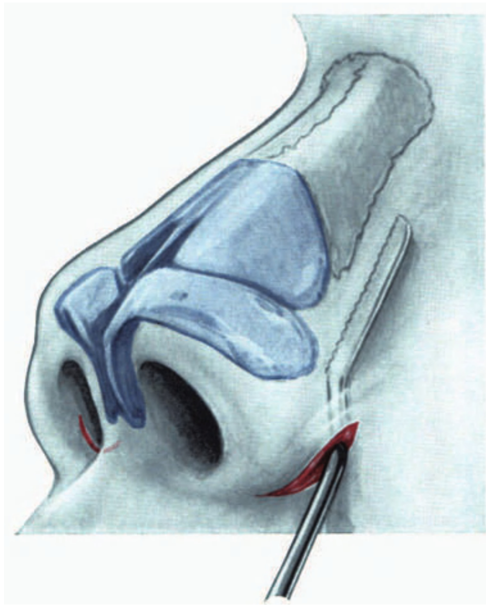


Fig. 58a. Representation of lateral osteotomy on the left side using the bayonet saw from the alar border incision (JORDAN). The lateral incision in the vestibule is depicted on the right side of the nose

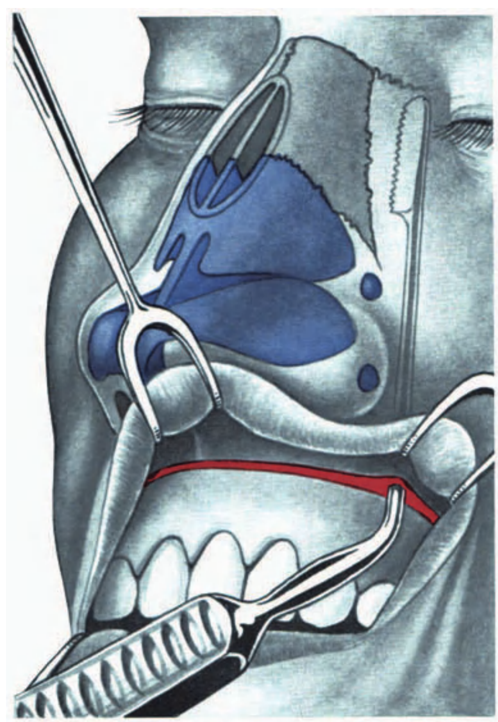


Fig. 58b. Lateral osteotomy using sublabial approach

angulare and the caput infraorbitale of the M. quadratus labii sup. are not torn but rather are carefully pushed laterally with the skin and periosteum. In this procedure the elevator with built-in suction described above is very valuable. — When undermining from the nasal vestibule, LENZ restricts himself to a narrow zone along the dorsum and uncovers the lateral parts from an approach in the oral vestibule, in order to avoid a lesion of the A. nasalis with subsequent bleeding. — JOSEPH, who performed an extra separation of the skin for the lateral osteotomy, constructed a special short grooved director (Fig. 57a) to facilitate the intro-

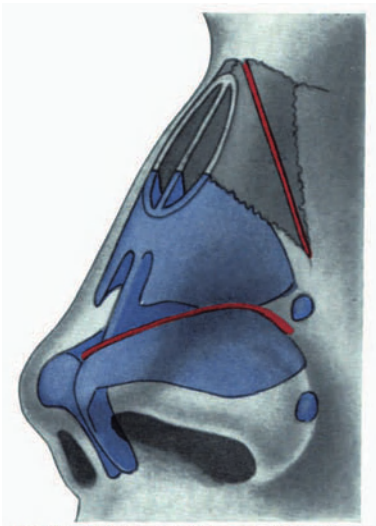


Fig. 59a. Direction of the osteotomy in the continental method

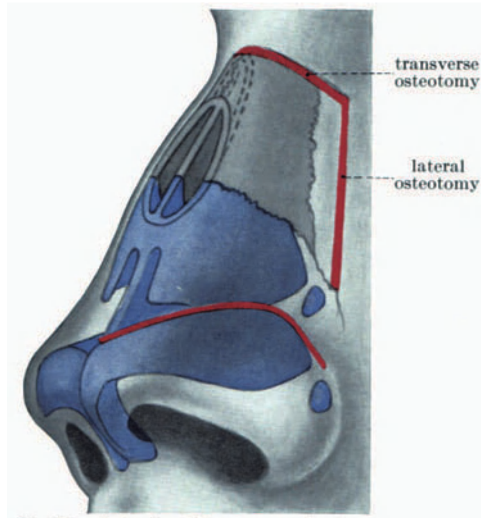


Fig. 59b. Lateral and transverse osteotomy (Anglo-American method)

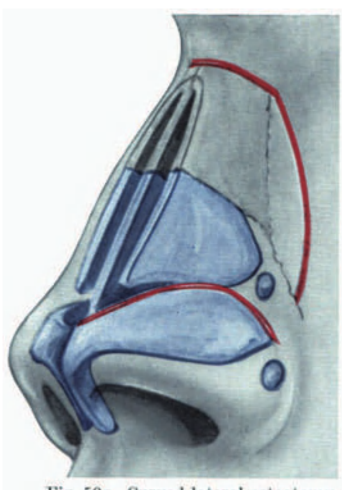


Fig. 59c. Curved lateral osteotomy by O. BECKER (USA) and STRAATSMA

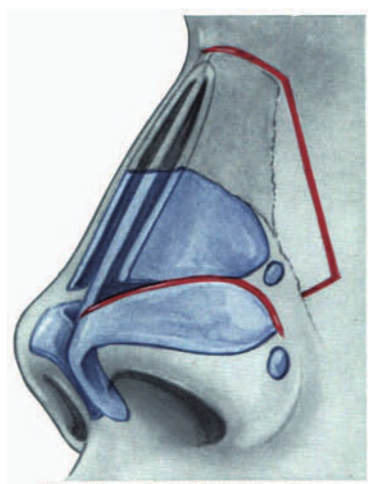


Fig. 59d. L-shaped lateral osteotomy by HUFFMAN and LIERLE

duction of the saw into the very small subcutaneous lateral pocket present in this method. — SELTZER and FOMON, likewise proponents of separate décollement, have developed a similar director. This is introduced as in Fig. 57b, then turned 180^0 under the skin and in this position (Fig. 57c) permits the unhindered movement of the saw against the bone. — For introduction of the saw, JORDAN makes a small external incision lateral to the alar base ("alarfacial incision") (Fig. 58a). He then uses this lateral, external incision at the end of the operation for application of a fixation or contraction suture, which runs through the nasal base from one alar base to the other and is supposed to narrow the base of the nose. — E. SCHMID, LENZ, HUFFMAN, LIERLE and STAFFIERI operate from the oral vestibule (Fig. 58b) as LAUTENSCHLÄGER did earlier. HUFFMAN and LIERLE make the 1 cm-long gingivolabial incision laterally from the second bicuspid. AUBRY chooses this sublabial approach in the correction of deflected nose and in callus formations in the area of the osteotomy line.

Just as there is with hump removal, a controversy arises as to whether one should remain *subperiosteally or supraperiosteally* with the instrument used for severing. Again we choose the first way. According to the most recent opinions, the osteotomy line should run as far laterally as possible, along or even outside

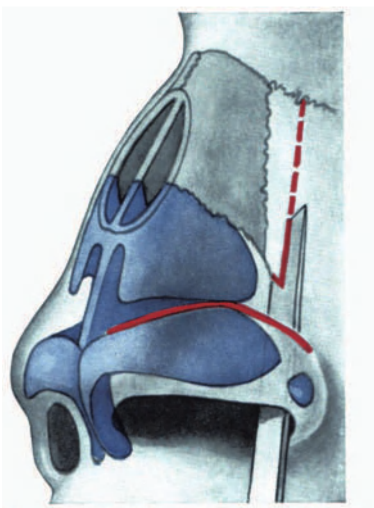


Fig. 60a. Lateral osteotomy with the chisel

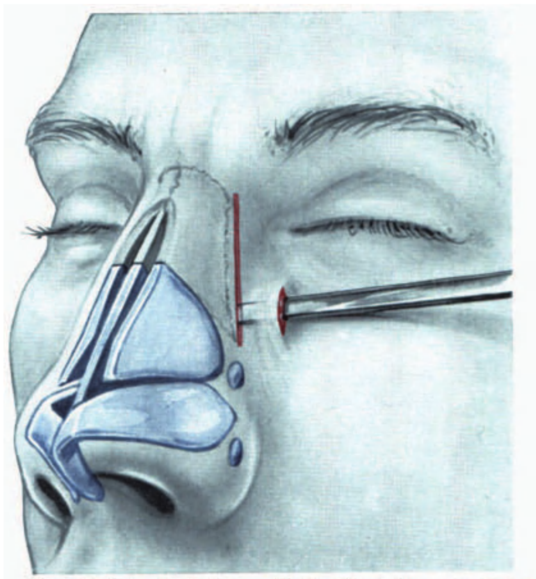


Fig. 60b. Lateral osteotomy with the chisel with approach from a lateral skin incision by F. SMITH and MIR Y MIR

of the cantho-alar line. At first the Americans and the English maintained this opinion. Thus the lateral *line of separation* was named "*Anglo-American*", different from the more medially situated "*continental*" one in contrast (Figs. 59a and b). The so-called continental line was used by JOSEPH, FRÜHWALD and the other German, Austrian, French and Italian pioneers of rhinoplasty. If one works with the chisel or with the drill, one can follow an outwardly slightly convex, curved line, as O. BECKER (USA) suggests (Fig. 59c). The saw-osteotomy of HUFFMAN and LIERLE is performed even more laterally. Below, it ends $^1/_2$ to 1 cm laterally from the piriform aperture (Fig. 59d). The short stretch to the aperture is broken in with a blow of a chisel. Thus the osteotomy line obtains an L-shape, which TAMERIN also recommends. In the upper part of the osteotomy the Sulc. praelacrimalis of the frontal process of the maxilla is always to be regarded as the lateral limit.

Lateral subperiosteal osteotomy *with the chisel* goes back to MOSHER in the year 1906. It was practiced by SHEEHAN and is now used by AUBRY, BARSKY, BECKER (USA), ROWLAND, RISH, MAY, COHEN, STRAATSMA, GATEWOOD and many others (Fig. 60a). With FRÜHWALD the bone is first sawn slightly and then completely separated with the chisel. FERRIS SMITH, as later STRAATSMA, CRIKELAIR, DOWD, FOMON and his pupils, as well as MIR Y MIR, perform these few chisel blows in the upper bony part from a fine, vertical, lateral skin incision of 2 to 3 mm in length (Fig. 60b). Chisels with double directors were constructed by SARGNON, CLAOUÉ and ROWLAND, and in addition some with only one director by RISH, O. BECKER (USA), AUBRY, and HEERMANN.

CINELLI has developed an electrically driven osteotome. In 1954 SELTZER published an *automatic surgical mallet* with interchangeable chisels, which is supposed to be more suitable than the regular mallet and chisel for the completion of the bone separation along the saw-line at the frontal process of the maxilla. The same instrument is used by dentists for removing impacted teeth. According to COHEN, who advocates the chisel technique, it is supposed to be easier to make the line of separation farther laterally outside the cantho-alar line with the chisel, especially in cases with deflected nose as well. COHEN chooses approximately the same osteotomy line as BECKER and STRAATSMA. In lateral osteotomy with the chisel, NEIVERT uses a guiding needle which he sticks laterally into the limen nasi and pushes upward so that it lies against the bone. He also introduces the chisel through the skin below the inner canthus. Along with his dentist's drill with protective shield, GÜNTERT also constructed an *electrically driven saw* for the lateral bone separation (1952). This saw, however, has the disadvantage that the axis of the saw-blade lies exactly in the extension of the handle. Its operation appears to us to be somewhat difficult because it seems possible that, with the handle, one might come into conflict with the upper lip when applying the saw-blade. In 1957 HILDMANN described a quite similar hand-saw. In the book on rhinoplasty by SELTZER (1949) there is already talk of an electric saw, but one finds no illustration of the handle, but only one of a protective metal speculum which must be held over it (Fig. 61).

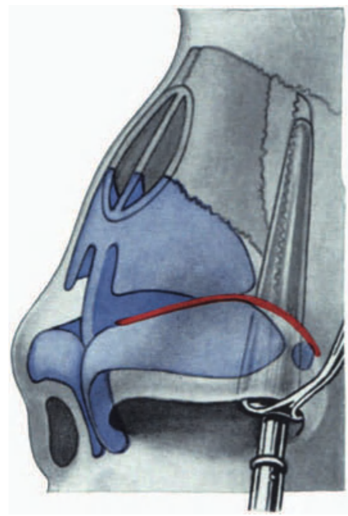


Fig. 61. Lateral osteotomy with the electric saw by SELTZER and with director

The fine, *electrically driven burr* with a pistol-grip of SELTZER, which we have already mentioned in hump removal, should be of service primarily in lateral osteotomy. It has, however, the disadvantage that it is used better on one side than on the other, or that one needs two instruments, that is, two hand pieces which are symmetrical, as in a mirror image (Fig. 62). For this reason SELTZER developed the instrument further and in 1954 constructed a fine, electric oscillating saw which represents one sector of a circular saw and which operates with 15,000 oscillations per minute. It is mounted on a handle which one holds like a pencil and which is in turn coupled with the flexible shaft of a dental drill. It cuts quickly through the bone. The periosteum and the overlying soft tissues can be raised with the protective speculum mentioned above. In the same year SELTZER also published the model for a grooved director of steel constructed for this purpose (Figs. 63a and b).

For the lateral osteotomy, especially of thick bones or of callus, the procedure with the usual dentral drill with the protective shield of R. MEYER has proved its value. This device was mentioned above in the discussion of hump removal.

We use two symmetrical shields, one for the left side, the other for the right. The speculum of AUFRICHT (Fig. 46) can also serve as a director, but it offers less certain protection than our special shields. As drill bits the dental perforating and polishing burrs of metal or diamond are best here (Fig. 64). There is only slight danger of the diamond drill's becoming entangled in the surrounding soft tissue, even without the shield.

The periosteum-skin covering loosened by the over-all undermining is pushed to the side at the canthus with the shield, which makes possible a clean approach of the perforating burr or diamond drill in the infracanthal line. Then the electric drill is set in motion. With gentle pressure on the bone one can cut through it with

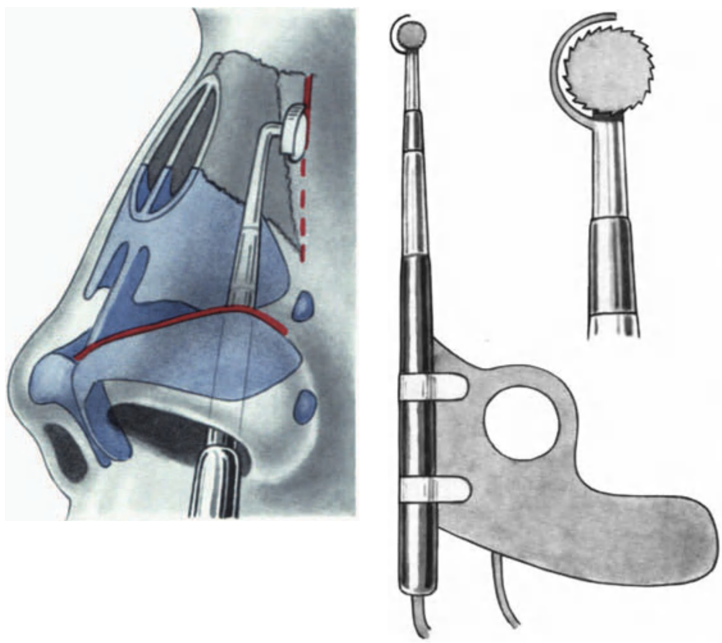


Fig. 62. Lateral osteotomy with electric fraise by SELTZER

ease. Like a pencil, the burr is drawn downward from above, until it reaches the piriform crest quite laterally and below. The speed of the drill is 8000 or 9000 revolutions per second. Scarification of the periosteum on the inner side of the bone, or even of the mucosa itself is irrelevant but should be avoided when possible. It can occasionally happen with the chisel, saw, or drill as well. With the drill and saw it can be avoided easily, if one does not cut through the whole thickness of the bone completely at every point instead one can leave thin bony bridges on the inner side, which are easily broken in the mobilization of the bony pyramid. — Grinding with the firmly mounted soft tissue shield of GÜNTERT and of MÜNDNICH, which we likewise have mentioned already, finds its use here in lateral osteotomy as well. — In 1955 GORLIA presented his own drilling method. He makes two small incisions on each side in the cantho-nasal line; he introduces his electrically operated perforating burr ("fraise perforante") through each of the 2 mm long, vertical incisions and drills several holes along the desired line of bone separation. These holes suffice for breaking the bone along the desired line (Fig. 65).

The greatest difficulty of the whole work on the bone is the clean separation approximately horizontally up in the area of the naso-frontal suture. This is the so-called *transverse osteotomy*. The electric dental drill with our shield is very suitable here. At this point we use thin, disc-shaped grinding wheels of diamond

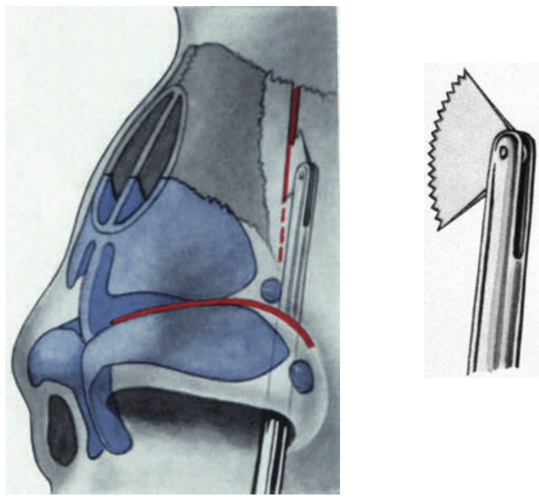


Fig. 63a. Lateral osteotomy with electric oscillating saw by SELTZER

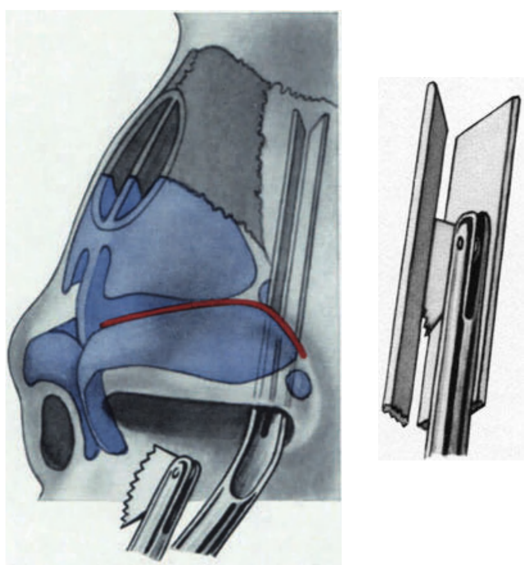


Fig. 63b. Grooved director for the electric oscillating saw by SELTZER

(Fig. 66). The transverse osteotomy for both sides of the nose can be performed from the left side, that is, through the left intercartilaginous incision, without changing hands. One guides the wheel slowly from the left slope of the glabella across the midline to the right slope. The bone is easily cut. If the little diamond grinding wheel should slip to the side under the shield, the soft tissues will hardly be injured. The diamond surface does not become tangled in strands of connective tissue. Koechlin also points out the importance of a clean separation at the glabella, since slightly diagonal fractures below the desired line of osteotomy can otherwise occur in the midline displacement of the bone. He has come out with an especially fine perforating drill with a diameter of less than 1 mm. This drill

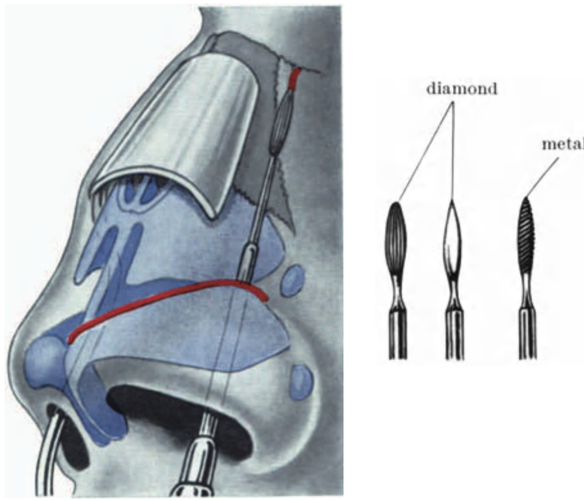


Fig. 64. Lateral osteotomy with perforating burr and protective shield by R. Meyer

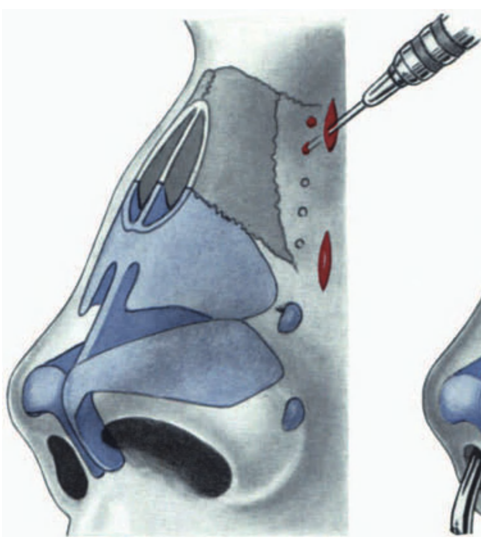


Fig. 65. Lateral osteotomy with perforating drill by Gorlia

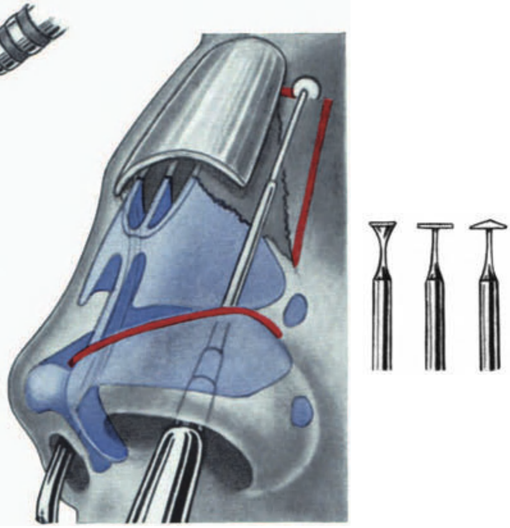


Fig. 66. Transverse osteotomy with diamond fraise under the protective shield by R. Meyer

bit can be introduced through a short hollow needle. The needle penetrates the skin at the glabelle and the drill is guided through the needle to the bone (Fig. 67). Thus the bone can be drilled vertically and, in this area of difficult approach, a break line can be made, similar to that which we have seen in the lateral osteotomy with the method of Gorlia (Fig. 65).

Occasionally, especially when the bone is thin, we perform the transverse osteotomy in the subperiosteal pocket with the Thiess concave chisel curved toward the convex side (Fig. 68). We separate the bone in a slightly curved line starting at the ascending lateral osteotomy line and extending to the middle of the glabella. With a staight chisel it would not be easy to work subcutaneously so far up, since the chisel would slip on the bone. Some surgeons, like FERRIS SMITH, CONVERSE, FOMON, make out by introducing a sharpedged straight chisel through a small horizontal or diagonal insision $^1/_2$ cm above and $^1/_2$ cm medially from the canthus and then cutting through the bone with two to three blows in a horizontal direction (Fig. 69). Narrow incisions for the introduction of the chisel are also made by SILVER and others 1.2 cm below the canthus (Fig. 69), by ROWLAND, NEIVERT, and others farther laterally in the fold of the lower eyelid (Fig. 69), and by GALTIER in the base of the eyebrow (Fig. 70). — In 1955 MYERS

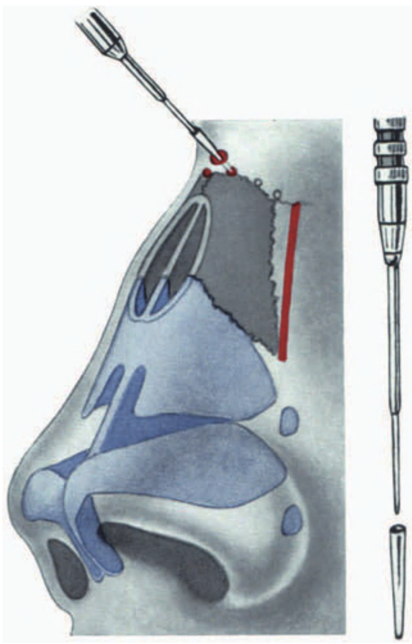


Fig. 67. Transverse osteotomy by KOECHLIN

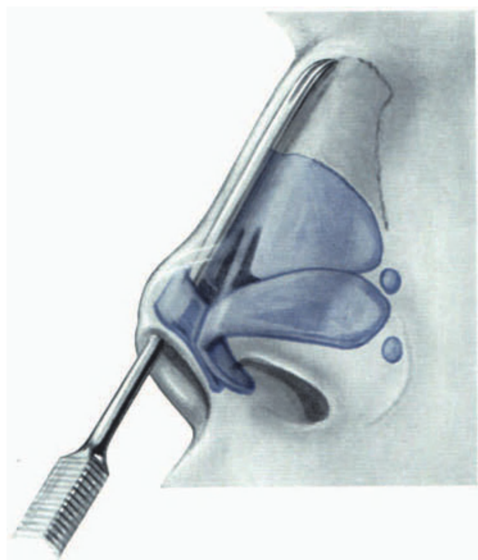


Fig. 68. Transverse osteotomy with the Thiess chisel (R. MEYER)

introduced a bayonet-shaped chisel with a very sharp edge for this purpose, with which he can perform the transverse osteotomy even subcutaneously through the intercartilaginous incision (Fig. 71). — In 1955 GOTTSCHALK constructed a small saw with the shape of a hoe, which cuts through the bone by rotation of the handle back and forth on its axis (Fig. 72).

After this separation of the bone on all sides, one can now take steps toward the *mobilization* and median realignment *of the two bony plates*. If the bony plates still appear too large, one should undertake the necessary removal of bone; this should not be done according to the outmoded method of JOSEPH, with a wedge resection at the line of the lateral osteotomy, but rather at the open edge which the hump removal has left. This correction can be performed with the rasp or with the drill if it is a matter of a bony edge 1 to 2 mm wide. If there is a larger amount of bone to be removed, one can use the ROWLAND forceps. We do not consider an enlargement of the lateral gap in the bone to be practical. Pronounced callus or scar formation can occur latter at this point. For this reason we also consider

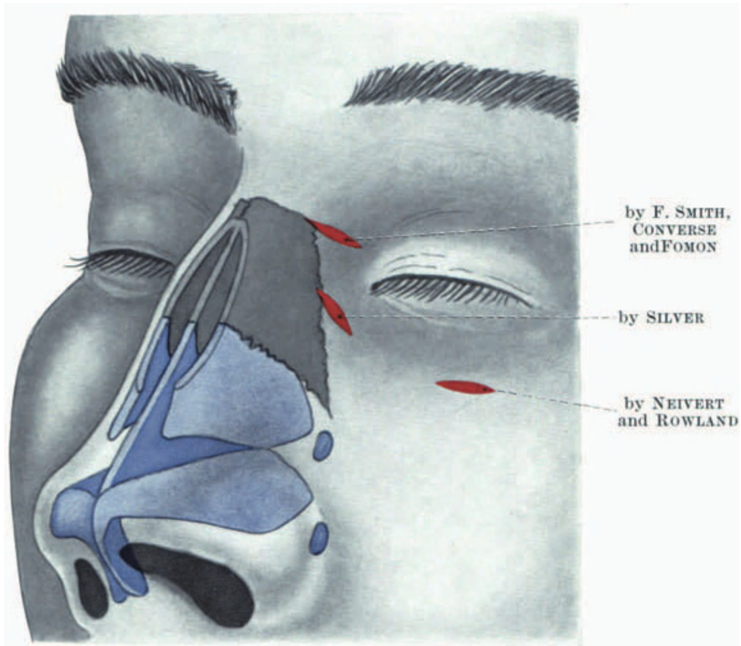


Fig. 69. Incisions for transverse osteotomy with the chisel

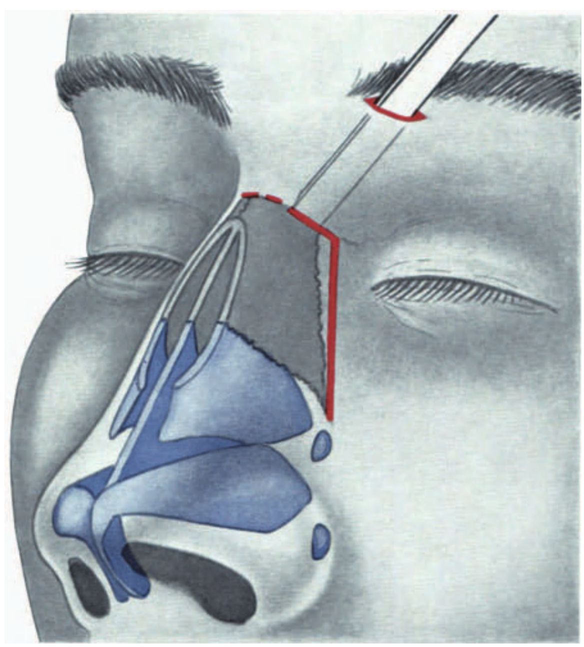


Fig. 70. Transverse osteotomy with the chisel, approach from inner end of the eyebrow by Galtier

unsuitable the procedure of Eckel (1955), in which the bone is broken with bone forceps starting at the lateral base of the piriform aperture upward along the line of the lateral osteotomy; in this case too wide a lateral bone-gap is formed. In larger bone-gaps it can lead to unpleasant pinching of the skin. Then the lateral slope of the nose is not flat but concave, which very much disturbs the impression of the face in some lighting conditions. The same applies to the complete removal of the nasal bone as recommended by WEGENER and BAUD.

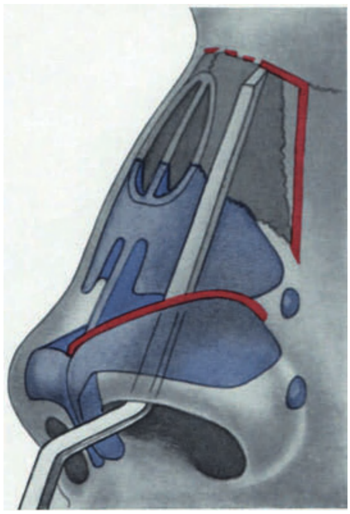


Fig. 71. Transverse osteotomy with bayonet-shaped chisel by MYERS

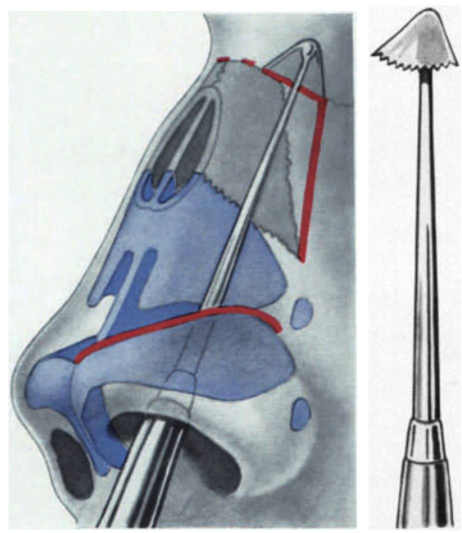


Fig. 72. Transverse osteotomy with the saw by GOTTSCHALK

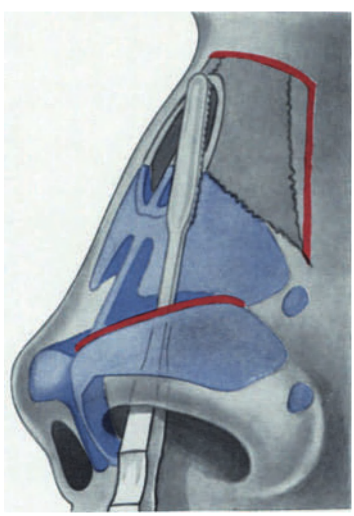


Fig. 73. Smoothing the bone with the rasp after hump removal

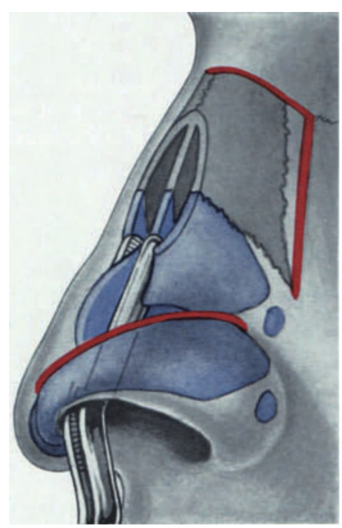


Fig. 74. Trimming of the border of the cartilaginous septum with the help of the accurator by TAUSEND. The protruding septal cartilage is removed along the accurator

Now one must check the smoothness of the anterior edge of the three freshly prepared bones, including the septum; any unevenness must be removed with the rasp (Fig. 73). Most important is that the septum does not project. It must be covered by the nasal bones. The edge of the cartilaginous septum, too, must be trimmed if necessary. To accomplish this, TAUSEND (1949) made a special instrument, a so-called accurator, in the form of a bayonet forceps, which is supposed to assure a straight line for the cut (Fig. 74). The connection remaining in the lower part between the upper lateral cartilage and the septal cartilage must be cut with scissors (Fig. 75). Sometimes with this a strip excision at the medial border of the upper lateral cartilage is also permitted for narrowing the nose in the middle section. This medial strip of cartilage may even be removed together with the adjoining mucosa.

When the nasal hump which has been removed does not extend as far as the root of the nose, the separation of the lateral bony nasal wall from the bony

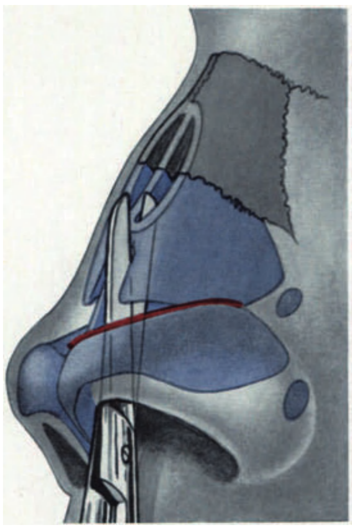


Fig. 75. Severing the connection between the upper lateral cartilage and the septal cartilage using the scissors

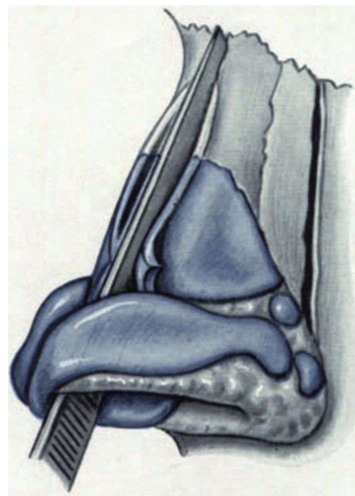


Fig. 76. Median osteotomy with the chisel after hump removal. (From H. J. Denecke)

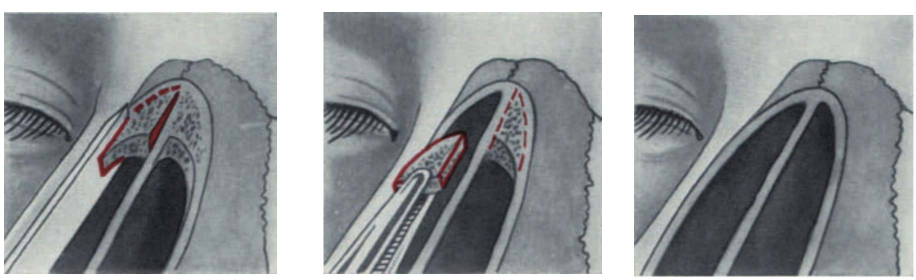


Fig. 77. Chiseling out a bone wedge bilaterally

septum in the upper part of the nose is also completed. This is accomplished with a few blows of the chisel directed parallel to the midline of the nose (Fig. 76).

In case of a wide nasal root it is even necessary to chisel away a small wedge of bone at this point (Fig. 77). This method of upper bone separation goes back to Joseph's student, Aufricht. — Even when the hump has been removed as far as the glabella, a bony bridge in the upper angle of the resection on both sides of the septal border still must be removed. This can be done with the chisel. At times we use the Luer forceps for this. Levignac has constructed a delicate, long forceps ("pincegouge á mors étroits") for this purpose.

Now one can proceed to the *median realignment of the mobilized bones*. This luxation of the nasal bones and the frontal processes of the maxilla is accomplished either with thumb pressure or with a forceps. We usually try here to bring the anterior border of the nasal bones into the midline with light thumb-pressure at first. To do this we press with both thumbs flat against the bone, while the fingers rest against the maxilla of the other side. Following this the bone

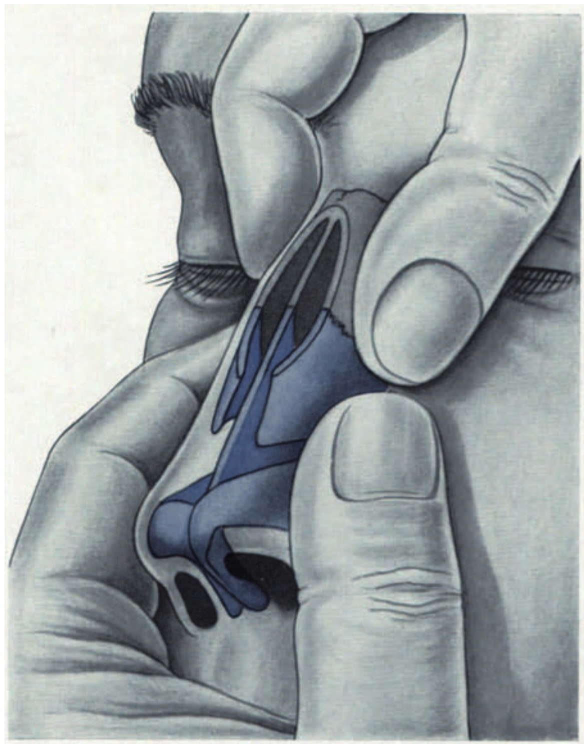


Fig. 78a. Median repositioning of lateral nasal walls using thumb pressure

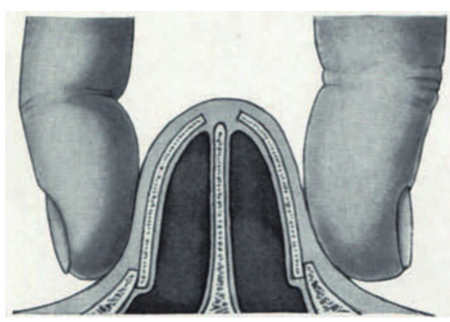


Fig. 78b. Wedging the medianward repositioned nasal bones in region of lateral osteotomy

is pressed toward the midline, also at the edge of the lateral osteotomy (Fig. 78a). One must make sure that the mobilized medial border of the osteotomy is placed beneath the lateral border and locked there (Fig. 78b). Thus one can prevent the realigned bones from springing back. If the realignment of the bones is not successful with gentle thumb-pressure, we prefer to use the forceps method. The forceps used for this maneuver are very similar to each other. They were described by Walsham, Ash, and Claude Martin (Fig. 79a). Formerly this bone displacement was performed with the osteoclast or rhinoclast of Joseph or of Sargnon. We proceed with the Walsham forceps in such a way: the inner blade, which can be padded with rubber, is placed against the mucosa at its fold of the agger nasi

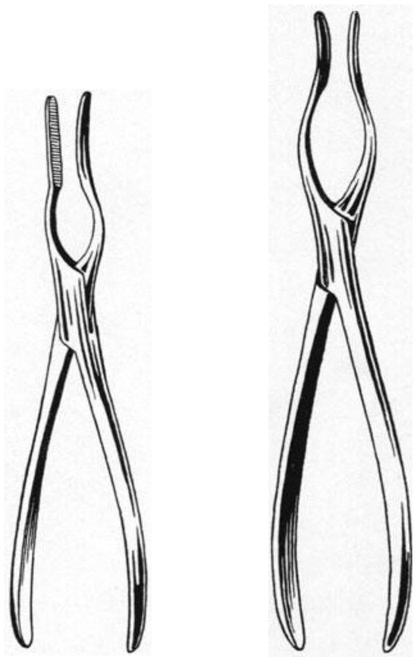


Fig. 79a. Left: forceps by Ash or Claude Martin. Right: forceps by Walsham

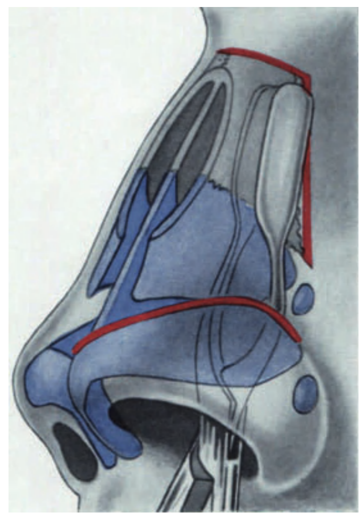


Fig. 79b. Median repositioning of the lateral nasal wall using the Walsham forceps

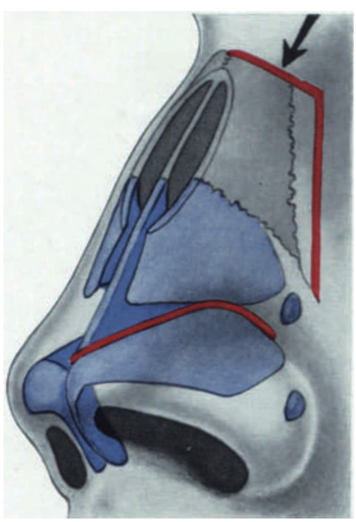


Fig. 80a. Correct fracture line (arrow) along the nasofrontal suture

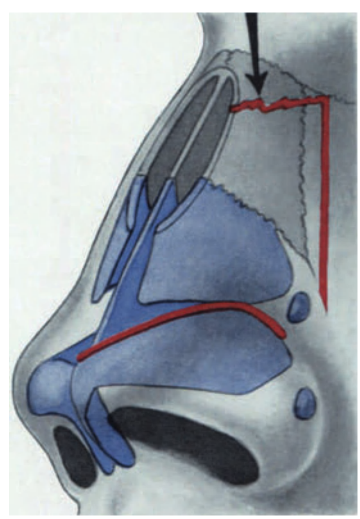


Fig. 80b. Wrong fracture line (arrow) which occurs when the transverse osteotomy in thick bones is not done or else is inadequate

and the upper nasal cavity. The other blade is introduced into the subperiosteal pocket above the bone. Thus we can feel the bone solidly between the two blades (Fig. 79b). It is best to reanesthetize the mucosa at the agger nasi and farther back with novocain or Xylocaine before applying the forceps. One should also make sure that the forceps is pressed as far as possible toward the glabella. Now it is closed tightly and pressed carefully toward the midline. The posterior edge slightly is tilted inward and gently back again.

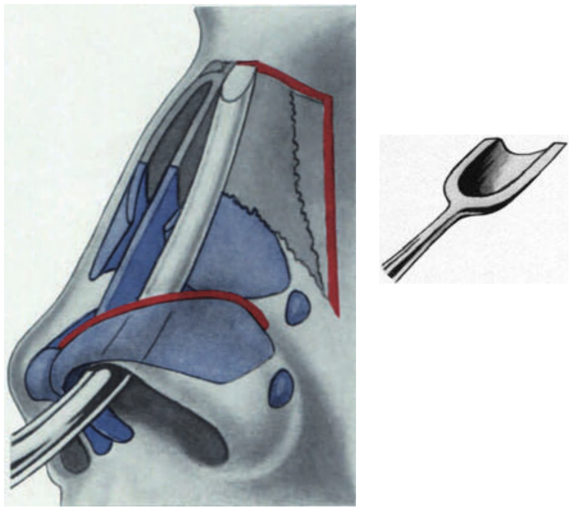


Fig. 81. Deepening the naso-glabellar depression with the chisel by SELTZER. Sketch at the side shows the glabella chisel by NEIVERT

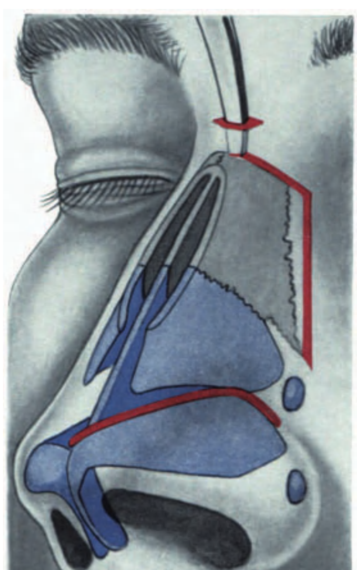


Fig. 82a. Removal of bone to deeper nasal root by RISH through small skin incision

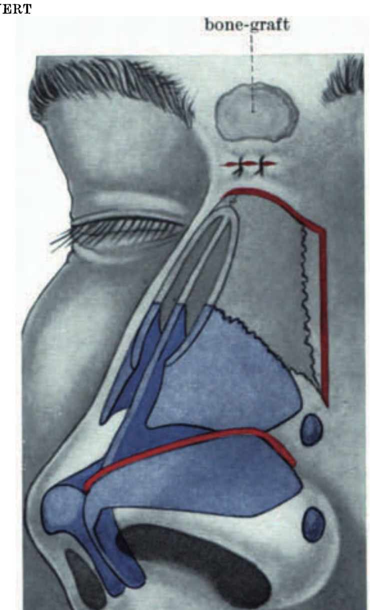


Fig. 82b. Bone graft over the glabella by RISH

This maneuver is called "infracturing" or "inward fracturing". It can also be performed in the opposite sense, that is, by outward rotation of the WALSHAM forceps; it is then called "out-fracturing". Most important is the careful inward setting and locking of the lateral edge of the mobilized bony plate as the final step.

After similar procedure on the other side we obtain a narrow, symmetrical bony pyramid. It is now obvious whether the transverse osteotomy is truly horizontal and clean, or whether a *wrong fracture line with medial spur formation*

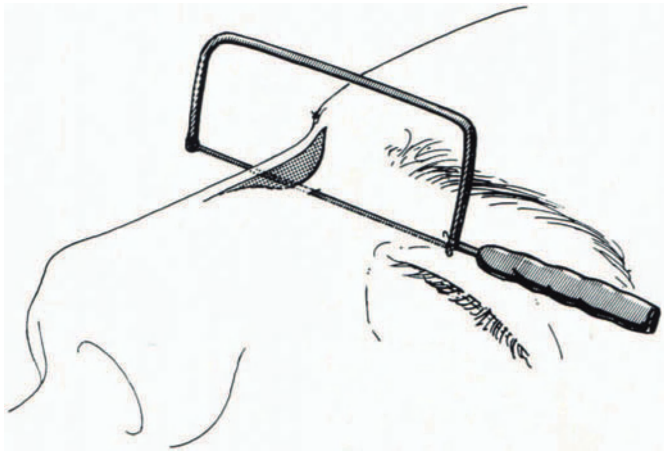


Fig. 83a. Deepening the glabella with the saw by NEIVERT

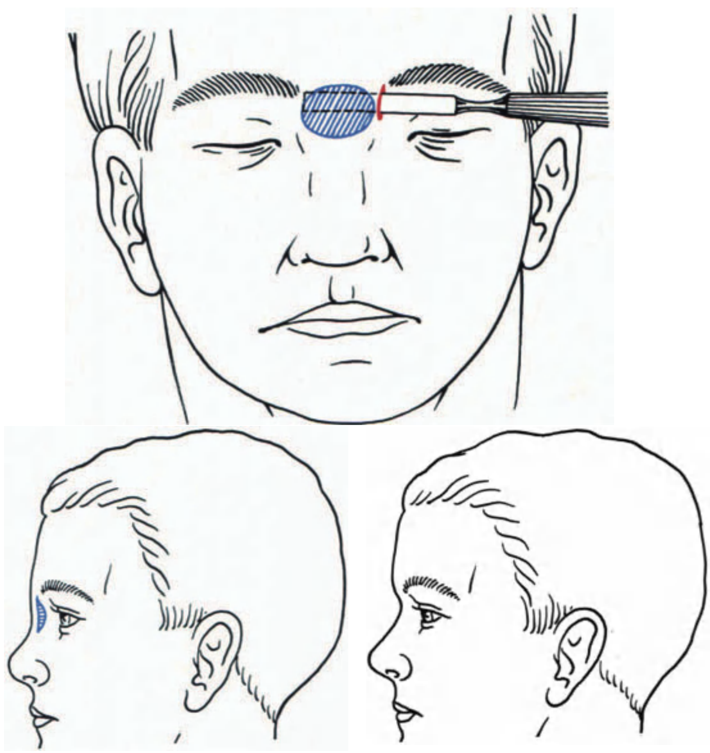


Fig. 83b. Bone removal at the glabella with the chisel through a lateral incision

has occurred because of incorrect procedure, especially in thick bones (Figs. 80a and b). MALINIAC, BARSKY and KÖCHLIN have pointed out the possibility of this mistake. Such a spur must be mobilized or removed subsequently with the LUER forceps.

If the *lateral osteotomy* has been made *too far toward the midline*, that is, not enough toward the base of the bony pyramid, one can see or at least palpate a ridge with the fingers after realignment of the bone, as pointed out by BIENIAS. In such a case there is still a way out. That ridge from lateral osteotomy which is situated too far medially is broken with the WALSHAM forceps parallel to the line of fracture.

With firm use of the forceps a shattering of the bony edge is hardly to be feared.

Now one should check whether the dorsal line is straight. Occasionally it is also necessary to remove slices from septal or the upper lateral cartilage in order to straighten the transition from the bony to the cartilaginous dorsum. Sometimes one must *deepen the glabella*. This is done best with the chisel, as mentioned above. In 1952 SELTZER developed a special, curved chisel for this purpose. It can be introduced through the intercartilaginous incision (Fig. 81).

NEIVERT and ROWLAND use a special concave chisel with which they are able to remove the bone chips (Fig. 81). The chisel of McINDOE, too, is suitable for cutting a so-called naso-glabellar depression. This instrument can likewise be used subcutaneously or subperiosteally. For removal of chips at the bone RISH introduces the chisel through a 2 mm horizontal insision at the glabella (Fig. 82a). In order to improve the nasofrontal angle even more and to emphasize the forehead convexity above the glabella, he transplants a bone or cartilage graft to the edge of the forehead (Fig. 82b), as FOMON does. The bone should come from the hump if possible. — MOOTNICK saws off the hump deep enough that he obtains the desired naso-frontal angle and then breaks through the uppermost part of the hump with the chisel. If a deep depression must be dug in the bone, in overly obvious "Greek profile" without a glabellar depression, NEIVERT uses a kind of scroll saw with saw-wire (Fig. 83a). We find this technique too traumatic and too complicated. We think we are able to do better work with the burr, concave chisel, or LUER forceps. If one does not want to perform a complete rhinoplasty with endonasal incisions and décollement, one can correct the overly shallow glabella with the chisel through a lateral, external incision (Fig. 83b). But we prefer the endonasal approach.

In an *overly pronounced naso-glabellar depression*, AUFRICHT performs the hump removal somewhat higher, filling in the depression in the uppermost portion, rather than performing it in the plane of the nasal root. EITNER fills the overly deep nasal root with the bone from the removed hump.

From AUFRICHT, CONVERSE, SELTZER, RISH, and GONZALES-ULLOA, we have taken over an original combination of *hump-nose correction with plastic surgery of the chin*. We insert the reshaped hump to the chin bone in order to improve the profile in receding chin (see Plastic surgery of the chin, Vol. II).

2. Correction of isolated wide bony nose

We can follow the discussion of narrowing of the nose after hump removal with the treatment of *isolated wide bony nose*. This frequent deformity of the nose can be inherited or caused by trauma. In the inherited form both nasal walls are far apart from each other and are joined in the midline by a wide, flat bony plate. Traumatically caused flat and wide noses usually have a thick frontal process of the maxilla. Occasionaly we find thick bony appositions which are due to periosteal irritations at the points of lateral fracture or infraction.

The first subcutaneous narrowing of a wide nose was performed by ROE in 1887, the second probably by WEIR in 1892. JOSEPH first reported on this in 1904.

The method of JOSEPH for the correction of wide bony nose has scarcely been modified in the later development of rhinoplasty.

After the bilateral intercartilaginous incision (see p. 40) décollement follows, that is, the elevation of the soft nasal tissues including the lower lateral cartilages from the bony nose, septal cartilage, and upper lateral cartilages (see p. 41). Just as in correction of the wide nose after hump removal in which the bone is not completely separated at the dorsum, a bilateral *paramedian osteotomy* is now performed in isolated wide nose. For this one can use the saw, the burr or the chisel, as in the lateral osteotomy (see p. 50). These instruments are introduced into the subcutaneous pocket through the intercartilaginous incision on both sides. One can also perform the osteotomies through very short intercartilaginous incisions which are just sufficient for the introduction of the saw, but then the required décollement is not so easy.

The *lateral osteotomy* (see p. 50) through a small additional incision follows. This osteotomy is performed far laterally, as we have seen above. The objection has proved to be groundless that the lachrymal sac could be injured during an osteotomy of the frontal processes of the maxilla.

As in the narrowing of the nose after hump removal, the *upper transverse osteotomy* (see p. 57) is of great importance in the correction of isolated bony nose as well. At times, if a flat bony plate exists in the middle, we must remove this as if it were a hump. In this case, however, the removal is more successful with the flat chisel than with the saw. The electric drill also proves to be more advantageous than the saw here.

The following steps are the same as those described in hump-nose. Here, too, the more or less wide cartilaginous bridge at the transition from the upper lateral cartilages to the septal cartilage is cut through with the scissors (see p. 62). Or, if necessary, it is removed by the resection of a strip of cartilage along the cartilaginous septum.

Now the bilateral *median realignment of the isolated bony plates* can take place (see p. 63). In general with the exception of callus formations, only small segments of the bone — or none at all — should be removed. In 1955 ECKEL suggested the complete removal of the lateral bony nasal walls using a bone forceps following elevation of the periosteum externally and the mucosa internally. We have not yet dared to apply this procedure. On the other hand it seems to us to be important that the medially displaced bone be placed with its free lateral edge below the maxillary edge of the lateral osteotomy, thus locking it. Because of this the dorsum lies hardly any lower. If we disregard this locking maneuver, we obtain a slight rise in the midline due to the somewhat vertical position of the displaced bones. Sometimes this is desired, especially in traumatic wide noses which can almost be considered to be saddle noses. However, this additional raising should not be exaggerated at the cost of bad shaping of the nasal wall on both sides. We must consider that the border of the bone at the osteotomy will again be drawn laterally in the formation of callus in the lateral osteotomy gap. This is a process which can continue for weeks and months after the operation. A widening can thereby occur again. For this reason the lowering of the lateral borders of the bone is also indicated in cases of dorsal flattening. If the narrowed nose then does not appear high enough, a graft, for example from the septal cartilage, can add the necessary height.

Flat and wide noses with pronounced saddling, the correction of which requires *a dorsal graft or implant*, should be a one-stage procedure. But if this deformity is combined with a highly deviated or thickened septum, the latter does not necessarily have to be corrected at the same time. First the bony nose can be narrowed (see p. 67) and the implant can be inserted. The septal correction is made separately. In the combined operation of osseous narrowing and of implantation, the osteotomies and the median realignment of the bony plates should take place first, and the implantation of the dorsal support should be the second step of the operation. SOMMER recommended the unilateral three-step, one-stage operation of narrowing with implantation grafting and with submucous resection of the septum. As a rule we proceed in this manner.

If the widening of the bony nose is combined with a widening and flattening of the nasal tip, which is usually done in congenital wide noses, then the narrowing of the nasal tip as described on p. 76ff, can be performed after the median realignment of the lateral nasal walls.

The *fixation of the narrowed bony nose* is important. We hold the medially displaced nasal walls in place with a retention dressing of plaster of paris or a similar material (see p. 210) when possible. It is thereby absolutely necessary

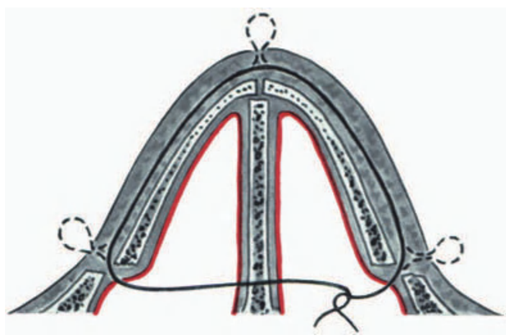


Fig. 84. Applying the subcutaneous fixation suture by FOMON and NEIVERT, which is passed around the bones

to leave the plaster cast in place for at least 7 days. In cases of extreme narrowing we even leave it alone for 10 to 12 days. In some circumstances in exceedingly wide noses, especially in traumatic ones, we use a suture to surround and hold the displaced walls in place. This was described by FOMON and his colleagues in 1954 and by NEIVERT one year later. These authors use tantalum wire, whereas we use 2/0 nylon suture material. One pierces the skin at the side of the nose in the bone gap of the lateral osteotomy. Then one guides the needle through one nasal cavity, through the septum, through the other nasal cavity and out the bone gap of the osteotomy on the other side, through the skin. The needle is then guided through the same puncture point subcutaneously to the midline at the dorsum, where it again emerges from the skin. Again the needle is introduced into the puncture point from which it has just emerged and guided subcutaneously to the original lateral puncture point, and from here into the lumen of the nasal cavity. Now the other end of the suture is brought through the osteotomy gap into the nasal cavity and the two ends tied there (Fig. 84).

3. Correction of wide nose in ozena

Often *wide noses* occur *in ozena*. Up to this time an important role in the pathogenesis of ozena has been attributed to the generally — but not always — present typical external nasal deformity, the wide and flat nose. The nose is flattened, almost without prominence, the columella is retruded, the alae are widened, and the nasal tip seems somewhat bulbous due to the relaxation of the septum and the lower lateral cartilages. This pathognomonic nasal shape was described with the terms, "Zaufal's nose" or "Tarneaud's platyrrhiny".

Platyrrhiny is so pathognomonic for ozena that it does not seem all to risky to place it along with cacosmy as an element which differentiates idiopathic ozena from chronic atrophic and symptomatic rhinitis. The great number of surgical operations continually being suggested for the treatment of ozena is justified by the fact that the etiopathogenesis of this disease is still unknown today. Lacking an etiological therapy, the surgeon can only obtain a result which represents a partially clinical improvement while he attempts to have an effect on the local symptoms.

The WITTMAACK operation, that is, the diversion of Stenson's duct into the maxillary sinus (antrum of Highmor) has been abandoned. Likewise the surgery of the sympathicus is hardly used. It is supposed to provide a change in the vascularization of the mucosa. Therefore the various methods which are directed

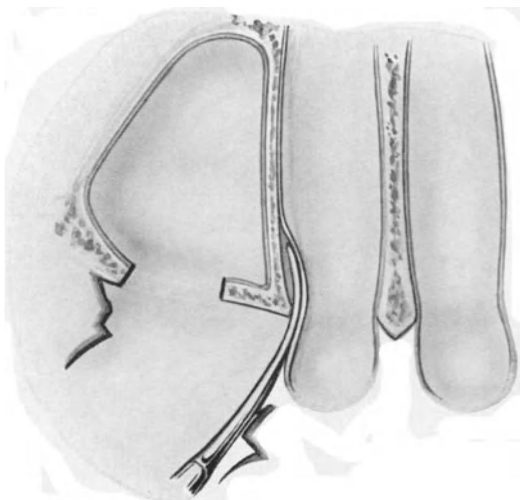


Fig. 85. Ozena surgery in wide nose, schematic view in horizontal section. Maxillary sinus opened. Separation of the mucosa from the lateral nasal wall with approach from piriform crest

at the reduction of the diameter of the nasal cavities represent today the only possibility of surgically influencing the symptomatology of ozena. The most well-known of these methods are those of LAUTENSCHLÄGER, HINSBERG, SEIFFERT, HALLE, ECKERT-MOEBIUS, RAMADIER and EYRIÈS, JACOBI, RÉTHI, and JESCHEK. We do not want to go into these various methods here and refer the reader to the descriptions in the surgical textbooks (H. J. DENECKE in Vol. V of the "Kirschner-sche Operationslehre", among others) and to the works of the individual authors.

Assuming that external platyrrhiny has a part in the pathogenesis of ozena, several authors have undertaken the first attempts to improve the symptomatology of ozena by narrowing the nasal pyramid.

KOPP reported favorable results in the treatment of atrophic rhinitis by means of simple nasal osteotomy and narrowing of the external nasal structure. WOLF emphasized the progressive improvement of ozena symptoms by means of cosmetic rhinoplasty. EISENSTODT and COTTLE recommended a technique of corrective rhinoplasty with implants in the dorsum and columella. Later ERSNER and ALEXANDER also stated that rhinoplasty alone, by means of osteotomy and auto-grafts in the dorsum, is sufficient to cause the disappearance of atrophy and crust formation.

It now seems appropriate to bring the experience of all these authors under one common denominator and to combine external narrowing rhinoplasty with reduction of nasal cavity size. We have turned toward the combination of these two complementary procedures (R. MEYER). External rhinoplasty completes the narrowing of the nasal cavities and makes it more effective.

We *narrow the nasal cavities* according to a modified method of LAUTENSCHLÄGER.

From an incision in the oral vestibule the anterior wall of the maxillary sinus is exposed. The periosteum is pushed medially as far as the piriform aperture. Working from the exposed piriform crest with an elevator one separates the mucoperichondrium in the inferior nasal meatus and at the base of the nose to a considerable distance anteriorly as well as at the agger nasi toward the middle

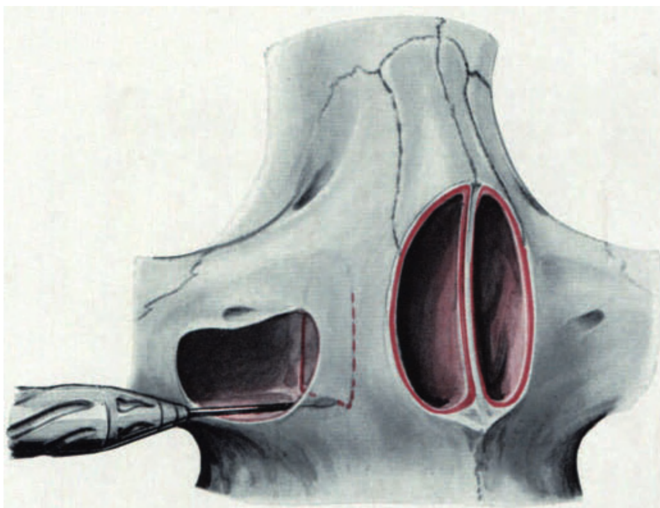


Fig. 86. Schematic view of ozena surgery in wide nose. Cutting around the antronasal wall using the perforating burr

meatus (Fig. 85). The maxillary sinus is opened as in the CALDWELL-LUC operation (Fig. 85). Since we need the dental perforating burr immediately afterward, we also perform the fenestration of the sinus with this instrument. If the mucosa of the sinus is thin and not inflamed, we leave it in place. If it appears thick we remove it. The antronasal wall is now cut through on all sides with the fissure drill. One must take care that the partially elevated mucoperichondrial membrane is not injured (Fig. 86). The cutting of this wall, just like the previous opening of the sinus, can also be performed with the chisel. Now the mobilized wall can be pushed medially (Fig. 87), whereby the mucoperichondrium of the nasal cavity is pushed and folded along the nasal floor but is stretched on the other three sides. In this way one is able to displace the wall to such an extent that it lies against the septum without tearing the mucosa. Occasionally unimportant tearing of the mucosa occurs in the area of the ethmoid or posteriorly toward the choanae.

In order to hold the displaced antronasal wall in its new position and in order to narrow the lumen at the transition from the vestibule to the nasal cavity even more, we insert bone grafts laterally next to the piriform crest (Figs. 88a and b). These can be taken from the iliac crest or from the rib, or can be pieces of Supramide, Polystan, Teflon, etc. If necessary these grafts or implants can be sutured with catgut or nylon to the subcutaneous tissue in the area of the nasolabial fold.

According to EYRIÈS one can additionally fill the nasal floor, the septum, and the area of the agger nasi with the same graft or implant material. — When we work with bone from the rib, we usually insert two pieces on either side. The fragments are about 2 cm long and placed above each other at the piriform aperture and extend posteriorly a few millimeters beyond the bony borders of the mobilized antro-nasal wall into the enlarged sinus. The upper of the two pieces of bone is placed in the region of the agger nasi. Sometimes a smaller bone

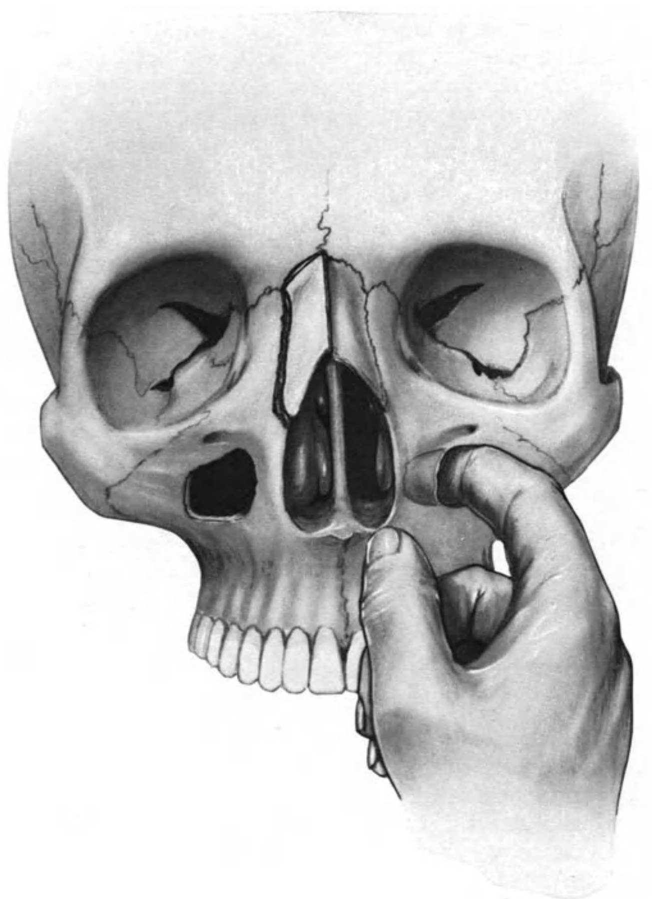
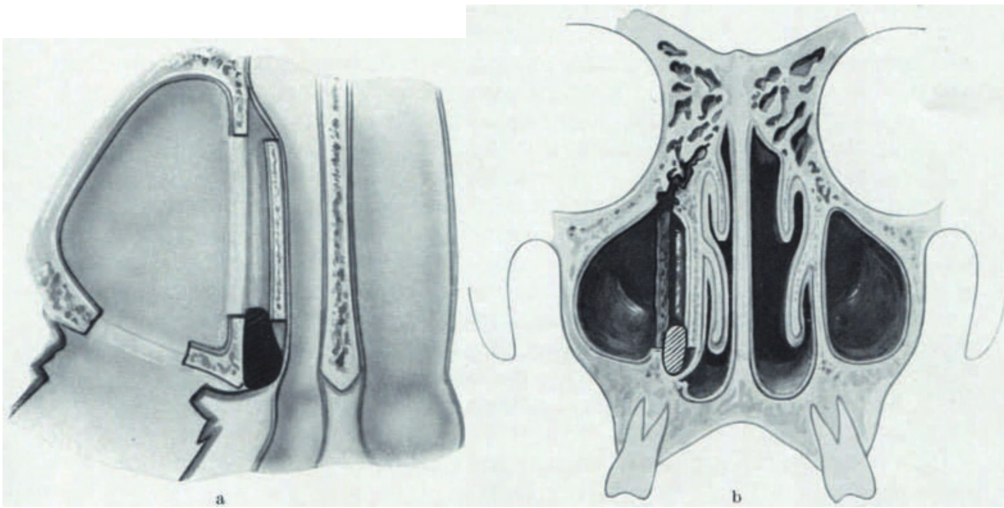


Fig. 87. Schematic view of ozena surgery in wide nose. On the right side the antronasal wall and the bony nasal roof are repositioned medially. On the left side the finger presses the antronasal wall medially

graft can be placed in between at the posterior border of the bony frame. With plastic implants the blocking interposition can extend from front to back (Fig. 89). Packing of the considerably narrowed nasal cavities is not absolutely necessary. We also do not pack the maxillary sinus, since we do not consider it necessary and because it only requires prolonged and, for the patient, very unpleasant postoperative treatment.

The procedure is followed by the external correction, that is, the osteotomy and median repositioning of the nasal bones and the frontal processes of the maxilla (see p. 67). The mobilized bones are displaced toward the midline with the WALSHAM forceps, and the narrowing of the upper arch of the nasal bones is achieved as well. This upper narrowing begins at that point where the lower and posterior narrowing of the first stage of the operation stops. If we compare the nose with a house, we can say that in this surgery not only the walls are pushed



Figs. 88a and b. a Ozena operation in wide nose schematically represented in horizontal cross section. After mobilization and median repositioning of the antronasal wall, the wall is supported by a small implant. This is supposed to narrow the entrance to the nasal cavity at the same time (R. MEYER). b Ozena operation in wide nose represented schematically in vertical cross-section. One antronasal wall has been repositioned medially and is supported by an implant (R. MEYER)

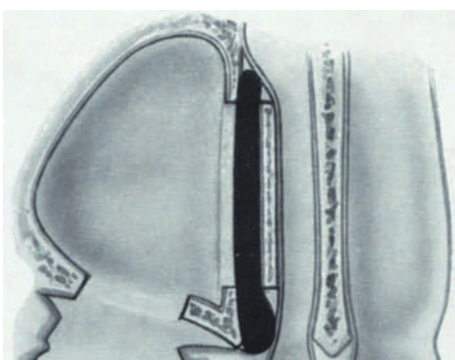


Fig. 89. Ozena operation in wide nose represented schematically in cross section. After mobilization and repositioning of the antronasal wall the wall is supported along its entire length by means of an implant (R. MEYER)

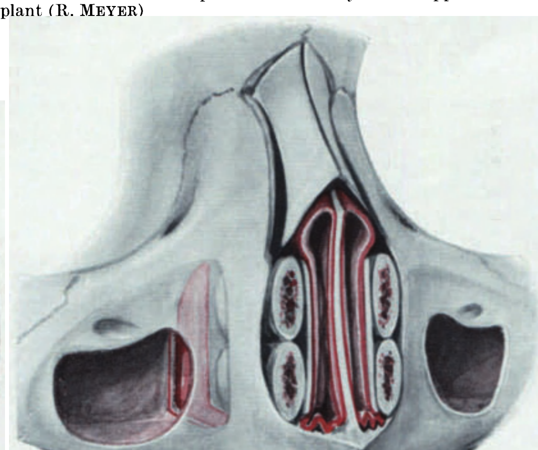


Fig. 90. Schematic representation of situation after bilateral ozena operation in wide nose, by R. MEYER. External and internal nose have been narrowed. Two bone grafts from the rib have been inserted bilaterally

inward, but that the gabled roof adapts itself to the new spatial relationships and participates in the narrowing.

We see the advantage of our combined procedure in that the lower and middle turbinate as well as all sections of the wall around it are displaced toward the septum. Thus the lumen of the whole nasal cavity is narrowed relatively evenly and the narrowing implants prevent the displaced wall from returning to its original position (Fig. 90). JACOD has described a kind of lock made of acrylic at the antro-nasal threshold, while HOFFMANN has described a similar wedge made of Palavite. Since we place our bony grafts far forward at the piriform aperture, we achieve a narrowing of the nasal cavities even at their beginning, that is, at the transition from the vestibule to the cavity. Moreover this is achieved from the side and not from below, which is not the case with previously known methods. With this we have combined the inner ozena operation with the external correction of wide nose, but not with that of a wide and flat nose. Due to the slanting position of the nasal bones, the dorsum has probably been raised somewhat, but as a rule not enough so that filling is necessary. For this additional correction of saddling by using filling material, we proceed according to the description in the chapter on saddle nose (see p. 146). If dorsal filling is originally intended, the material can be taken from the rib. Thus with a secondary operation graft material for the endonasal surgery as well as for the implant surgery at the dorsum is obtained. A comprehensive operation consisting of three parts is performed.

1. Removal of graft material from the rib.
2. Narrowing of the nasal cavity using a modification of the method of LAUTENSCHLÄGER.
3. Correction of the external nose by narrowing of the external body structure and by dorsal graft.

We perform the external nasal correction, the narrowing of the bony pyramid and the dorsal implant surgery by means of the open method, that is by cutting through and elevating the columella including the membranous part of the septum. This is also described in the chapter on saddle nose (see p. 179).

In ozena with a relatively narrow nasal cavity we have successfully tried the method of severing the N. petrosus superfic. maj. after KRMPOTIC. In such cases a plastic narrowing would have caused unnecessary blockage of the nasal air passage. Only the future can tell whether severing the nerve on the growing skull will prevent the development of platyrrhiny, making plastic surgery unnecessary.

4. Correction of narrow bony nasal vault

Narrow bony nose occurs much less often than wide bony nose. Usually they are very narrow hump noses. In addition there is also unilateral narrowness due to depression of one bony lateral wall. In the first case hump removal without displacement of the lateral walls may occasionally suffice. At most a slight fracturing of the bony border at the line of hump removal is necessary. Unilateral narrowness of the bony nasal vault actually results in a deflected nose and therefore can be treated as such. These two deformities of the external nose and their correction have already been described in the book by JOSEPH. On the other hand, infrequent, abnormal, bilateral narrowness of the bony nasal vault without hump is treated neither in the standard works of JOSEPH or FOMON nor in other older or more recent literature on rhinoplasty.

We have tried to use a method of our own. In such cases we proceed in a manner opposite to that in the combined wide nose-ozena operations. We combine a submucous lateral mobilization of the inner lateral nasal walls through the maxillary sinus with a subcutaneous and submucous mobilization of the external lateral nasal walls, i.e., with a widening of the external bony nasal structure (R. MEYER). In this operation we proceed as we do in the ozena operation. From the oral vestibule we open the maxillary sinus wide and mobilize its medial wall on all sides with the drill. The thin mucosa of the sinus is scored in the process, whereas that of the nasal side should be protected wherever possible. Then, also from the sublabial approach, the piriform crest is removed with a bone punch from the naso-maxillary suture to the floor of the nose. Especially in the lower section the bony wall is removed far to the side up to the sinus, as in the sinus operation of DENKER. The result is a considerable enlargement of the piriform aperture in the lower part and a vertical, slit-like opening in both sinuses. Now the lateral nasal wall can be moved, laterally this time, either by finger pressure or with an instrument. With this movement the slit on the sinus opening at the piriform crest closes again more or less completely. The nasal mucosa, which is elevated from the bone at the floor of the nose as well, can be pulled laterally without tearing, together with the bone of the lateral wall. In some cases one must use catgut or nylon sutures to fix the shifted bone, together with its mucosa, laterally to the maxilla or to the premaxillary tissue.

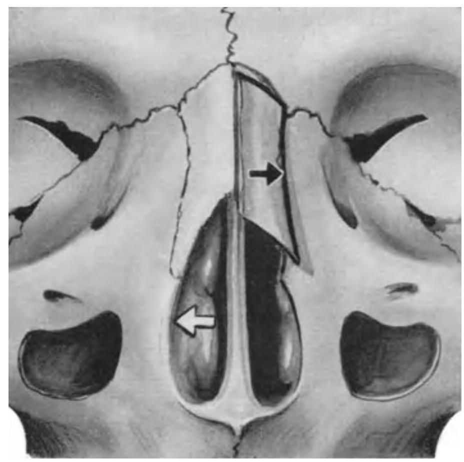


Fig. 91. Correction of overly narrow nose by lateral repositioning of mobilized antronasal wall and by widening the external nasal structure by lateral repositioning of the nasal roof bilaterally after osteotomy, according to R. MEYER

For widening the external nasal structure, which can be performed without displacement of the sinus wall in suitable cases, we encounter the same preparation as in narrowing. Décollement (see p. 41) through the intercartilaginous incision (see p. 41) can be limited to the ridge of the dorsum and to the area of the lateral osteotomy. Of course the periosteum must be elevated over a considerable area laterally from the planned line of bone separation. Bilateral mobilization of the bony plates which are to be displaced now follows; this is accomplished by paramedian (see p. 68), lateral (see p. 50) and transverse osteotomy (see p. 58). In additional hump nose, hump removal (see p. 34) is performed instead of paramedian osteotomy. The totally mobilized bony plates are now lifted over the edge of the lateral osteotomy with a WALSHAM forceps and placed in the subperiosteal pocket at the side of the osteotomy (Fig. 91). The lateral edge of the lateral osteotomy can also be resectioned with forceps, saw, drill, or chisel, taking care not to injure the periosteum. Thus the medial edge of lateral osteotomy can likewise slip sideward. A lateral bone strip excision can be performed here. This procedure is recommended by ECKEL for the correction of wide or deflected nose as well (see pp. 60 and 68). We reject this method in wide or deflected nose. In the midline the borders of the bone should touch each other again, whereby the dorsum is only slightly depressed. In some circumstances the border of the bony septum may be palpable through the skin. Thus it does not necessarily need to be covered by the lateral bones. The inner periosteum and the mucosa of the bony vault may be elevated from the bone only in the area of the lateral osteotomy so that they do not tear during the mobilization. They should be left intact medially in the duplicative fringe from the septum to the nasal bone.

This operation creates more space and improves the ventilation conditions in the nose. In contrast to the operation for ozena this one absolutely requires copious packing of both nasal cavities far forward and above under the bony vault. The packing should remain in place as long as possible, 3 to 5 days or more, or be changed, if necessary.

In 1950 DOUGLAS showed that with removal of bone at the lower border of the piriform aperture one obtains an enlargement of the nasal cavity in an insufficiently corrected cleft lip and palate with a high nasal floor and narrow entrance to the nasal cavity. The same also applies to syphilitic noses with destruction of the septum and with nasal collapse, as well as to nasal fractures and pronounced deviation of the septum. With a deviated septum it should naturally be only an additional operation. This technique can be regarded as a forerunner of our procedure (R. MEYER).

IV. Shaping of nasal tip including lower lateral cartilages and columella

1. General considerations about plastic surgery of nasal tip, necessary incisions

Correction and remodeling of the nasal tip place the surgeon before the most difficult tasks in rhinoplasty. The success of shaping a nasal tip depends upon many factors of which not all can be completely influenced by the surgeon. Thus even with the most precise and careful procedure the desired result is not always achieved, and one often must reckon with the possibility of small subsequent corrections. Postoperative edema of the nasal tip can linger for months due to a particular reaction of the tissue and the circulatory system. Bluish-red or livid discoloration can even occur later.

The shape of the nasal tip depends primarily upon the shape of the lower lateral cartilages. But skin thickness, the subcutaneous fat layer and the subcutaneous connective tissue deposits also play a role. Even the activity of the sebaceous glands must be taken into consideration. The shape and length of the cartilaginous septum, the shape and size of the upper lateral cartilages, the shape and size of the maxillary spine, the direction and tension of the muscles and of the connective tissue in the area also contribute to the new shape of the nasal tip. A basic requisite for the success of the surgery is exact knowledge of the shape of the cartilages, of the relationship of the cartilages to one another and of the cartilages to the nasal bones, as well as of the mimic and respiratory muscles. During the dissection of the lower lateral cartilages one can make certain conclusions about the later result according to the presence or absence of adhesions of the perichondrium or of the surrounding connective tissue with the cartilage. Above all one must be careful of too extensive an excision of cartilage. Only when one knows the various basic techniques and the limits of surgical possibilities can one dare to attempt a virtuosity guided by esthetic sensitivity in modelling the nasal tip. For here, especially, one must take into account that the postoperative loosening of the tissue can cause some modification of shape. Experience teaches how much one must over-correct here and there. Also, with intentionally strict symmetrical procedure in separating various tissues and in excisions, postoperative scar contraction due to uneven scar formation can lead to asymmetries in the area of surgery.

In each individual case we must diverge from the basic techniques and must use improvised modifications. With this in mind we would like, however, to present the basic principles for corrections of the nasal tip. In this part of rhinoplasty we can scarcely remain with the methods of the old master, JOSEPH. Even his faithful pupils, like SAFIAN and AUFRICHT have suggested considerable modifications.

The basic incisions have already been described: they are the intercartilaginous incision at the limen nasi (see p. 40), the transfixion incision (see p. 43), and the incision at the rim of the vestibule (see p. 40). With almost every plastic operation on the nasal tip we use all three incisions. The third one is not used by many surgeons.

Through the intercartilaginous incision we elevate the dorsal skin over the upper lateral cartilages at least as far as the nasal bones, and usually quite far beyond this above, even if nothing must be done to the bones. In doing this we remain supraperiosteal over the bones if the bony structure is not to be corrected also.

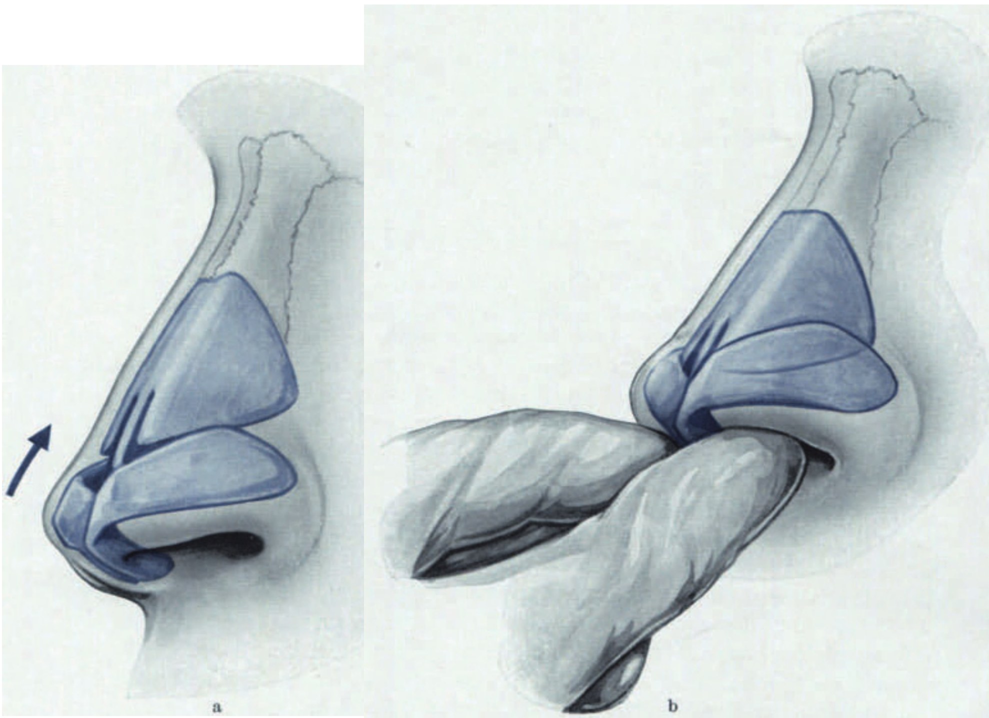
2. Excisions of septal cartilage

The resection of a strip of cartilage along the anterior border of the septal cartilage is done to raise the nasal tip slightly. This can be done now or else later after reshaping the lower lateral cartilages. Guide lines can hardly be set up for the size of this resection. In general it is left to the judgment of the surgeon, but this, too, is an object of controversy among plastic surgeons. FOMON, GOLDMAN and their colleagues reject the excessive excision of sectors along the anterior border of the septum and bilaterally on the upper lateral cartilages. This was the method prescribed by JOSEPH. They reject it because with this, an unnatural appearance of the nose with slightly retracted columella and ugly retrusions laterally above the alae is said to result often.

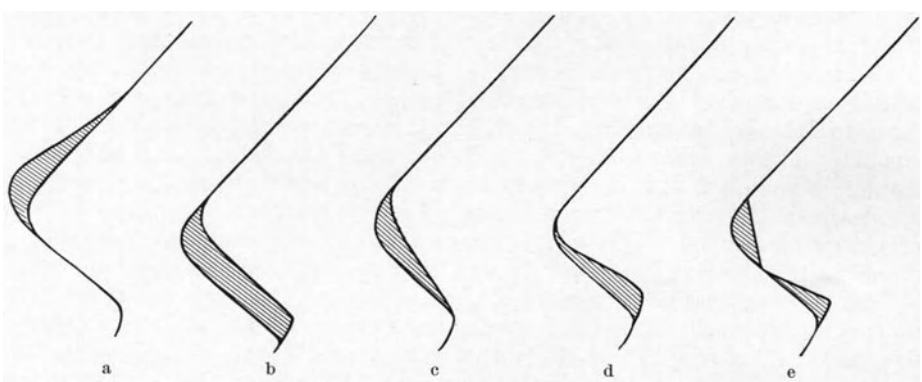
A later retraction of the columella beyond the desired amount is said to occur sometimes after this causing a drooping tip. For shortening the nose this group of Americans has operated since 1952 according to the principle of the rotating lifting of the arch of the lower lateral cartilages to a position above the upper lateral cartilages. This is similar to raising the visor of a helmet (Fig. 92). In doing so the upper lateral cartilage should be protected so that the surfaces in contact between its lower part and the lateral crura of the lower lateral cartilage are as large as possible. This means that by formation of scar tissue, later slipping of the cartilaginous and dermal visor to its former position is prevented. Resection of the anterior border of the septal cartilage may perhaps be necessary. This should only be done last as removal of excess. Besides, as little as possible of the cartilaginous tip structure is excised. It should rather be cut through and repositioned, thus being reshaped. As ROE said in 1890, the soft parts of the nose should be modelled as if they were made of clay and held in their new form by means of the external dressing. Not all experienced surgeons, especially the advocates of JOSEPH's principles, concur with this concept of rhinoplasty. — We assume a position between both methods and take something from each.

The anterior and lower borders of the septum and the angle under the nasal tip can be seen easily after the following procedures: the elevation of the dorsal skin (see p. 41) through the incision at the limen nasi (see p. 40), joining the two intercartilaginous incisions with the button-end knife (Fig. 44a) and then continuing the incision for transfixion (Fig. 44b) in the membranous part of the septum in front of the septal cartilage (see p. 43). Now one can perform the border resections on the septal cartilage to the extent necessary and in the shape desired for shortening and reduction of the nose. In order to be able to maneuver better in this area some surgeons apply a so-called basal traction suture of nylon or silk at the base of the columella (Figs. 94 and 95).

The *extent of excision of septal cartilage* requires a certain amount of experience. Even if we agree with the helmet visor theory of FOMON and GOLDMAN and use it in practice, we must concur with JOSEPH and his pupils. They stated that the length of the nose is determined primarily by the length of the septum and secondarily by the soft parts of the nasal tip. — The excision on the upper



Figs. 92a and b. "Visor-flap" mechanism of FOMON ("overlapping technique"). a Visor down; b Visor lifted



Figs. 93a—e. Resection on the septal cartilage for shortening nasal tip. a Along the anterior edge; b Along the caudal edge. rectangular resection; c Wedge-shaped resection; d Wedge-shaped resection; e Resection for more pronounced formation of the double angle of the nasal tip

anterior border of the septal cartilage, which forms the dorsum, is determined by the new nasal line. The line of excision should be the extension of the line formed by the bony dorsum (Fig. 74). Sometimes the tip correction is combined with hump removal. If the work on the bone has then preceded reshaping the tip, as in our procedure, the necessary resection of the cartilaginous dorsum is

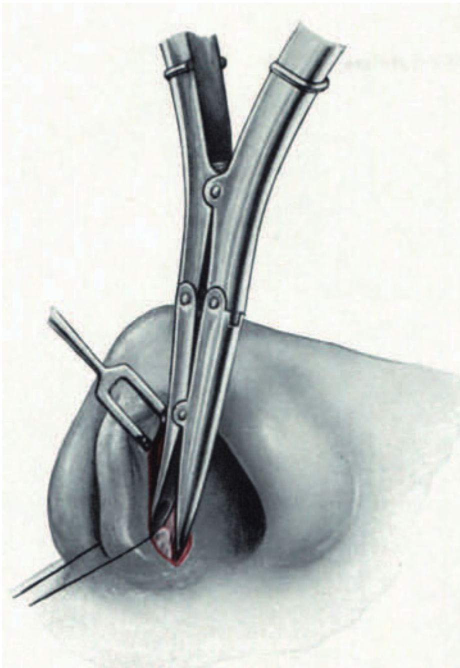


Fig. 94. Removal of the maxillary spine with the forceps of ZAUFAL-JANSEN

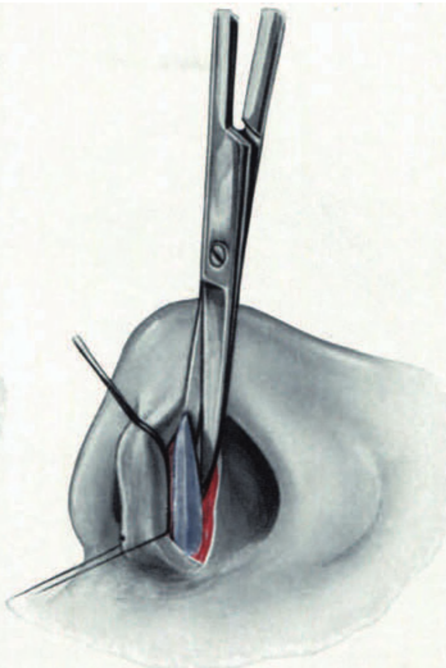
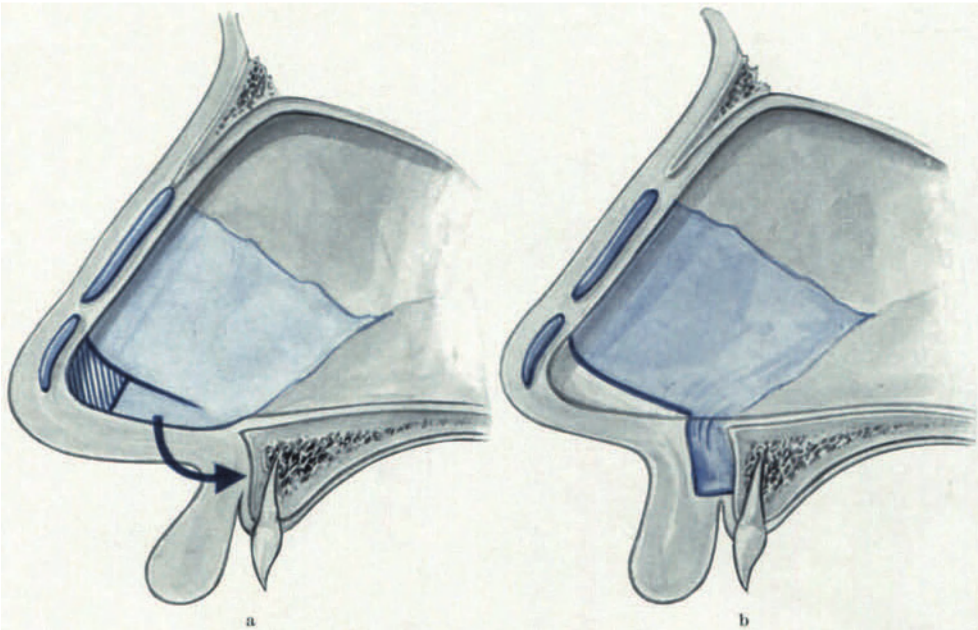


Fig. 95. Resection of the caudal edge of the septum with scissors

now performed (Fig. 93a). Some surgeons prefer to work on the bone following the tip correction as the second phase of the operation. Then resection of the cartilage must wait until the end of the operation. Here, in our opinion, is the disadvantage of this procedure sequence, as can be seen below.

Fig. 96. Correction of hanging columella by means of skin excision from the columellar part in the membranous septum

The extent of the border excision at the lower edge of the septum is determined by the planned raising of the columella for shortening the nose. One must over-correct to a certain degree. This is done because the soft parts of the nasal tip and the columella tend to have a slight ptosis even months after the operation. If the nasolabial angle is all right before the operation, i.e. at least 90^0, then a quadrangular piece of cartilage can be resected along the lower edge. That means that the line of excision should run parallel to the former border (Fig. 93b). If the angle is too sharp, which is usually the case with long noses, then a wedge-shaped piece with its point toward the maxillary spine is excised along the edge (Fig. 93c). In an opposite manner a wedge of cartilage with its flat end toward the spine must be removed from the edge of the cartilage if the nasolabial angle is too oblique and the upper lip is short (Fig. 93d). In these cases the spina is also enlarged and quite prominent. This requires removal, at least in part, with a chisel of BROWN and McDOWELL (Fig. 149) or with the bone forceps of ZAUFAL-JANSEN or of LUER (Fig. 94) (see also p. 115). JOSEPH used a special short-bladed bayonet saw.



Figs. 97a and b. Correction of the nasolabial angle by CINELLI. a The posterior part of the surplus cartilage border is not severed. b It is swung downward onto the bone

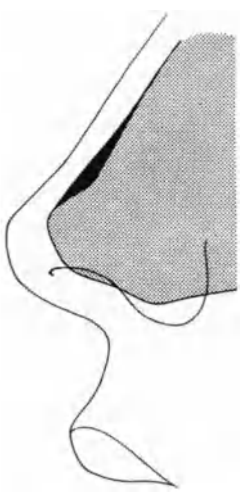


Fig. 98. Supratip depression in the septal cartilage (LIPSETT)

Naturally the *nasolabial angle* must harmonize with the rest of the profile. With slight proganthic jaw, for example, or with strongly receding chin, the angle must not be more than 90°. In general it may be larger in women than in men, especially in women with very delicate features. According to present esthetic feeling, the profile of the nasal tip shows two angles, one at the most anterior part of the columella, and the other somewhat farther forward and above at the end of the dorsal line. This can be seen in Fig. 98. This double angle looks very natural and attractive. It can be achieved in the tip correction. The septal border is cut accordingly, or the lower border of the medial crus of the lower lateral cartilage is resected as required, as can be seen below. The new line of the lower border of the septal cartilage should have an angle in the anterior third (Fig. 93e).

The line of this cut meets the mucosa of the septum just at its transition with the skin of the membranous part of the septum. It should be cut flush with the cartilage. The resection is performed best with scissors from the front to the back, that is, from the tip toward the spina (Fig. 95). SELTZER uses a grooved director in the form of a clamp for the knife.

With a low position of the columella, the so-called *hanging columella,* no tissue should be resected at the middle part of the septal border. Instead, a curved excision should be made at the anterior edge of the transfixion incision, that is, in the columella itself (Fig. 96). This spindle excision includes the skin on both sides of the columella and the connective tissue between, in some cases, part of the medial crura as well it they extend far rearward. — It should be pointed out here that the skin of the columella should never be called the septum. Thus there is no mention here of hanging septum, but rather of hanging columella (FRÜHWALD). — If one cuts away too much from the inner (posterior) edge of the columella at the line of transfixion, a shape like that of "*hidden columella*" occurs. The correction of hidden columella is discussed below (see p. 114).

On the other hand, the resection of the oval piece of tissue should not extend to close to the border of the columella, as is illustrated in the textbook by JOSEPH. The resection incision should run a little farther back into the membranous part of the septum, but still in front of the transfixion incision. In 1958 CINELLI proposed a method for correcting *hanging nasal tip with too acute and receding nasolabial angle*. He does not cut away completely the excess at the lower border of the septal cartilage, but swings it downward 90⁰ or more to the bone and beneath the upper lip (Figs. 97a and b).

To avoid pronounced postoperative drooping of the nasal tip, we cut a small depression in the anterior border of the septal cartilage, just above the nasal tip. This should take up the excess of subcutaneous tissue (Fig. 98). In relation to the dorsal line, the tip must be very slightly prominent, in order to give the nose an attractive shape. This depression in the cartilage above the tip reduces the danger of postoperative formation of a so-called duck-bill nose with a small hump above the tip and a slight depression above that.

LEVIGNAC has also described this according to information of LIPSETT. Since we have used this trick we have not experienced any pronounced drooping of the nasal tip nor fibrous hump formation just above the tip.

3. Corrective surgery of the lower lateral cartilages

The exposure of the lower lateral cartilages for correction can be done in various ways. The most common are the luxation method ("bucket-handle exposure") from an incision at the outer rim of the vestibule and the eversion method from the intercartilaginous incision. First the techniques of the exposure are described, followed by the various procedures for reshaping the lower lateral cartilages.

a) Luxation method

We usually use the *luxation method* introduced by EITNER. It is also used by FOMON, GOLDMAN and their colleagues, by BROWN, MCDOWELL, O. BECKER (USA), AUFRICHT, SELTZER, DUFOURMENTEL, etc. The incision runs 1 to 3 mm inside the outer rim of the nasal vestibule. The incision must be made very precisely. This can be done easily by pulling the anterior portion of the rim forward with a two-pronged retractor and at the same time turning the inner wall of the ala outward by means of finger pressure on the nasal tip (Fig. 99). One can also do it without the retractor by using two fingers to compress the loose portion of the nasal tip which has been severed from the septum (Fig. 100).

It is important that the skin of the vestibule is incised exactly perpendicularly with the knife (Bard-Parker No. 15). This is especially important in the area of the soft triangle (Fig. 1) at the transition of the ala to the columella, where the lower lateral cartilage no longer accompanies the border of the skin. Tears easily occur at this point, which can later lead to ugly cicatricious contraction. The incision at the rim of the vestibule should be continued as far as the anterior third of the columella. The incision should remain about 1 mm from the rim and may extend into the lateral third of the ala where the cartilage diverges from the rim. The lateral end of the incision may also turn away from the rim of the vestibule, corresponding to this divergence. From the incision the border of the cartilage is found with a blunt scissors or with a thin elevator. This maneuver, as well, must be performed very carefully. The skin of the ala and of the nasal tip, together with its subcutaneous connective and fatty tissue is now elevated with a thin elevator or with a blunt scissors. The slightly curved scissors of McIndoe with flat blades is best for the purpose. The elevation is best accomplished by opening the scissors carefully ("manoeuvre de Lagarde"). The

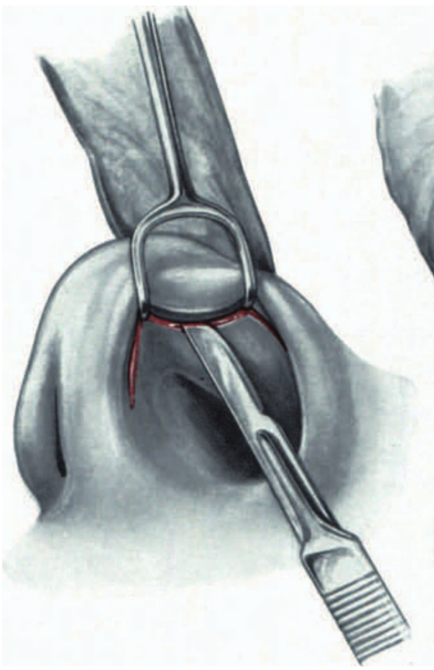


Fig. 99. Vestibular rim incision for exposure of the lower lateral cartilage using the luxation method. The vestibular rim is exposed by means of a two-pronged retractor and finger pressure

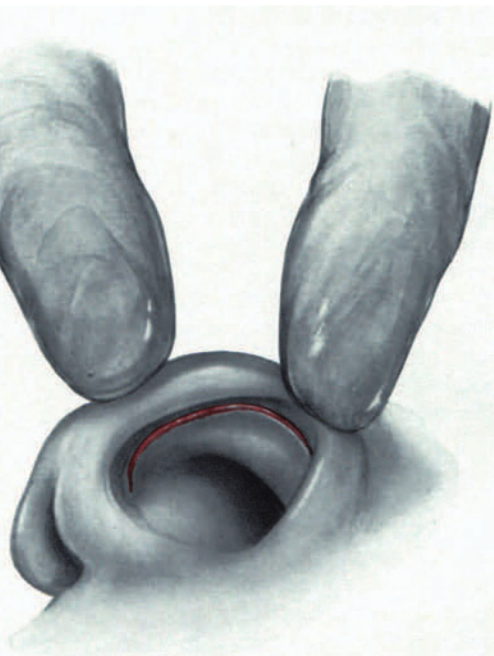


Fig. 100. Vestibular rim incision for exposure of the lower lateral cartilage using the luxation method. The vestibular rim is exposed by means of pressure from two fingers

M. dilatator (= pars alaris musculi nasalis), situated quite laterally at the end of the cartilage, must not be injured (Fig. 101). The resulting pocket must be completely free from strands of connective tissue. It should extend as far as the intercartilaginous incision at the limen nasi thus actually forming a bridge flap of lower lateral cartilage and vestibular skin. One must be certain that there are no more strands of connective tissue (Fig. 102) and that the lower lateral cartilage has been freed from the skin of the nasal tip beyond the cartilage above the middle of its arc. When this has been done, the bridge flap is grasped with a wide anatomical forceps and luxated out of the nostril, but without too much pressure on the tissue. A wide, flat elevator can then be introduced between the bridge flap and the rim of alar skin which has been freed from the cartilage (Fig. 103). Neivert and Seltzer use a specially constructed probe for this, upon which the lower lateral cartilage is supported (Fig. 104). All fat and connective tissue is carefully cleaned from the exposed cartilage. Then the lower lateral

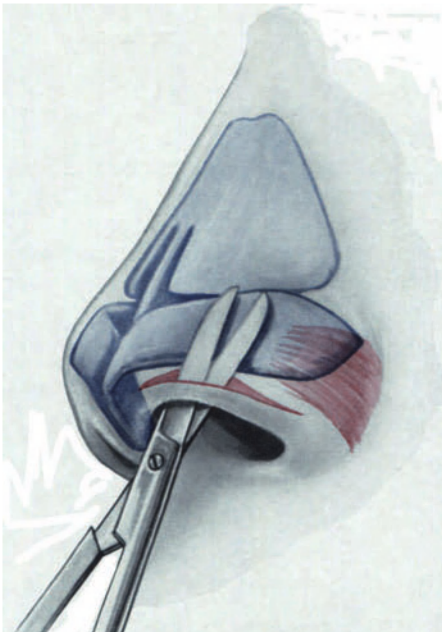


Fig. 101

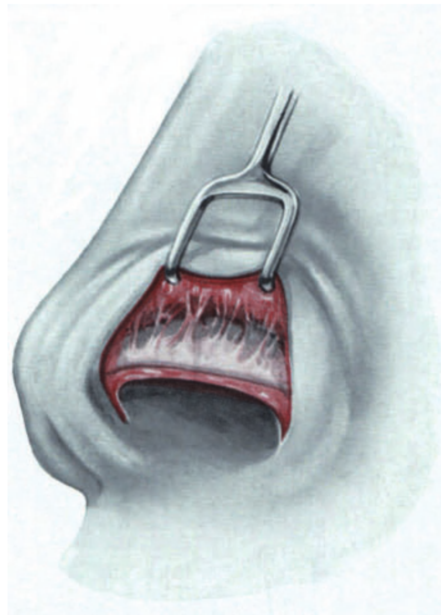


Fig. 102

Fig. 101. Décollement of the lower lateral cartilage in the luxation method through the vestibular rim incision. This is achieved by spreading the blades of a slightly curved, blunt scissors ("manoeuvre de LAGARDE"). The M. dilatator (pars alaris M. nasalis) must be protected

Fig. 102. Décollement of the lower lateral cartilage in the luxation method. Adhesions still must be separated

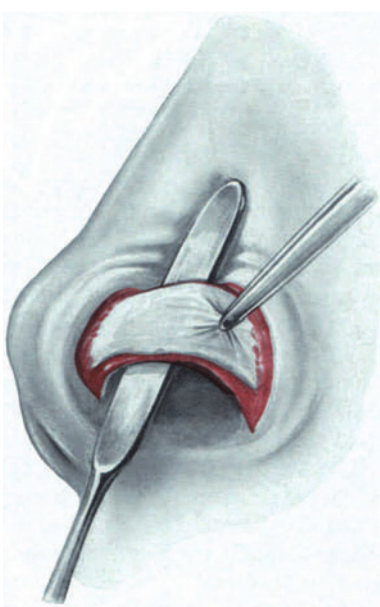


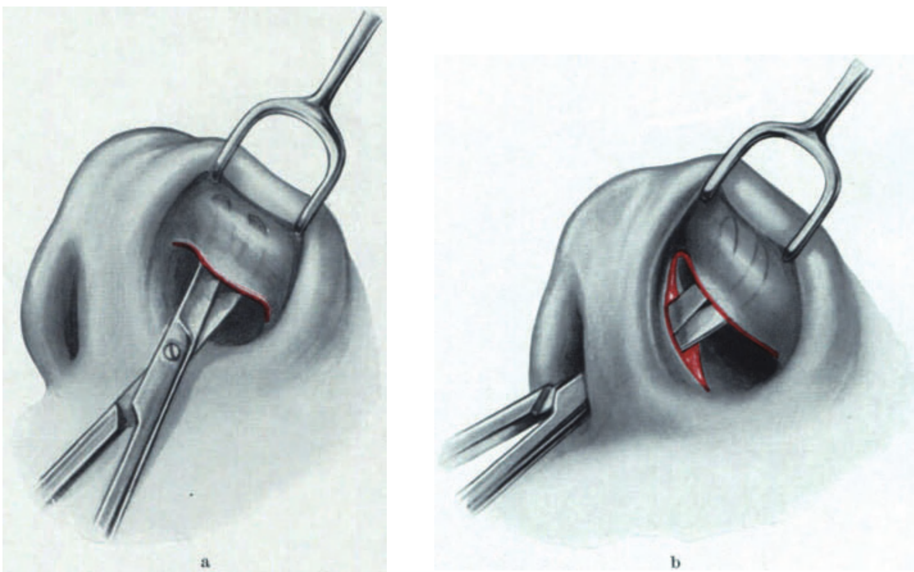
Fig. 103. Exposure of the luxated lower lateral cartilage by means of an elevator. Luxation method

Fig. 104. Exposure of the luxated lower lateral cartilage with the probe of NEIVERT-SELTZER. Luxation method

cartilage can be incised, resected, and remodelled as desired. The bridge flap is pushed back into the nostril after completion of these cartilage corrections, which will be discussed below (p. 87).

b) Eversion method

The *eversion method* is used by McIndoe, Salinger, Cohen, Converse, Rode, Sommer, and most of the English plastic surgeons. In this method the lower lateral cartilage is not luxated in its natural position. Instead it is turned outward, causing the upper border to be below and vice versa. The lower border of the intercartilaginous incision is grasped with a one- or two-pronged retractor



Figs. 105a and b. Décollement of the lower lateral cartilage using curved scissors. Eversion method. a The scissors are introduced directly through the intercartilaginous incision on the same side. b The scissors are introduced from the other nostril through the transfixion incision

and is pulled downward out of the nostril (Fig. 105a). One can also help this by using finger pressure from the outside. Thus the upper border of the lower lateral cartilage is exposed. With utmost care, the lower lateral cartilage is now separated from the overlying skin which has been pulled along with the cartilage. This is done best with the wide and strongly curved scissors, of Mayo, Fomon, or Knight. If one works with a lightly curved scissors, it is best introduced into the open limen nasi from the opposite nostril through the transfixion incision (Fig. 105b). One can also use a heavy, blunt, strongly curved, special scissors. This is introduced from the intercartilaginous incision on the same side (Fig. 105a). Carefully one works with the scissors-blades toward the lower border of the lower lateral cartilage, which now is located above. By increasing the pull with the retractor, the everted surface of the lower lateral cartilage which has been turned outward, can now be seen and can be grasped with a clamp. It is freed of fat and connective tissue remnants and is now reshaped. While some surgeons perform the cartilage excisions together with the vestibular skin (Rode, McIndoe), others carefully spare the vestibular skin by separating it from the cartilage to be resectioned. Pitanguy even goes so far as to free the external skin as well as the vestibular skin from above as far as the lower border in the eversion of the cartilage. Thus both skin portions are spared completely. — We use the eversion method only rarely, when only minimal corrections are to be made on the lower lateral cartilage. Such instances might be, for example, a very slight border excision or a wedge excision from the upper border (Fig. 106); further, in combination with correction of saddle nose using a graft; and in cases in which an excision on the border of the ala must be done. We think that the view for more complicated reshaping of the lower lateral cartilage is not as good with the eversion method as with the luxation method. The advantage of eversion is that in cases in which the alar border already has the desired shape, there is no danger of postoperative pinching due to unnecessary scar formation.

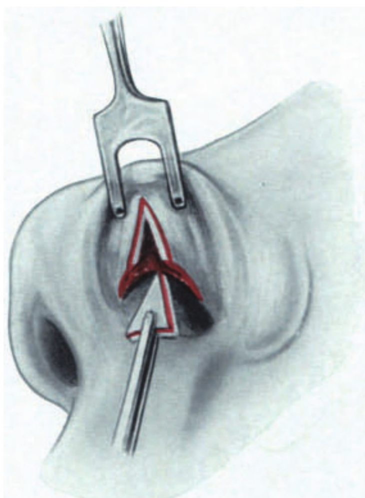


Fig. 106. Wedge-shaped excision from the lower lateral cartilage using the eversion method

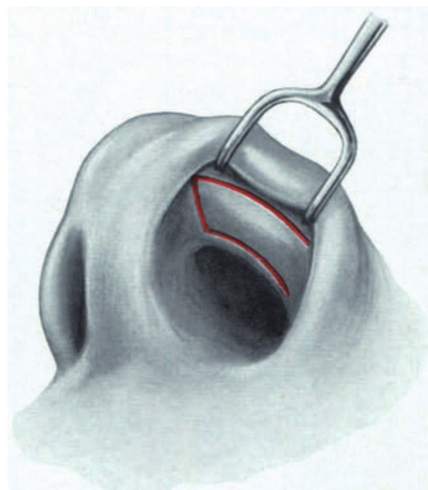


Fig. 107. Flap consisting of vestibular skin and cartilage according to SAFIAN

This applies especially to the "soft triangle" of CONVERSE at the dome (Fig. 1). The adherents of the eversion method want to avoid an additional incision, which in some circumstances might also lead to a thickening of the alar border; this is emphasized particularly by SALINGER.

BROWN, MCDOWELL and others use the luxation method and the eversion method.

The method of SAFIAN can be regarded as a compromise between the two methods. A *rectangular flap* is formed by the vertical connection of the two incisions, the vestibular rim incision and the intercartilaginous incision, anteriorly in the dome of the nasal vestibule, and by the décollement of the alar skin from the lower lateral cartilage. This flap consists of the lateral crus of the lower lateral cartilage, and of vestibular skin. It is joined laterally to the ala (Fig. 107). This flap can be rotated outward for reshaping the exposed cartilage. When a correction must be made on the medial crus of the lower lateral cartilage, the vestibular rim incision is extended to the columella as in the luxation method. BERSON, RÉTHI, AUBRY, GALTIER and others have used the flap after SAFIAN.

CONVERSE goes his own way and gains access to the lower lateral cartilage with one of two methods, according to the extent of excision desired. In the first method he frees the vestibular skin from the lower lateral cartilage working from the limen nasi toward the vestibular rim. Thus the lower surface of the cartilage is brought into view. Then he can resect the cephalic border of the cartilage.

According to his second method he makes an *intracartilaginous incision* (Fig. 108) at a point which is determined by the extent of excision on the cephalic border of the cartilage. From this incision the vestibular skin is freed from the section of cartilage to be resected, and the overlying skin is elevated. Thus the upper strip of cartilage is exposed for excision. If CONVERSE additionally wants to resect a strip of cartilage perpendicular to the alar border in the anterior part of the lateral crus, then he uses a small rim incision as well. From here he frees the vestibular skin from the cartilage and elevates the skin over the cartilage. JOSEPH already exposed the cartilage in this way to punch out a strip of cartilage (Fig. 110). CONVERSE cuts out the piece of cartilage with scissors. RUBIN likewise makes an intracartilaginous incision. For this he uses a specially shaped knife,

Fig. 108. Intracartilaginous incision (CONVERSE)

Fig. 109. Resection of lower lateral cartilage by MIR Y MIR (blue hatching)

published in 1948, with a director which keeps the incision at a particular, even distance from the alar border.

O. BECKER (USA) combines the eversion and luxation methods. He resects the cephalic border of the lower lateral cartilage by means of eversion together with the vestibular skin, while he excises a triangular piece at the arch of the lower lateral cartilage working from a rim incision with slight luxation.

KAZANJIAN, like CONVERSE, exposes the lower lateral cartilage only in the region in which he wants to make an excision. Working from an intracartilaginous incision he resects the upper border of the lower lateral cartilage a few millimeters wide (Fig. 112c). If a narrowing of the tip is necessary, he cuts a triangular piece from the anterior part of the lower lateral cartilage, with the point toward the vestibular rim (see also p. 88). He frees the piece of cartilage from the vestibular skin and replaces the skin flap.

MIR Y MIR uses a similar procedure. He incises the lower lateral cartilage from inside in a diagonal line. He excises a small wedge anteriorly from the arch of the cartilage together with the vestibular skin. He then removes the whole section of cartilage above the incision after previously freeing the external skin and vestibular skin in this region (Fig. 109).

c) Incisions and excisions on the lower lateral cartilages for modeling

In the literature one finds the most varied shapes of *incisions and excisions on the lower lateral cartilages.* For narrowing the nasal tip JOSEPH punched out a strip bilaterally in the anterior part of the lateral crus, perpendicular to the vestibular rim, together with the vestibular skin (Fig. 110). He had punches of various widths. SELTZER as well has developed a punch for this purpose. EITNER also makes such strip excisions, but he leaves the vestibular skin, which he carefully elevates from the cartilage. He was the first to recognize that resection of the vestibular skin can lead to cicatricious pinching-in and retractions of the alar border. At the end of this phase of the operation he cuts away only over-

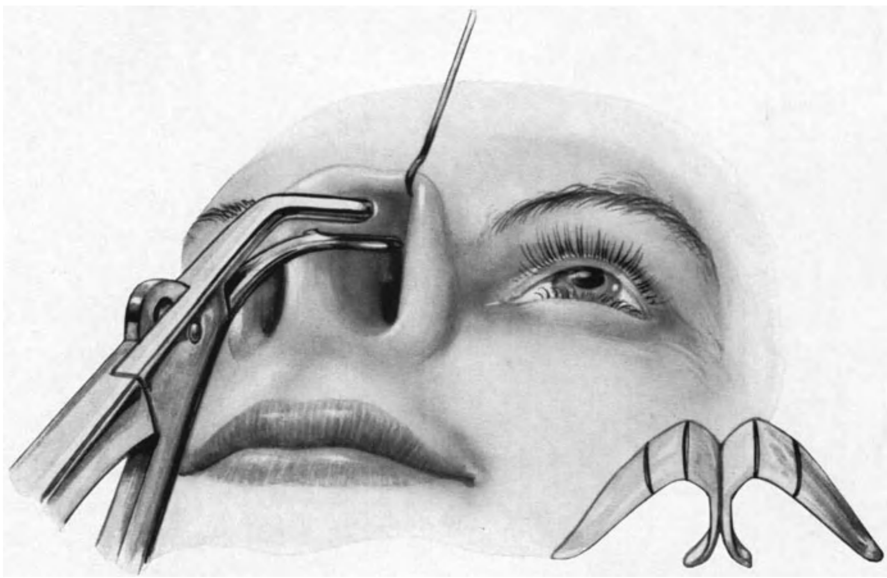
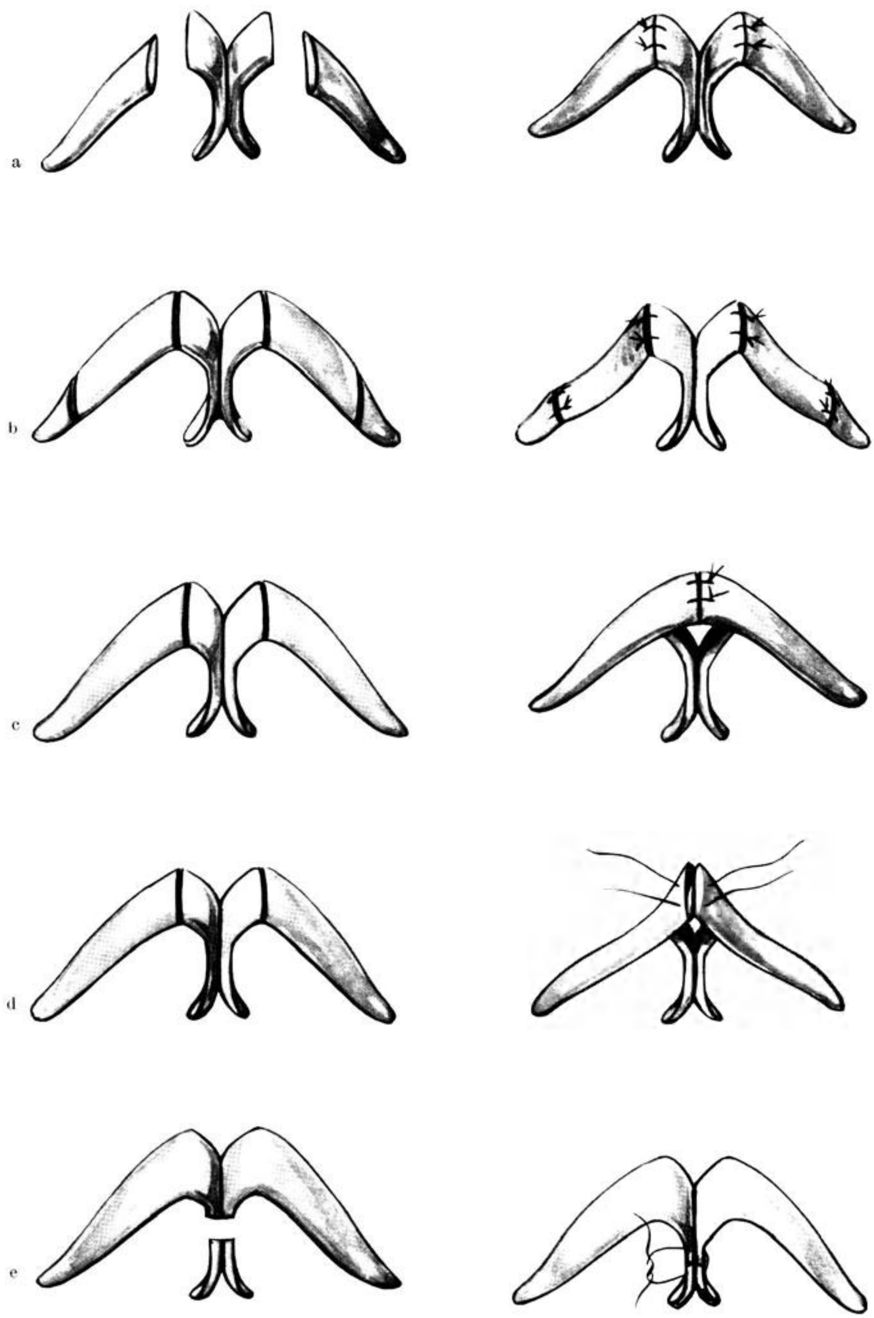


Fig. 110. Strip excision from lower lateral cartilage and vestibular skin using the punch of JOSEPH (obsolete)

lapping vestibular skin at the limen nasi. If possible, he sutures all edges of the resection with fine catgut (Fig. 111a). In pronounced lateral convexity of the ala, he cuts a wide, rectangular piece of cartilage from the middle part of the lateral crus. He turns this piece so that the external surface lies inward and sutures it in this position. This is supposed to give the ala a normal shape (Fig. 111b). In wide nasal tips he resects a strip of cartilage at the anterior arch of the lower lateral cartilage and sutures the resection edges of the lateral crura together in midline, edge to edge (Fig. 111c). If he wants to achieve an elevation of the tip as well, he sutures the stumps of the lateral crura with inner sides adjacent (Fig. 111d). We feel that the last technique should not be used with thin skin on the nasal tip, since the sharp edge of the cartilage can be noticed through the skin. — In very prominent nasal tips without widening, he does a resection on the medial crus, either in the anterior or in the middle part (Fig. 111d). All these methods of EITNER, in which the lower lateral cartilage is cut all the way through, have not been able to gain much attention.

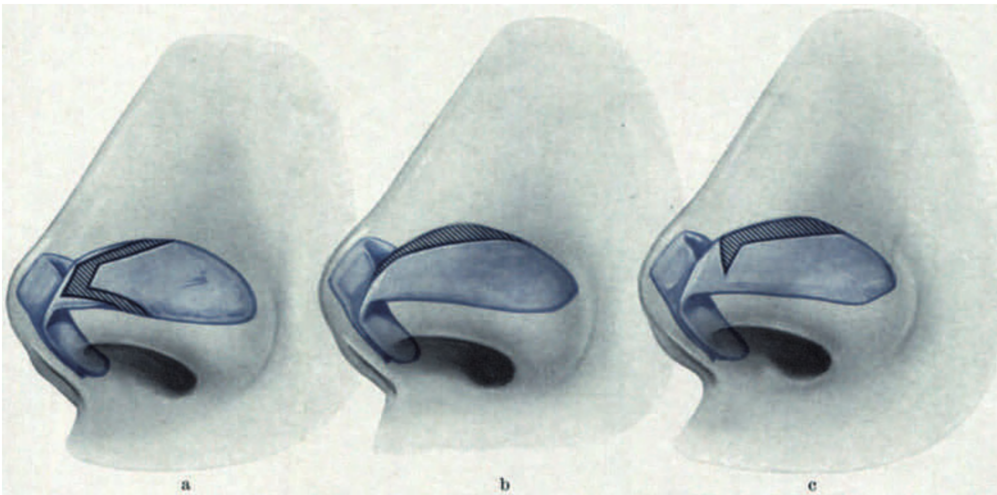
After the anterior vertical strip incision, SAFIAN reduces the flap (see p. 85) containing the lateral limb of cartilage by resecting the upper and lower borders (Fig. 112a). SELTZER resects a narrow strip in the arch of cartilage and on the upper border of the lateral crus. In many cases AUFRICHT leaves the lower border



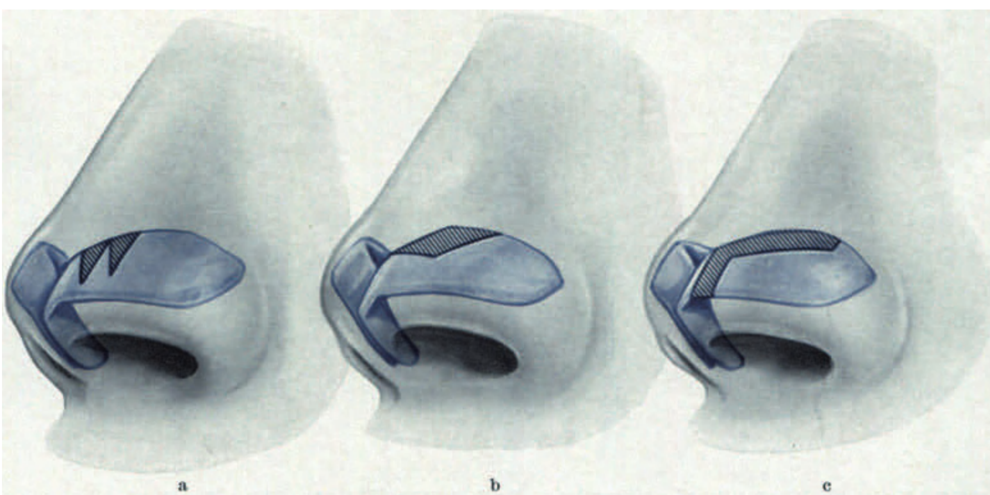
Figs. 111a—e. Excisions and suturing on the lower lateral cartilages according to EITNER

of the arch of cartilage intact and cuts away only the upper border. With this excision he cuts into the medial crus, from which he also excises a vertical strip (Fig. 112b). KAZANJIAN likewise resects the upper border of the cartilage and in many cases makes a wedge excision anteriorly in the arch of cartilage as well

(Fig. 112c). Many plastic surgeons (RODE and others) even make such wedge excisions only, without border resections (Fig. 113a). MALBEC makes a rhomboidal cartilage excision on the cephalic border of the lateral crus (Fig. 113b). The so-called "hockey stick" excision in the lower lateral cartilage, with the long part of the stick along the cephalic cartilage border (Fig. 113c), comes from

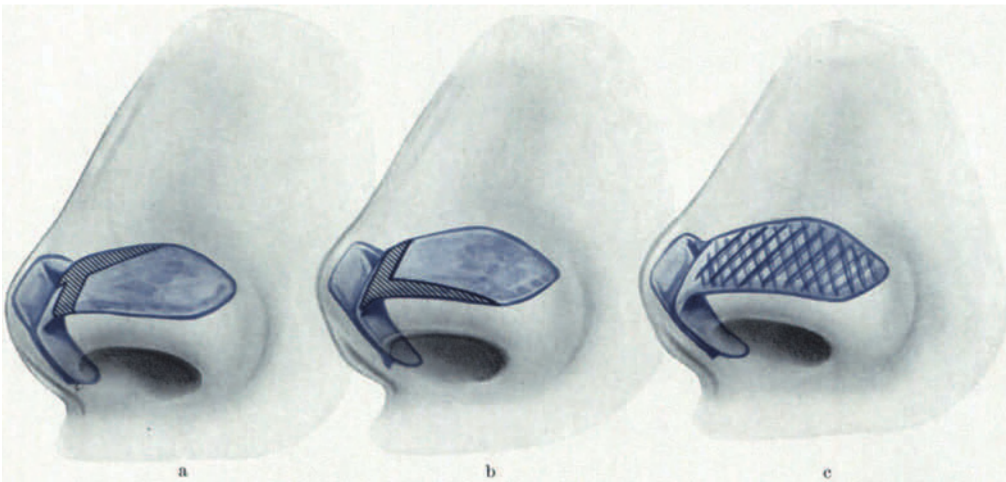


Figs. 112a—c. Excisions on lower lateral cartilage. a by SAFIAN; b by AUFRICHT; c by KAZANJIAN

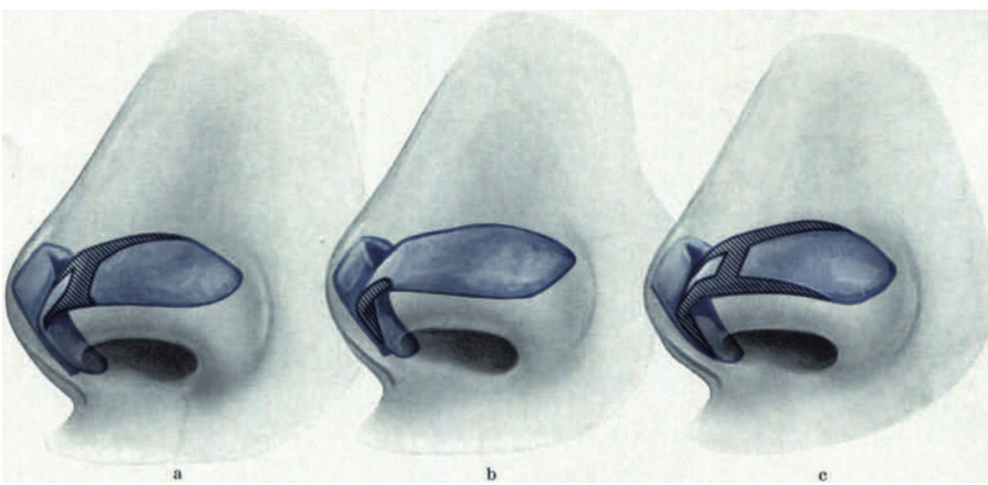


Figs. 113a—c. Excisions on lower lateral cartilage. a by RODE; b by MALBEC; c by BROWN and MCDOWELL

BROWN and MCDOWELL. The removal of cartilage by these techniques can be done using either the luxation method or the eversion method. O. BECKER (USA) makes approximately the same excision, but using two incisions (see p. 86). CONVERSE excises the cephalic cartilage border medially even beyond the strip excision which is perpendicular to it, that is, into the medial crus (Fig. 114a). GOLDMAN has described the L-shaped excision, in which the long arm of the L is formed by the caudal border of the lateral crus (Fig. 114b). The vertical division of the cartilage in the dome is done right at the beginning, so that the lateral crus can be luxated as with the Safian flap. This makes the L-shaped excision possible. The resulting lateral cartilage stump is sutured with a U-suture to the stump of the medial crus, so that one covers the other like a roof-tile. An excision is thus superfluous, and retraction at this point is impossible. This somewhat complicated procedure favors postoperative drooping of the nasal tip angle. It seems



Figs. 114 a—c. Excisions on lower lateral cartilage. a by Converse; b by Goldman and Fomon; c cross-hatching of the lower lateral cartilage by Goldman, Wolfe and others



Figs. 115 a—c. Excisions on lower lateral cartilage. a by O. Becker (USA); b by Seltzer (boxing tip); c by Brown and McDowell (break)

best to avoid all vertical incisions on the arch of cartilage, or else to place them in the medial portion of the arch, that is, in the anterior part of the medial crus. Beinfield recommends severing the lower lateral cartilage farther laterally. This makes contact possible between a sufficiently large medial part of the cartilage with the upper lateral cartilage (comparable to the "overlapping technique" of Fomon described on p. 77). This severing could favor lateral retractions. Fomon and his colleagues proceed in much the same manner as Goldman. Goldman, Wolfe and others have also indicated the method of cross-hatching the cartilage (Fig. 114c). This makes it possible to "iron out" or reshape the cartilage. The new conception which coincides with this, in which the nose is to be handled like clay and pressed into a plaster cast, was mentioned at the beginning of this chapter (see p. 77). In corrections of hypertrophies of the tip, SANVENERO-ROSSELLI makes the crossed incisions ("tagli incrociati") on the upper lateral cartilage as well (Fig. 133b). After severing the lower lateral cartilage at the arch, O. BECKER (USA) narrows both stumps by means of excision on the upper and lower borders (Fig. 115a). KROATH describes such an excision of the lateral border as his own technique.

To form the modern, attractive *profile with double angle* for women mentioned above (see p. 78), SELTZER recommends a resection of the caudal border of the medial crus in its anterior third ("boxing tip") (Fig. 115b). BROWN and McDOWELL do the same as a border resection ("break") in addition to their hockey-stick-shaped excision in the lower lateral cartilage. Only the luxation method is possible as an approach for this (Fig. 115c). — WALTER and several other authors are against resections on the caudal border of the cartilage. On the other hand, we sometimes consider them appropriate when the curvature of the alar border is to be modified somewhat.

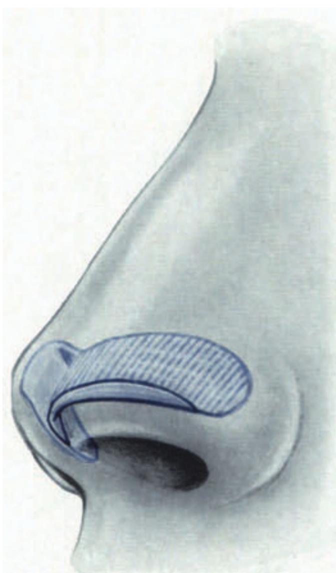


Fig. 116. Lower lateral cartilage resection accor ding to WEGENER (blue hatching)

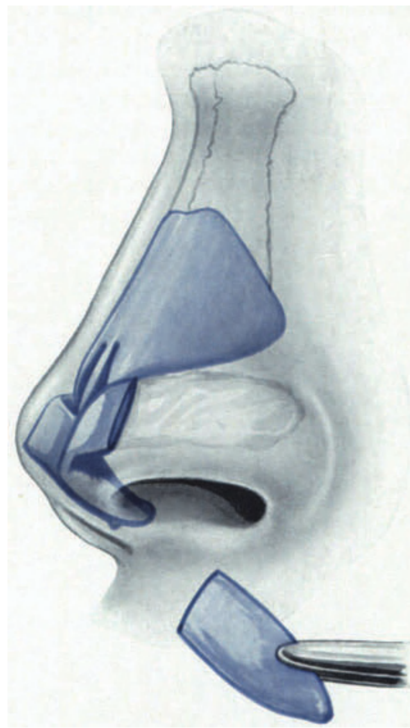


Fig. 117. Complete removal of the lateral crus, according to GALTIER

WEGENER removes almost all of the lateral crus and leaves only the lower border as a thin rib of cartilage (Fig. 116). PITANGUY severs such a narrow cartilage bridge quite medially. In extreme cases of bulbous nose, GALTIER resects the whole lateral crus (Fig. 117), a procedure which we strongly reject.

We consider such extensive excisions as the last ones mentioned to be too dangerous for routine procedure, so long as perfect modelling of the tip is possible with more conservative procedures. In almost every rhinoplasty we make a more or less extensive correction of the alae. Using the luxation method we excise the cephalic border of the lower lateral cartilage from the medial angle laterally almost to the lateral end, according to the width of the lateral crus to be corrected (Fig. 8). Actually one can not learn from any description in literature of the lower lateral cartilage at which of the two angles the transition from the medial crus to the lateral crus takes place. Apparently the middle section between the two angles, usually about 2 to 3 mm long, belongs neither to the medial crus nor the lateral crus, but rather to the arch itself. In our upper border resection, we leave the bridge of cartilage at the arch with a width of from 1 to 3 mm.

We pull out and luxate the lower lateral cartilage together with the vestibular skin as a bridge flap under the alar rim. Then we hold the flap in this position with a wide elevator (Fig. 118) in order to be able to free it without obstruction

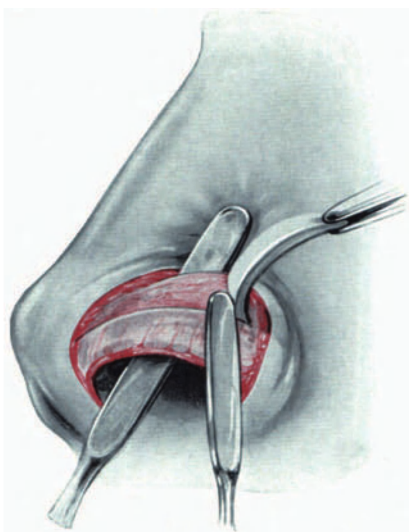
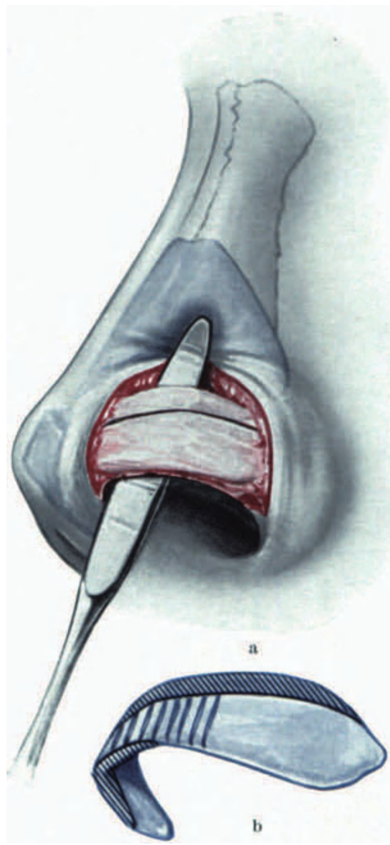
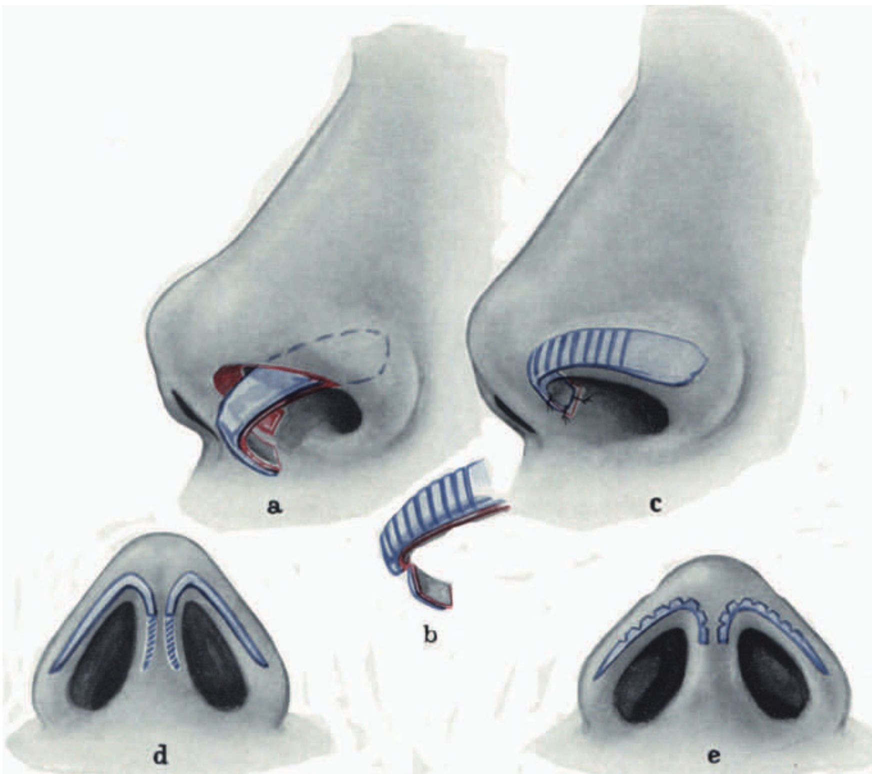


Fig. 118. Technique for removal of the cephalic border of the lower lateral cartilage by means of luxation method



Figs. 119a and b. Excisions on the lower lateral cartilage (blue hatching) and carving in region of the cartilage dome by R. Meyer. Luxation method

from the external perichondrium and from the subcutaneous connective tissue and then to reshape it. We consider the removal of surplus subcutaneous connective tissue important. The incision is made with the knife on the cleaned cartilage from the angle almost to the lateral end of the lateral crus. In doing so we make sure that the remaining arch of cartilage has the same width bilaterally. With a thin septum elevator is freed that part of cartilage above the incision. It sometimes consists of more than half of the width of cartilage. So that the strip of cartilage being resected does not tear during the elevation, one should grasp it with a wide anatomical foreceps rather than with a fine surgical foreceps (Fig. 118). Then using the knife we carve the remaining arch of cartilage with multiple cuts perpendicular to the border of the cartilage. These cuts are about 1 mm from each other, beginning on the medial crus about 1 or 2 mm inside the medial angle. In the part between the two angles the cuts are somewhat deeper, and in the lateral part more superficial. At the point where we want to place the lateral angle of the new dome in the corrected nasal tip we cut through the cartilage to the inner perichondrium during the carving. This produces emphasized curvature, especially at this point. In relatively wide noses, which do not necessarily require a vertical cartilage excision, is made this deep carving as far medially on the cartilage as possible, that is, about in the region of the medial angle. We do just the opposite in cases where we want to make



Figs. 120a—e. Modelling the lower lateral cartilage for rearward repositioning of the nasal tip by LIPSETT. a The narrowed lower lateral cartilage is severed medially and luxated out. b Resection of one part of the medial crus (the resected piece of cartilage is also illustrated). Carving of the cartilage dome. c Suturing the shortened medial crus. The stiffness of the cartilage is broken by scoring. d View from below: the cartilage to be removed is shown with blue hatching. e Situation after completion

the pointed nasal tip somewhat more blunt by accentuating the angle farther laterally (Fig. 119). In bulbous nose if one notices that the correction is not sufficient after carving, then one can still remove one, two, or more of the cartilage rectangles between the carving incisions. In doing this one should be most careful to protect the perichondrium on the inner side. Sometimes, especially with delicate cartilage or thin skin, it is advantageous to leave a thin uncarved strip of cartilage on the upper border of the cartilage bridge. This gives the arch the correct tension.

The procedure of the "chondroplastic flap" of LIPSETT is principally the same as ours. In his procedure the bridge flap consisting of the cartilage bridge and the vestibular skin adhering to it is severed medially, half way up the medial crus and is changed to a laterally pedicled flap. This flap is similar to that of

SAFIAN, only narrower and extending farther medially. The cephalic border of the lateral crus can be resected here as well. When only the tip is to be shortened, cartilage is not excised from the dome of the vestibule, i.e. in the arch of cartilage. Instead the most medial part of the chondroplastic flap is simply cut away. We resect the small cartilage rectangles at the transition to the medial crus without removing the vestibular skin. If the arch is too blunt, its stiffness can be eliminated, and it can be reshaped by carving. After the flap has been cut appropriately it is replaced in the vestibule and sutured (Fig. 120).

BEINFIELD as well is of the opinion that cartilage resection should never take place in the dome of the lower lateral cartilages, because there is too much postoperative drooping otherwise. To compensate for such a retrusion, he cuts a small "arm-flap" from the medial crus which is supposed to support the upper lateral cartilage.

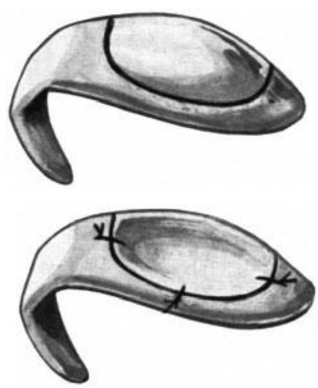


Fig. 121. Strongly convex cephalic part of the lateral crus of the lower lateral cartilage is excised, turned, and sutured in with the convex side inward

Fig. 122. Cartilage grafts in the columella (batten) and in the tip

If too much cartilage is removed at the dome, not only lateral pinching-in but also a crow's nose ("nez en bec-de-corbin" of LEVIGNAC) can occur. This happens because the columella is too short in relation to the length of the septal cartilage and because both anterior angles of the nostrils are pulled rearward and stretched. The correction of such a mistake can be made later with a cartilage graft.

In women we usually also perform the medial cephalic cartilage resection of SELTZER or BROWN and MCDOWELL (Fig. 119b). In a nasal tip with thin skin, if a convexity of the lower lateral cartilage is present in the upper part of the lateral crus, we cut a rectangular or oval piece in the middle part of the lateral crus up to the upper border, leaving a bridge of cartilage intact. We turn the excised piece of cartilage around so that the outer surface lies inward, similar to the technique of EITNER. The piece is fixed in its new position with two to three fine catgut sutures (Fig. 121).

Like MCINDOE we are generally careful to make no excisions on the caudal border of the cartilage which are perpendicular to it, but only to make border excisions which run parallel to the border. Only in rare cases of wide nose do we excise a strip of cartilage perpendicular to the border, as explained above, but then quite medially in the medial angle of the dome. We are of the opinion that a certain weakness occurs in the architecture of the nasal tip with a strip excision. In such a case we consider additional support of the tip necessary, in the form of a cartilage strip graft anteriorly in the columella. This can be done very easily through the vestibular rim incision which is extended to the columella. From this incision we prepare the bed for the graft with a blunt scissors. As a support graft one can use the resected border of one lower lateral cartilage, or the border of both, or best of all, a piece from the septal cartilage (Fig. 122). EITNER grafts cartilage from the ear in the columella. FOMON, GOLDMAN and their colleagues likewise graft a strip of cartilage as an autograft or a homograft, even in cases in which they do not make any resection on the lower lateral cartilage. They call the cartilage graft a "batten", which they usually take from their cartilage bank.

The implantation of this *batten in the columella* and of small, round pieces of cartilage under the skin of the nasal tip is all that we have adopted from the method of GOLDMAN and FOMON. Otherwise we do not consider this method very practical. KLICPERA has likewise taken our view that the stability of the nasal tip is disturbed after certain strip excisions.

The method of carving the arch of the lower lateral cartilage has found its opponents here and there. In principle it belongs to the methods of the American

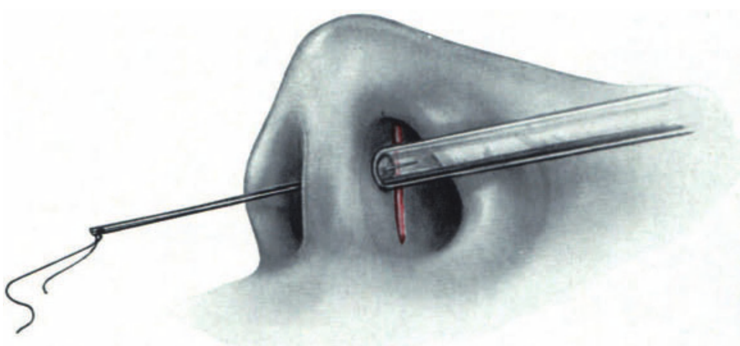


Fig. 123. Passing the mattress suture through the membranous septum. The tip of the needle is protected by means of the end of a suction tube

plastic surgeons mentioned above. In that method the nasal tip is supposed to be pressed like clay into a desired shape, owing to the multiple incisions, and is supposed to be held in this shape by the dressing. FOMON calls this method "rhinologic" as opposed to the "orthopedic" method of JOSEPH. SAFIAN is against the term "orthopedic method". Although he has modified the procedure of JOSEPH with his flap, he retains the cartilage excisions of his teacher (see p. 85). He rejects shaping the nasal tip by means of carving and cross-hatching. As mentioned above, we have used carving of cartilage in combination with sparing excisions for more than 10 years and in doing so have never had bad experiences.

If an *assymetry of the ala* occurs, a strip excision can be made additionally on the caudal border of a lower lateral cartilage, or a strip of cartilage from the upper lateral cartilage can be added. The alar rims must always be placed somewhat higher than the columella.

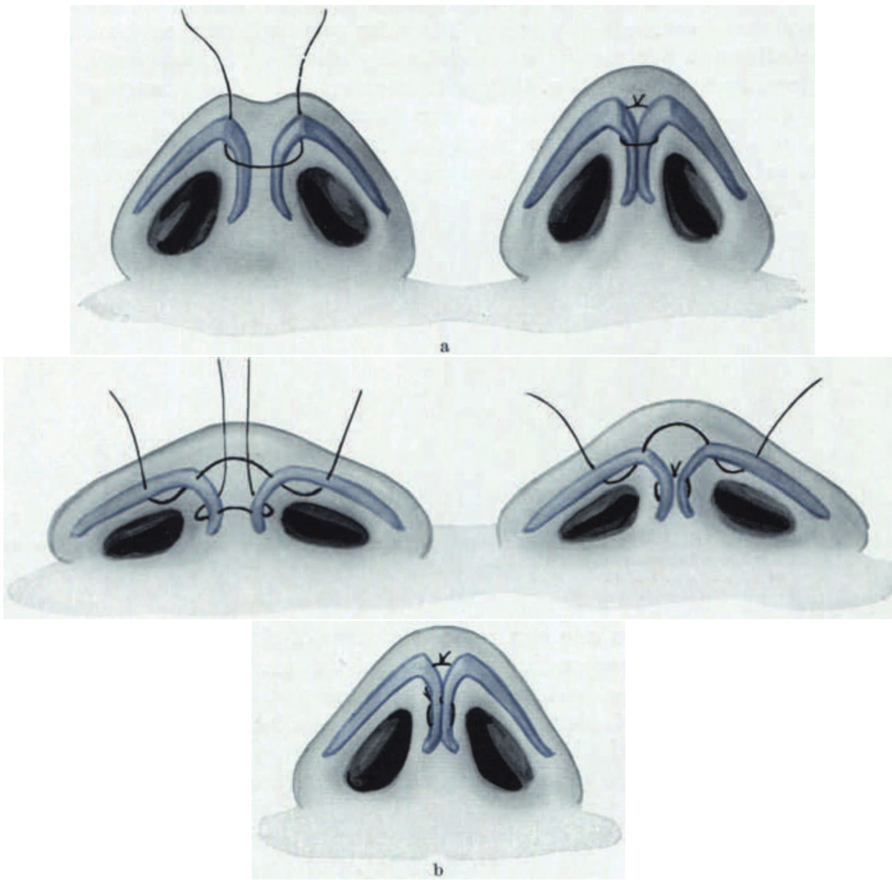
If we want to achieve a slight narrowing of the nasal tip, then we remove the loose cushion of *connective tissue between the medial crura* of the cartilage, especially in the anterior part. The vestibular rim incision which we have extended to the columella provides the approach for this. We pull both medial crura into one nostril. If necessary we suture them together with fine chromic catgut in their most anterior part. Then we apply a mattress suture by running the suture material twice through each cartilage and tying it on one side just behind the medial angle, or, if we have severed the cartilage or made a strip excision, just behind the cut.

Since we must keep trauma of the cartilage at a minimum, we make the suture with fine chromic catgut and an atraumatic needle. The *mattress suture* can also include the vestibular skin bilaterally. Then one ties the suture in the nasal vestibule. If the suture is tied above the skin, 2/0 or 3/0 nylon is used. A straight needle of KEAT is inserted into one side of the columella. The tip of a suction tube is pressed against the other side at the same point. After the clearly noticeable penetration of the medial crura, the point of the needle emerges precisely at the point located symmetrically on the vestibular mucosa of the other nostril. It is important to keep the needle absolutely horizontal so that no distortion of the columella occurs (Fig. 123). The needle is inserted twice, and both times the medial crus should be penetrated. Some surgeons make this suture working from a vertical median columella incision after JOSEPH and EITNER. One can have a still better view during this tip narrowing using a suture to join the medial crura if one uses the RÉTHI *incision* (1931). The columellar skin is severed in the anterior third and is swung upward like a flap (Fig. 124). Bending around at right angles bilaterally, the incision joins the vestibular rim incision. In recent years in America MAY has particularly advocated the advantages of this incision. The RÉTHI incision comes from an older one of GILLIES from 1920 ("elephant trunk" incision). In the latter, the columella flap, which is to be pulled up over the tip, starts at the base of the columella. Because many surgeons had bad experience with that incision and because of the supposed danger of flap necrosis, this method was abandoned and forgotten. In 1956 HAUBERRISSER published a modification of the RÉTHI technique. In this modification he extends the vestibular rim incision farther laterally to the alarfacial junction, curves it in the crease at the alarfacial junction and continues it in the external skin all the way around the alarfacial junction. By doing this he can fold back the skin of the nasal tip still farther. As explained in the chapter on saddle nose, these incisions have had further modification by ŠERCER, COOGHLIN, and REHRMANN (see p. 180).

Fig. 124. After severing the lateral crura a few millimeters from the cartilage domes, the medial part of the lateral crura are drawn medially and joined by means of suturing. In this method of STRAITH for raising the nasal tip one can use the incision of RÉTHI as illustrated here

The incision of RÉTHI is especially suitable for cases in which one wants to achieve a more pronounced raising of the nasal tip by folding back the domes of both lower lateral cartilages and suturing them together. To do this one can use the method of STRAITH. The cartilage is severed perpendicularly to the border in the region of the lateral crus, a few millimeters from the dome and is then dissected out as far as the medial crus (Fig. 124). DE KLEINE as well advocates the median columella incision or mediocolumellar incision for such tip corrections. In general we do not consider this opening of the nasal tip necessary in tip corrections, since the luxation or eversion methods suffice. On the other hand it can be advised for the correction of harelip nose and other malformations as well as for correction of saddle nose and of deflected nose due to scarring (see respective chapters).

In order to bring the medial crura and the domes together, Berson has described a suture which goes around the anterior borders of the cartilage and is knotted in midline between the two domes (Fig. 125a). — In *wide, flat nasal tips* which have a slight depression in the skin between the domes of the lower lateral cartilages which may be considered sign of dog-nose, Joseph suggested a double approximating suture. This grasps the cartilages farther laterally and thus effects an elevation of the tip (Fig. 125b).



Figs. 125a and b. Suturing the lower lateral cartilages. a Approximation suture of Berson; b approximation suture of Joseph for narrowing the nasal tip

In the *bulbous tip* with a fold-like dent in midline just above the narrowed dome of the lower lateral cartilage, i.e. in the "weak triangle" of Converse (Fig. 1), one introduces a graft made of septal cartilage, if possible.

If the columella has not yet attained the proper stiffness in tip elevation by means of approximation sutures, then grafts of cartilage strips are needed. They are introduced best from the vestibular rim incision (see p. 95). One must make sure that the strip of cartilage lies flat against both medial crura, that is between them and the columellar skin. Sometimes a good cosmetic effect can be achieved by padding the skin of the nasal tip with a small triangular or even oval piece of cartilage. This small graft, which according to Straatsma can also be of derma, acts like a dot on the "i" in relation to the batten in the columella (Fig. 122).

Sometimes a stronger support of the nasal tip is desired, even in cases without saddle nose. Then it is better to take a somewhat thicker strip from the septum and wedge it between the medial crura, working from the transfixion incision. The two crura are carefully spread apart from behind with a small scissors, and the bed for the graft extended as far as the maxillary spine. According to EITNER a cartilage graft between the medial crura also aids *widening of the columella.* To give the graft the necessary support and to prevent its slipping during further manipulations, one fixes it in position with a mattress suture as DALEY does. First the piece of cartilage is pierced. Then the two ends of the suture material are passed through the medial crus bilaterally using a straight needle and are tied either subcutaneously (Fig. 126) or in the vestibule after emerging from the skin. For columellar sutures or septocolumellar sutures we use 2/0 or 3/0 nylon here too, while most Americans use 2/0 or 3/0 black silk, as DALEY does, or stainless steel wire, as FRED does. Steel wire and nylon can be left in place longer.

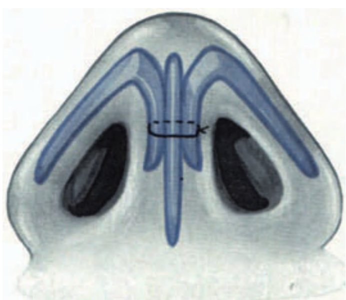


Fig. 126. Cartilage graft in the columella fixed to the medial crura of the lower lateral cartilages according to EITNER and DALEY

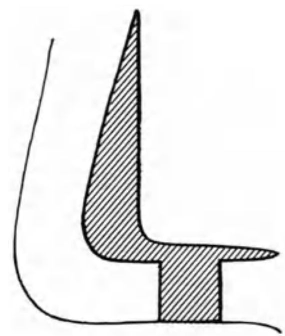


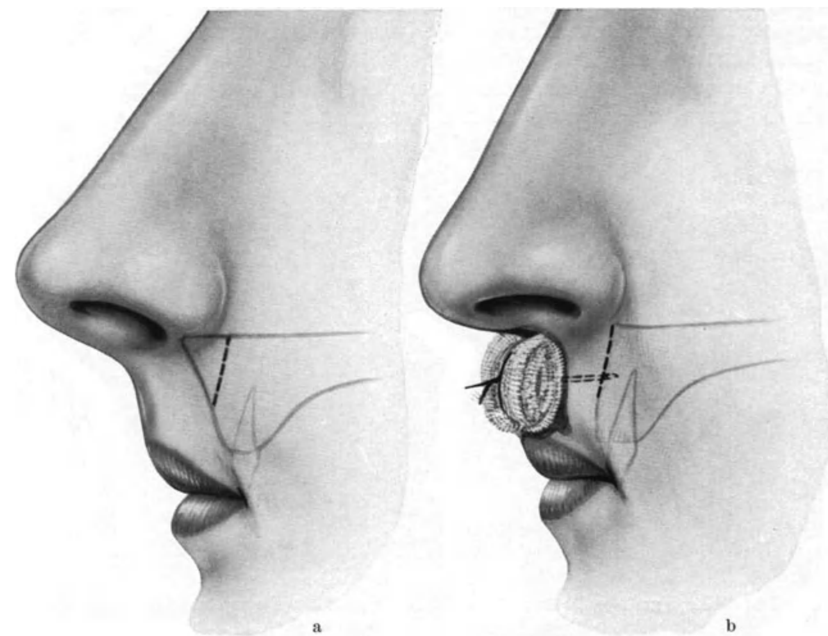
Fig. 127. Excision from the columella and from the septal cartilage in overly long columella

In *very long columella* one can remove a strip of skin across the columella, either including the corresponding segments of the medial crura in the middle part, or without cartilage in the base of the columella. With this one is able to reduce the height of the nasal tip (Fig. 127). We make this excision inward as far as the transfixion incision (see also p. 110). We feel that a corresponding wedge resection below the transfixion incision, in the cartilaginous septum as indicated by EITNER, is not appropriate. It is better if the necessary cartilage resection has been made or is made on the anterior border of the septum which has been exposed by the transfixion (Fig. 93a). Our shortening of the columella corresponds approximately to the procedure of JOSEPH for reducing the height of the prominent nasal tip. He did not combine this with a transfixion, however. Fine skin sutures of 5/0 or 6/0 Dermalon are used to approximate the resection stumps anteriorly and laterally. We do not use a mattress suture here.

4. Correction of nasolabial angle and fixation of remodelled tip

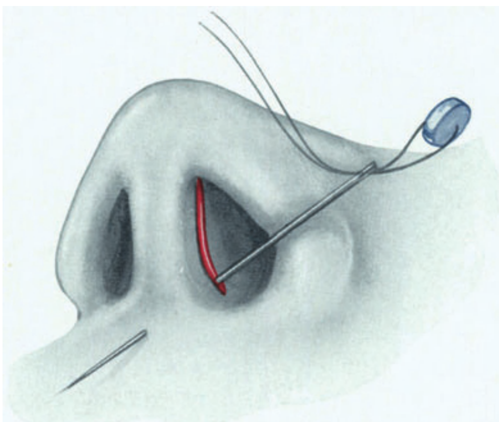
Before one closes the transfixion incision, one checks whether the nasolabial angle will be in the right place or whether it will be forced too far forward by an overly *prominent maxillary spine.* If a removal of bone is necessary and this has not yet been done or has not been done extensively enough, it can now be performed in the way described on pp. 79 and 114. Fixation in the position in which the nasolabial angle should heal is done by passing a mattress suture through the periosteum and tying it around a roll of gauze externally on the upper lip (Fig. 128). The procedure is just the opposite if the *nasolabial angle lies too far posteriorly* and is too small. One can use free cartilage grafts as DALEY does since the correction of CINELLI (see p. 80) can no longer be performed. The cartilage graft is introduced through the transfixion incision with a perforating suture and is brought in front of the maxillary spine. The suture is tied externally at the upper end of the philtrum (Figs. 129a and b).

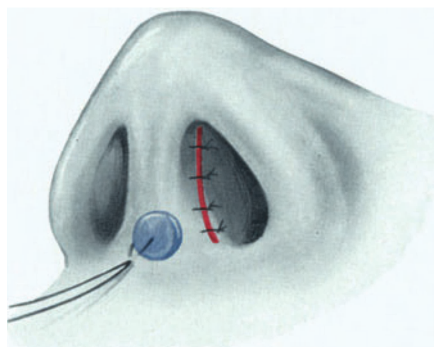
One now closes the transfixion incision using the so-called *septocolumellar suture.* This suture is passed straight through the columella and straight through



Figs. 128a and b. Correction of the nasolabial angle by means of resection of the maxillary spine (see also Fig. 94). a The dotted line indicates the bone to be resected. b Fixation of the rearwardly placed upper lip by means of mattress suture attached to the periosteum

the septum and is knotted at the side. Pressing against the opposite side with a suction tube is very helpful, since it keeps the straight needle of KEAT from piercing the lateral nasal wall (Fig. 123). It is unimportant whether one first passes the needle through the columella or the septum. It is more a matter of the direction in which the sutures are applied. Usually we want to displace the *tip and columella slightly rearward*, either in a complete reduction of the nose or only in a reduction of the nasal tip. To do this we pass the needle through the septum farther posteriorly than we do through the columella. We do just the opposite if we want to effect a slight prominence of the nasal tip. We suture the columella to the septum using sutures which run diagonally from below and posteriorly in an upward and forward direction. This corresponds to the original orthopedic suture of JOSEPH (Fig. 130a). If no displacement of the tip is planned one passes the septocolumellar suture perpendicularly to the transfixion incision through points opposite each other on the borders. In general two such septocolumellar sutures are sufficient. A third one can be tied below if the base of the columella must be narrowed at the same time or if the nasolabial angle must be maneuvered slightly rearward. Then we pass the suture at two points exactly opposite each other, on one side through the septal cartilage far back above the intact or resected maxillary spine, and on the other through the columella at its base (Fig. 130a). Too wide a columellar base necessitates the removal of subcutaneous tissue from behind, working from the transfixion incision (Fig. 130b). If the tips of the medial crura are luxated, they can be resected before applying mattress sutures. If the medial crura have too much curvature, their spring is broken by scoring and sutured only afterward. This too is done from the transfixion incision. OMBRÉDANNE replaces these cartilage stumps with a strip of septal cartilage, or he reimplants them reversed. — The *inverted suture* after AUFRICHT, also advocated by DALEY, has a similar but stronger effect than the basal septocolumellar suture. Instead of being passed transversely, the suture is introduced through the base of the columella in a triangle to emerge at the middle of the columellar base where the philtrum stops. It is then introduced through the same puncture point in the skin and passed into the other nostril





a b

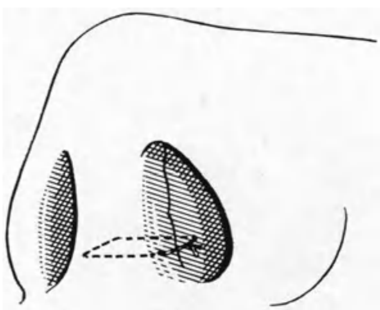
Figs. 129a and b. Cartilage graft by DALEY. a Insertion of the graft into the nasolabial angle through the transfixion incision; b cartilage in place

and is tied there (Fig. 131). Using this suture one can correct an obtuse nasolabial angle to the normal 90^0. JOSEPH used a suture passed around the base of the columella with similar effect. — We choose nylon instead of steel wire or silk for all these sutures on the columella, which is very susceptible to suture infections.

FRED rejects the tight septocolumellar mattress sutures, because the fibers of the M. depressor septi are pulled upward and extended by them, and because this muscle later contracts and displaces the base of the columella downward again. He loosely sutures the transfixion incision laterally after sufficient cartilage resection on the lower border of the septum. He gives two causes for the well-known *postoperative drooping of the nasal tip and columella:* the linear contraction of the scar along the septocolumellar suture, and the downward pull by the Depressor septi nasi, which belongs to the M. orbicularis oris. He overcomes the first cause with his "*invagination technique*", published in 1950, which RÉTHI described in 1934. In this technique the border of the septal cartilage exposed by the transfixion incision is freed of mucosa to 3 mm from the border. The border is then guided into the specially prepared groove on the rear surface of the columella and is sutured in place. In this technique less cartilage border is resected than in the usual techniques. RÉTHI calls this pulling of the septocolumellar skin over the lower border of the septal cartilage the "embracing flap".

We use the invagination technique only in cases in which a correction in the anterior part of the septum is also necessary, when we do not want to sacrifice the lower septal border at all, or else only very slightly. Otherwise this technique seems to be superfluous and could sometimes cause a high position of the columella, a so-called hidden columella (see p. 114).

To eliminate the second cause FRED indicates another original method, the so-called *"lip-freeing" technique.* From the transfixion incision he severs the



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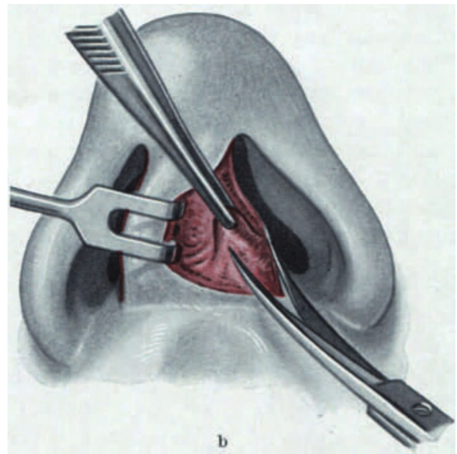


b

Figs. 130 a and b. a Septocolumellar suture as mattress suture. b In overly wide columellar base, subcutaneous connective tissue is removed from behind through the transfixion incision. (From H. J. DENECKE)

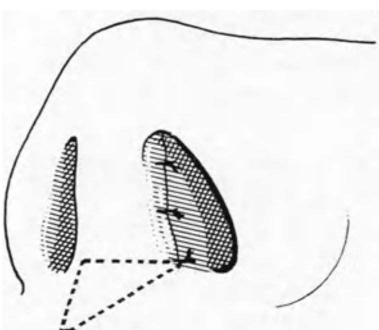


Fig. 131. Inverted suture of AUFRICHT-DALEY

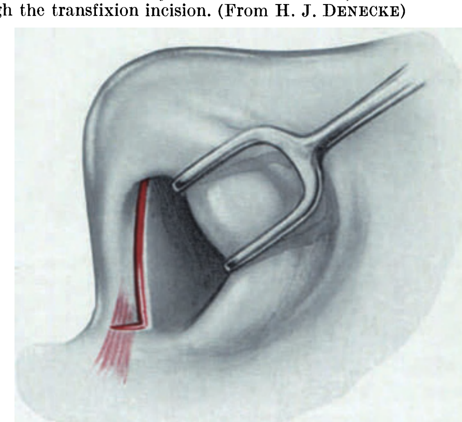
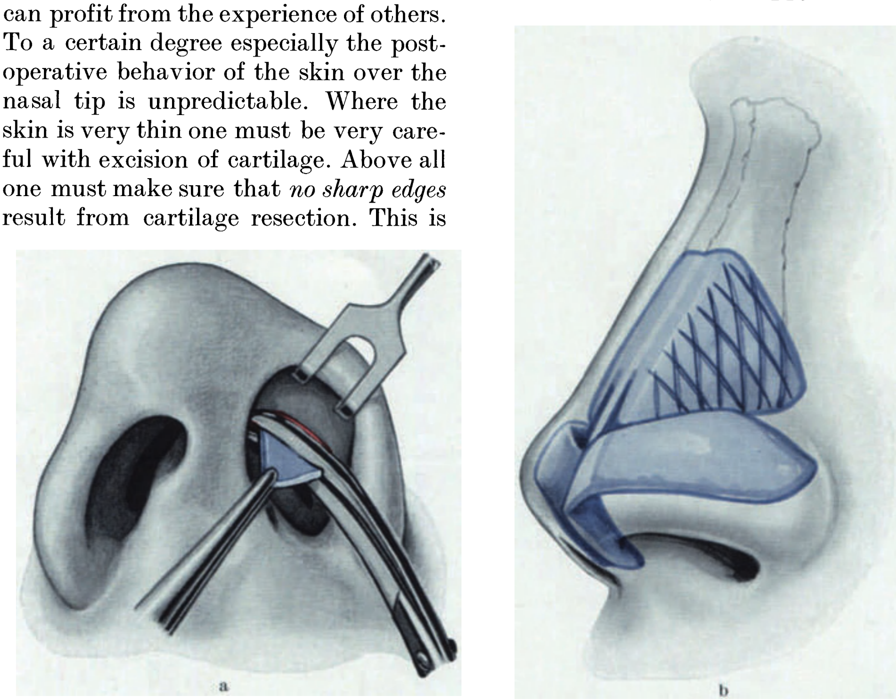


Fig. 132. Severing the M. depressor septi in the so-called lip-freeing incision of FRED

M. depressor septi nasi by working forward with delicate scissors-cuts until just under the skin of the columellar base (Fig. 132). He fills the cut by interposition of a small cartilage graft. This prevents the rejoining of the fibers of the Depressor septi nasi, which the French call "faisseaux médians du muscle myrtiforme" (LEVIGNAC).

The last step is the resection of the *caudal border of the upper lateral cartilage,* with or without the mucosa. This is done from the intercartilaginous incision. The resection keeps the upper lateral cartilage from overlapping the lower lateral cartilage (Fig. 133 a). In some cases one also breaks the spring of the upper lateral cartilage by crosshatching (Fig. 133 b). — The vestibular rim incision is generally not sutured. Only occasionally is 6/0 nylon suture used, if the replaced bridge flap of the luxation technique threatens to slip downward. Under no circumstances should a gap occur in the inner vestibular lining. Otherwise such a gap would have to be covered with a small flap from the vestibule, possibly at the expense of a good adaption of the incision borders at the limen nasi.

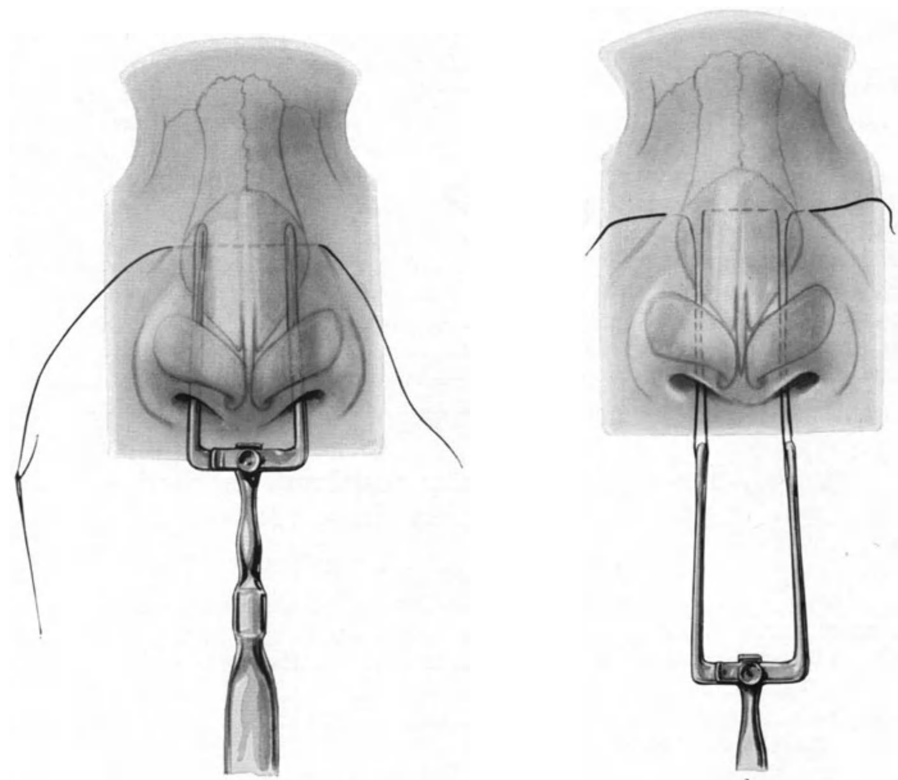
From these remarks one can see that tip corrections are very complicated and tricky and that artistic virtuosity is most likely to lead to gratifying results. Again and again one encounters difficulties and one is always happy when he can profit from the experience of others. To a certain degree especially the post-operative behavior of the skin over the nasal tip is unpredictable. Where the skin is very thin one must be very careful with excision of cartilage. Above all one must make sure that *no sharp edges* result from cartilage resection. This is not always visible but must be palpated with a finger after replacing the luxated bridge flap containing the lower lateral cartilage. Such inadequacies otherwise only appear in the course of postoperative reduction of swelling. It is often necessary to pull out the corrected lower lateral cartilage again after replacement and to reshape it. If sharp edges on the arch are disturbing, the cartilage bridge with the scoring must be narrowed even more. — Thick skin is likewise undesirable, because it does not adapt as easily to the newly shaped cartilaginous skeleton. A dressing with narrow strips of adhesive tape and with plaster or a splint is important here. — Sometimes it may be that the septo-columellar sutures must be opened and retied if the tip and columella are not as desired.



Figs. 133a and b. a Shortening the nose according to JOSEPH. From an incision at the caudal border of the upper lateral cartilage, a large wedge-shaped piece is excised. (From H. J. DENECKE.) b Crosshatching on the upper lateral cartilage

Sometimes a special fixation of the *upper lateral cartilage* in the narrowed position is necessary. The procedure of FOMON is good for this. The narrowed cartilaginous structure is pulled downward as well, by tying the ends of the through and through suture, which are in the nasal lumen, to the solid base of the columella (Fig. 134). In order to avoid the danger of a pressure necrosis, which is possible at the columella in spite of cushioning, we recommend passing the suture through the solid, cartilaginous septum just above the maxillary spine.

A question which is still debated is the order of the various phases of a rhinoplasty. As can be seen from our description, we favor working on the bony part first and then the nasal tip in a total reduction of the nose, as McIndoe and most of the English surgeons do. But many surgeons (Fomon, Straatsma, Sommer and others) are of the opposite opinion. If a septal correction is to be



a b

Figs. 134a and b. Fixation of the narrowed dome in the region of the upper lateral cartilage using a through-and-through suture. The suture is applied by means of a director (Fomon). a Needle and suture material are passed through the openings in the instrument which is inserted into the nasal cavities. b Suture material is drawn out of the nose by means of the director. The ends of the suture material are tied respectively over the nasal dorsum and in front of the columella over a pad. This pulls the cartilaginous nasal structure downward and forward

combined with tip surgery, we do the work on the septum first. But if the tip correction is to be combined with a dorsal graft and no extensive narrowing of the bony pyramid is necessary, then we work on the tip first.

V. Total reduction of the nose

The total reduction of the nose is the combination of the various single operations discussed above. As already mentioned, the question arises in which order the individual manipulations are to be performed. We consider it advantageous to begin with the reduction of the bony part and to adjust the cartilaginous part afterward in the same session.

The operation is begun with the intercartilaginous incision bilaterally (p. 40), décollement along the dorsum (p. 41) and the transfixion (p. 42). After subsequent hump removal (p. 43), lateral and transverse osteotomy (pp. 50 and 59) as well as median displacement of the bony plates (p. 63) we go over to the reduction and assimilation of the cartilaginous part of the nose. After adjustment of the anterior border of the septum with an appropriate border resection (p. 62), the lower border of the septum is equalized with respect to the tip angle and naso-labial angle, whereby border excisions of varying degree are possible (p. 77). Since the eversion method for exposure of the lower lateral cartilage in the alar correction which follows does not permit such a good view, we recommend the luxation method for work on the lower lateral cartilages in a total reduction (p. 81). The variety of incisions and excisions possible on the lower lateral cartilage is great (p. 87), but the technique of Lipsett (p. 93) is especially suitable since corrections are usually necessary on both crura. A resection on the caudal border of the upper lateral cartilage now follows (p. 102), the extent of which is directed by the reduction achieved by the other maneuvers. Then there can be adjustment of the anterior and lower borders of the septum by additional resections (p. 77), and of the columella by respective excisions (p. 109). Finally the nasal tip can be moved forward or backward by means of the appropriate suture of the transfixion incision (p. 98). — Only in extremely rare cases are excisions necessary at the base of the ala and of the columella. — Whereas the nasal packing remains in place for only 2 days, we leave the fixation dressing for 1 to 2 weeks.

VI. Surgery in particular positional anomalies and disturbances in shape of alae

1. Correction of alar collapse

Alar collapse is more a functional disturbance than a cosmetic one. The cause of alar collapse during inhalation is a particular slackness of the soft parts of the ala, particularly of the lower lateral cartilage. The cause can also lie in the upper lateral cartilages, perhaps because they are too slack or because they lie firmly in a narrow angle to the septal cartilage. The anomaly can be congenital, post-traumatic or neuromuscular.

Formerly there were special self-holding dilatators made of wire after Traube (1900), Feldbausch, Jankau and Ott, of rubber after Gomoiu, and of celluloid after Schmidthuisen. These had to be worn in the nostrils, usually at night.

These uncomfortable aids are obsolete today. The goal of an effective treatment is to stiffen the ala. This prevents the collapse during heavy inhalation. All sorts of homo- and heterografts have been used. Dundas-Grand and Menzel have injected paraffin into the ala. Baarsma and Halle have implanted metal strips. Sedermans has tried it with silver wire. Bakelites, like acrylic plates (Aubry) and paladone (Frühwald) were used unsuccessfully as implants and are to be rejected like paraffin. Autografting of cartilage has become popular. Eitner and Fomon use septal cartilage for this. Fomon, Barsky, Marino and Sherman graft pieces of rib cartilage carved in the shape of the lower lateral cartilages. Barsky and Eitner also use cartilage from the auricle. The rib cartilage plates used by Barsky for stiffening the lateral crura of the lower lateral cartilages still have the perichondrium on the inner surface. These grafts are inserted through a vestibular rim incision inside the nostril after Frühwald or through a curved incision in the lateral alarfacial junction after Schattner and Fomon (Fig. 306). A further method is suggested by Fomon: *surgical fixation* *of the upper lateral cartilages* in a new, wider position in cases in which the angle between these cartilages and the septum is too acute. The upper lateral cartilages are approached through the intercartilaginous incision. After décollement (see p. 41) of the dorsum and transfixion incision, the upper lateral cartilages are severed at their junction with the septum and reattached with catgut mattress sutures. In this manipulation their medial border is rolled inward (Fig. 135). In some cases of alar collapse the anatomical conditions are such that the cephalic border of the lateral crus of the lower lateral cartilage lies beneath the caudal border of the upper lateral cartilage like a roof tile, instead of above it. In such cases FOMON makes an improvement by luxating the *upper lateral cartilages beneath the cephalic border of the lower lateral cartilages* and suturing them thus in place (Fig. 136). In most cases he additionally narrows the base of the columella by excision of connective tissue, working from the transfixion incision, and by mattress sutures (p. 98). This enlarges the lumen. When the alar collapse is caused more by a thickening of the ala, then the ala can be severed at the alarfacial junction and from this incision the *superfluous cushion of fat can be*

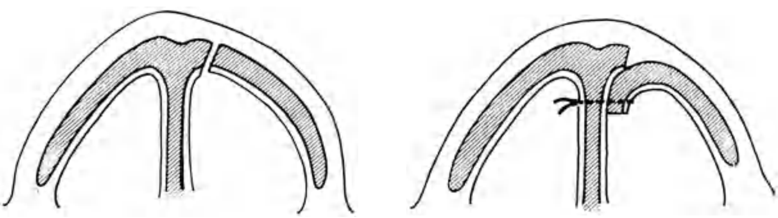


Fig. 135. Correction of alar collapse by FOMON by means of severing the upper lateral cartilage from the septum, rotation of its medial part and fixation in the new, more curved position

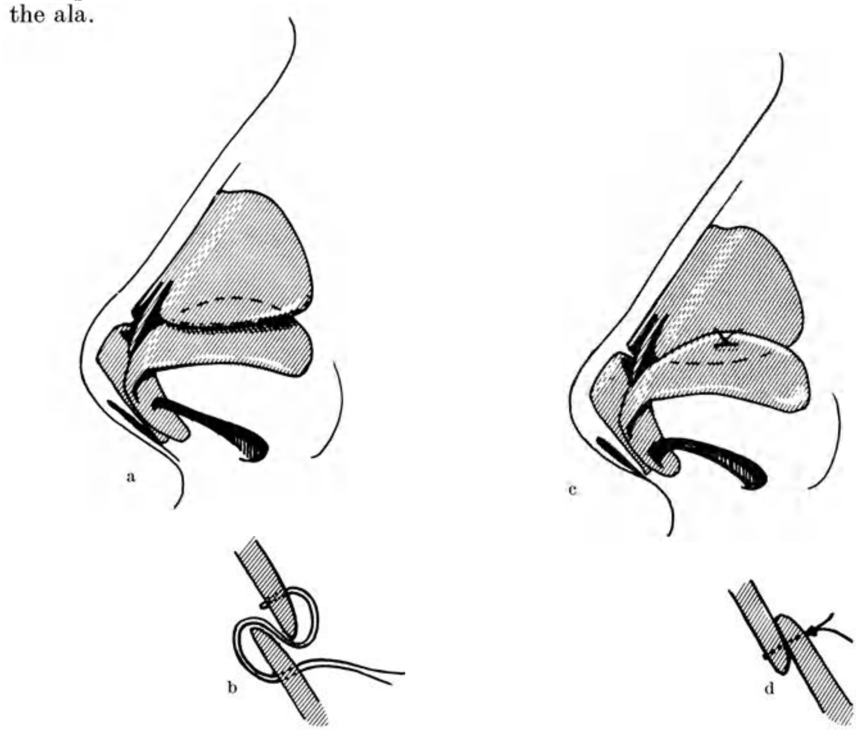
removed. This technique as well comes from FOMON. A *sickle-shaped incision* can likewise be made in the crease at the alarfacial junction. In some cases this improves the spatial relationships by rotating the slack alae outward a little (Fig. 137). SHEEHAN combines lateral sickle- or moon-shaped skin excisions at the alarfacial junction with excision and reimplantation of cartilage laterally in the nasal vestibule. He cuts out a rhomboid piece of cartilage vertically to the alar rim and reimplants it parallel to the alar rim. SANVENERO-ROSSELLI makes the same cartilage excision, but without reimplantation. RÉTHI diagonally excises a piece of cartilage together with the vestibular skin and sutures the defect. The inner lining of the ala is thereby stretched, and the ala gains adequate stiffness. FOMON wants to achieve a similar stiffening of the ala by exposing the inner surface of the lateral crus and crosshatching it, working from a vestibular rim incision. Then he passes a triangular, perforating approximation suture at the ala to create the convexity.

Alar collapse can also be caused by poorly performed rhinoplasties, for example if too much has been resected from the upper or lower lateral cartilage or from the vestibular skin. It is then usually necessary to replace *the inner lining of the vestibule using* THIERSCH *grafts*. Any cicatricious skin must be removed beforehand. As has been described above, cartilage grafts may also be necessary in some cases.

In less severe cases of alar collapse we recommend the excision of strongly concave *lower lateral cartilage and its replacement after being reversed 180°* creating a convex ala (Fig. 121).

HAGE reinforces the collapsed alar skin with pieces of cartilage from the auricle. He calls these "butterfly cartilage grafts". The grafts are sutured together in such a way that the suture is placed in the nasal tip. The implantation of these cartilage grafts is done using an open method with the incision of GENSOUL-LEXER (Figs. 232a and 311) or also of POTTER (Fig. 322).

In cases of considerable alar collapse with external scars we (MEYER) have removed the external skin and the lateral crus of the lower lateral cartilage leaving the vestibular skin and replaced the portions removed with a *composite graft from the auricle*. The composite auricular graft consists of only two layers: skin and cartilage. The skin of the postauricular surface is used in conjunction with the corresponding auricular cartilage from the concha to provide the convexity of the ala.



Figs. 136a—d. Correction of alar collapse by FOMON. a Position of the cartilage in which the alar collapse occurs. b Application of the luxation suture in the region of the caudal border of the upper lateral cartilage and the cephalic border of the lower lateral cartilage. c Condition after luxation of the cephalic border of the lower lateral cartilage by means of the suture. d Cross-section of final position

If the external skin is intact, but the vestibular skin is cicatricious due to a defect, we suture in a composite graft of auricular cartilage.

2. Correction of abnormally shaped alae

Abnormally long or wide alae, as they are found in the negroid nasal type, are corrected with a sickle-shaped excision from the lateral end of the ala. This method was developed in 1892 by WEIR (Fig. 137). JOSEPH later described a modification which is suitable for less extreme cases. He makes the wedge excision at the alarfacial junction only on the side of the vestibular attachment. The skin of the lateral nasal wall is elevated far enough so that it will not form wrinkles when it is approximated to the ala after the excision is made (Fig. 138). According to SHEEHAN the correction in such cases is made only in the floor of the nostril with a wedge-shaped incision (Fig. 139). SELTZER varies the wedge excision from the vestibule according to the position of the ala (Figs. 140 and 141). With long but otherwise normally shaped alae one can modify the Weir excision by leaving the vestibular skin intact.

Seltzer makes the sickle-shaped excision with a special director like a forceps, with which he grasps the ala at the alarfacial junction. We consider this impractical, however, because the incision must be adapted to the situation at hand. The incision can be made more carefully with a sharp knife than with a scissors.

The ala with low attachment can be corrected by means of a sickle-shaped excision farther up in the alarfacial crease (Fig. 283). This method can also be

Fig. 137. Surgical flattening of overly convex alae by Weir. (From Kleinschmidt)

Fig. 138. Surgical flattening of overly convex alae. Modification by Joseph. (From Kleinschmidt)

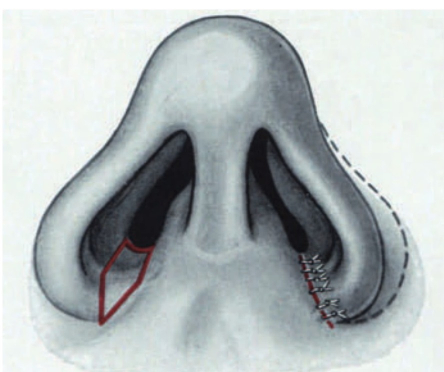


Fig. 139. Wedge excision from the vestibular floor by Sheehan. (From H. J. Denecke)

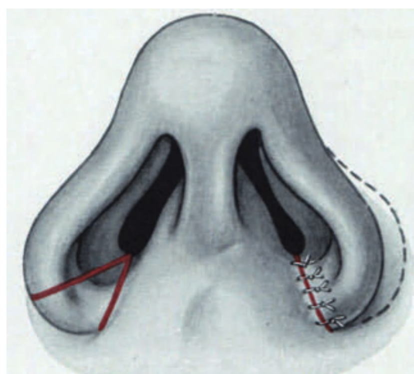


Fig. 140. Excision from the alar attachment by Seltzer and Berson. (From H. J. Denecke)

used in slight deformities due to harelip nose. In general one should not be afraid to make such excisions on the lower lateral cartilage. Such corrections might include balancing assymetries and, in particular, to eradicate an ugly, deep attachment of the alae in the region of the "weak triangle", as Millard recommends. The skin must be sutured with the finest suture material (6/0 nylon). Then the border scar is hardly visible after a few months. If the alar attachment is even lower, in some cases one must make a Z-plasty with a small flap from the lateral wall of the nose as Joseph does.

In the *very flat and slack negroid nose* Fomon recommends a wedge excision bilaterally at the alarfacial junction and cartilage grafts, one in the columella, another in the base of the columella above the maxillary spine and one in each ala (Fig. 306).

LEXER corrected the flat negroid nose in the following manner. A strip of skin is excised bilaterally from the floor of the vestibule. The ala is detached laterally in the alarfacial crease. Then it is rolled toward the base of the columella and sutured in this new position. COTTLE has modified this technique of JOSEPH by narrowing the base of the nose with a subcutaneous approximating suture. He passes this suture from one point of excision at the entrance of the nostril to the other, pulls the suture tight and ties it. He does this before he sutures the alar attachment into the new, more medial position.

Where such a technique is inadequate, JORDAN and GONZALES-ULLOA use an approximating suture of steel wire. From an incision in the sublabial fold the

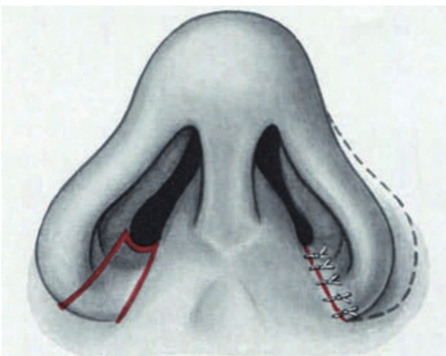


Fig. 141. Excision at the alar attachment by SELTZER. (From H. J. DENECKE)

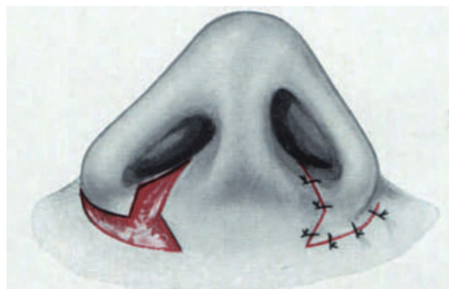


Fig. 142. Median repositioning of the alar attachment by HERLYN. Skin excision, right; medially repositioned and sutured alar attachment, left

Fig. 143. Incision

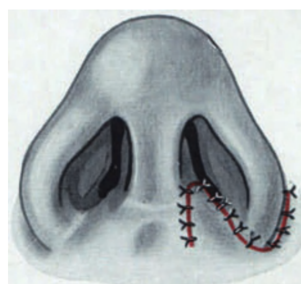


Fig. 144. Suture

Figs. 143 and 144. Enlargement of the nostril by swinging a flap from the skin area lateral to the alar attachment, by JOSEPH. (From H. J. DENECKE)

wire is passed through the two lateral ends of the alae and is twisted together, thus approximating them. At the same time JORDAN reinforces the base of the columella with a piece of cartilage which replaces the maxillary spine. In these cases it is often absent or, at most very small.

JOSEPH corrected *thick alae* with a strip excision at the alar rim. FOMON does this as described in the preceding chapter (p. 105).

JOSEPH also described a Z-plasty with an additional flap from the cheek for the *median displacement of the alarfacial junction.* Like BROWN and MCDOWELL, we too feel that the cheek flap has proved to be unnecessary. In his surgical textbook HERLYN describes a somewhat complicated but very clever maneuver for the median displacement of the ala. This can be seen in Fig. 142. AUFRICHT makes excisions similar to those of HERLYN.

With *narrow nostrils* one does just the opposite of the median displacement of JOSEPH. In the same manner a flap from the cheek at the alarfacial junction is rotated into the base of the nose in a Z-plasty as by JOSEPH (Figs. 143 and 144). According to BERSON and BARSKY this technique can also be used to correct small nostrils with raised floor (Fig. 303).

VII. Operations in certain positional anomalies and deformities of columella

1. Narrowing of wide columella

The skin of the wide columella is separated bilaterally through a lateral incision from its subcutaneous tissue so that it can be drawn to the side with a retractor. Then one uses a scissors to excise the tissue causing the thickness. Finally the skin is sutured laterally with fine single sutures, or else with mattress sutures which are passed through the total thickness of the septum (Figs. 145—147).

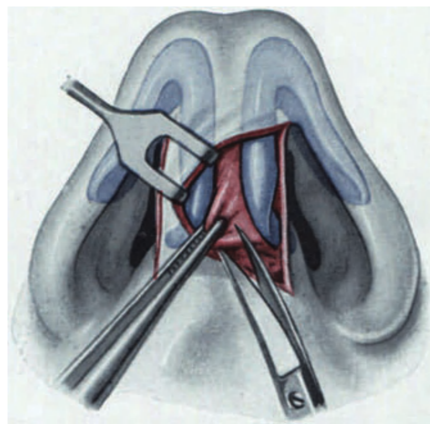


Fig. 145. Narrowing the columella by means of excision of surplus tissue between the medial crura of the lower lateral cartilage. (From H. J. DENECKE)

Sometimes it is also necessary to make a skin excision in addition to the excision of connective tissue. This is best done as by BERSON laterally at the skin incisions mentioned above. Here the skin is then closed with single sutures which stretch the vestibular skin. For this we use 4/0 or 5/0 nylon with an atraumatic needle.

If the widening of the columella is found together with a flat or *somewhat split nasal tip*, the tissue between the medial crura of the lower lateral cartilage is excised through the lateral skin incisions mentioned while the columellar skin is retracted. Afterward the medial crura can be approximated and tied into position with mattress sutures (Figs. 146, 147). — Sometimes the *ends of the medial crura of the lower lateral cartilage* project too far laterally in the region

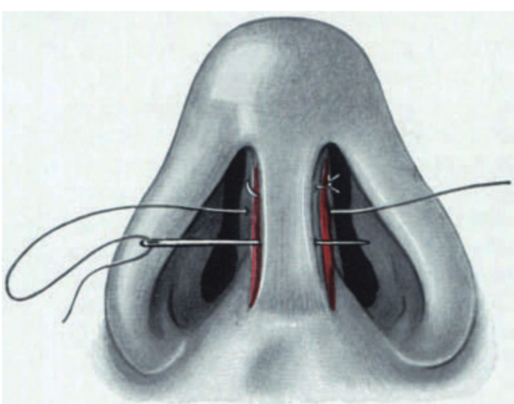


Fig. 146. Narrowing the columella. After excision of the surplus tissue, the suture is passed through the entire thickness of the columella. (From H. J. DENECKE)

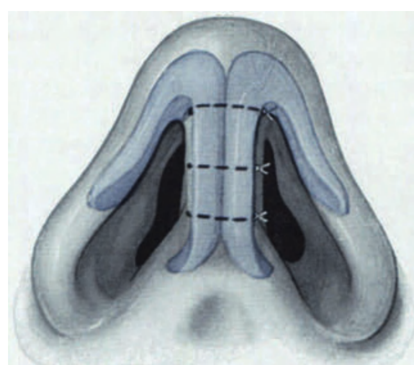


Fig. 147. Narrowing the columella. Approximation of the medial crura of the lower lateral cartilage by means of sutures. (From H. J. DENECKE)

of the columellar base and cause a widening of the columella. It is often necessary to break their spring by scoring to straighten them and bring them together in midline.

2. Lifting of hanging columella

This operation has already been mentioned in the chapter dealing with the nasal tip, since it usually is done in connection with a tip correction and rarely by itself (p. 79).

Fig. 148. Correction of hanging columella by JOSEPH. Excision of a strip of tissue through the entire columella. (From H. J. DENECKE)

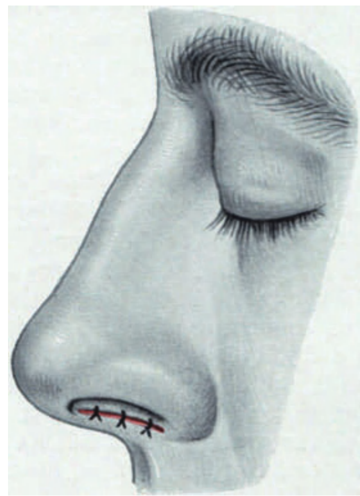


Fig. 149. Correction of hanging columella by JOSEPH. Suture. (From H. J. DENECKE)

The correction is made by excision of an appropriately wide, spindle-shaped piece of tissue within the columellar skin after JOSEPH. To do this the columella is pierced with the knife and the corresponding part is cut through in all tissue layers. In some cases a portion of the medial crura of the lower lateral cartilage must be excised along with it, if the latter project laterally. According to BROWN and McDOWELL the tissue should not be excised in the border region of the columella, that is, in front of the medial crura as originally described by JOSEPH. It should rather be done farther inward in the membranous part of the septum, where the transfixion incision is usually made (Figs. 148, 149). Here, too, the skin can be closed with mattress sutures (Fig. 123) or with lateral single sutures.

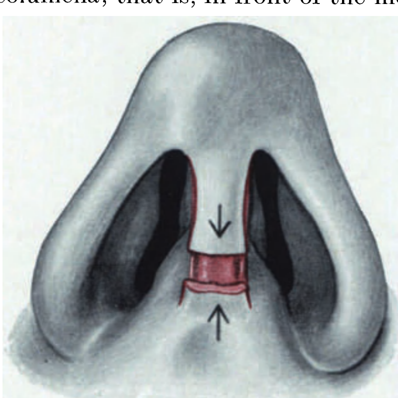
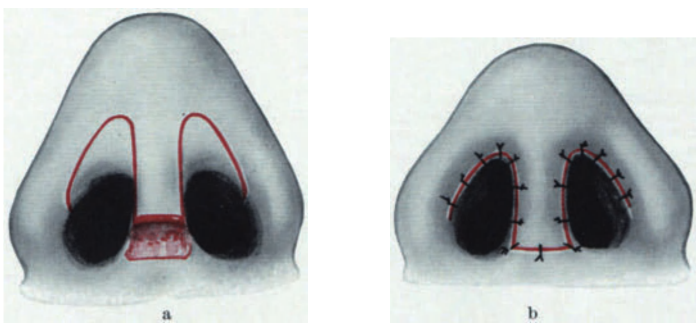


Fig. 150. Shortening the columella by JOSEPH. (From H. J. DENECKE)

3. Shortening of columella

One severs an *overly long columella* with the knife horizontally to its attachment at the upper lip reaching the transfixion incision and shortens it with a more or less wide strip excision (Fig. 150). The cut edges are approximated again carefully and sutured. By itself this operation is made actually only in extreme cases of incongruity of the columella length to the size of the other soft parts which make up the tip. In general the columella is shortened without any excision when modelling the tip. The new position of the tip after the rearward placement is fixed with the suture of the transfixion incision (p. 95). — Sometimes an *incongruity between the caudal surface of the nasal tip and of the columella* is present (Fig. 151a), which can give the impression of an overly long columella. Then the columella can be placed rearward bilaterally at the cost of the tip portion. In doing this the anterior dome is moved forward by means of a sickle-shaped excision, making the nostrils appear larger (Figs. 151a and b).

When the *nasal tip is too prominent* and can not be corrected adequately after the transfixion and with remodelling, one makes a strip excision. Sometimes this can be combined with a bilateral wedge excision at the alarfacial junction. This normalizes the profile angle, which is usually over 38^0 in long nasal tips.



Figs. 151a and b. Columella and tip correction by means of bilateral sickle-shaped excision on the anterior rim of the nostril and by means of strip excision at the columellar base (R. MEYER). a Excision of the dome in entire thickness. b Columella sutured after excision at the base

4. Lengthening of columella

The simplest way to *lengthen the columella is at the cost of its width.* After FOMON tissue is cut out through the transfixion incision and mattress sutures are applied, as described above in narrowing of the columella (Figs. 145—147). To do this one can pass the basal mattress suture through tissue of the upper end of the philtrum as well, which is a part of the upper lip. This pulls the columella together farther down at its base. But it is not sufficient only to use such through-and-through sutures. It is also necessary to create a subcutaneous wound surface which can cause scars in the region of the columellar base. This can be done, for example, from the transfixion incision with a scissors. Only then can one be certain that the change caused by the approximating sutures will last.

The customary method for lengthing the columella is the *V-Y advancement in the philtrum,* which is ascribed to GENSOUL as well as to LEXER and JOSEPH. A skin flap on the columella and the philtrum is cut. This is pedicled anteriorly at the nasal tip and ends in a point almost at the edge of the upper lip. The flap is repositioned forward and sutured in place. The resulting defect in the philtrum is closed by approximation of the lateral cut edges. Thus a Y-shaped suture is formed from the V-incision in the philtrum (Figs. 152, 153).

If a slight lengthening of the columella and a widening of its base is wanted at the same time, one rotates two small lateral flaps as by GILLIES from the upper lip to the base of the columella. By this means particularly, one can bring a retruded nasolabial angle farther forward (Fig. 154).

A further method of GILLIES can be used to lengthen a very short columella. This time one creates a *columella-philtrum flap* so that its distal end is in the nasal tip and its pedicle is at the rim of the lip. The flap is sutured to the columella

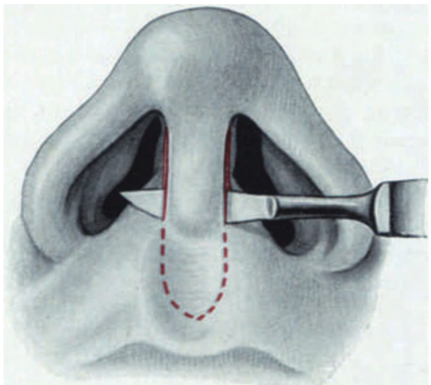


Fig. 152. Lengthening the columella according to JOSEPH. The dotted red line outlines the strip of skin on the upper lip which is used to lengthen the columella. (From H. J. DENECKE)

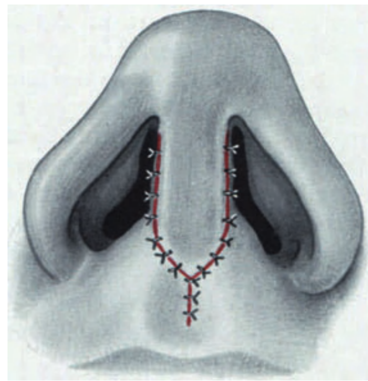
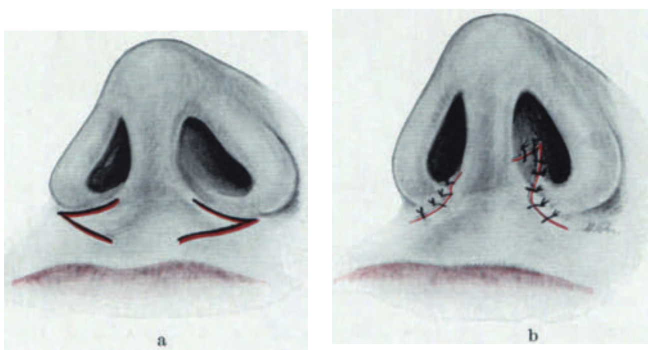
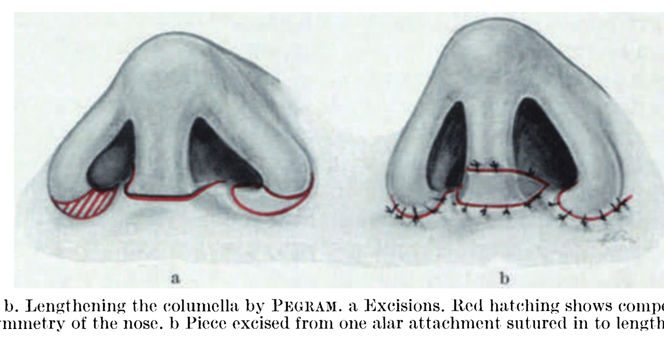


Fig. 153. Lengthening the columella according to JOSEPH. Suturing the upper lip and the columella. (From H. J. DENECKE)



Figs. 154a and b. Lengthening the columella according to GILLIES. a Formation of flaps bilaterally on the upper lip. b Rotation of the flaps to the columellar base



Figs. 155a and b. Lengthening the columella by PEGRAM. a Excisions. Red hatching shows compensating excision to guarantee symmetry of the nose. b Piece excised from one alar attachment sutured in to lengthen the columella

so that the skin formerly belonging to the upper lip now covers the base of the columella. In doing this one must pull the upper lip all the way to the base of the columella. It is left in this position for about 2 weeks, that is, until the flap has healed on. Then the flap is severed basally and the philtrum defect is closed by approximation of the lateral borders (Fig. 379). This is a valuable method which sometimes leads to better results than the V-Y method. We have modified it by creating a bridge flap instead of a pedicle flap. To do this we leave the distal end attached to the nasal tip.

A piece of the ala from the alarfacial junction can be added to the base of the columella, in the manner of a *composite graft*. The wedge-shaped piece excised is inserted in the columella like a piece of cake and sutured. PEGRAM described this procedure in 1954. He calls it a composite graft, just as BROWN calls his auricular grafts (p. 330). But here it is not a matter of a composite graft, but only of a simple skin graft, since no cartilage is included (Figs. 155a and b). In this procedure the contralateral ala must naturally be shortened by wedge resection to compensate for this.

BARSKY slides a flap *from both sides of the columellar base* and from the base of the vestibule and sutures them together in midline. In this technique he like-

Figs. 156a—c. Lengthening the columella by BARSKY. a Incision. b Forward advancement of the flaps and median suturing. c Donor sites sutured

wise includes a V-Y plasty, but done in the manner opposite to that which is described above (Fig. 156).

In conclusion another technique of GILLIES should be mentioned. It is used to lengthen the columella and to lower it at the same time if it is too high. This is the so-called "hidden columella". GILLIES creates two narrow skin flaps along the alar rim ("wing flaps") pedicled at the nasal tip. These he rotates onto the columella and sutures them together in midline after splitting the columellar skin along midline and pulling the edges apart (Fig. 378).

5. Correction of oblique columella

One can correct a paramedian displacement of the columella at its base with a Z-plasty of JOSEPH (Figs. 157, 158). A lateral displacement of the columella at the nasal tip can likewise be brought into midline with a Z-plasty of JOSEPH.

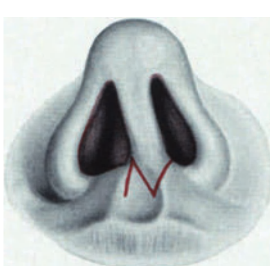


Fig. 157. Correction of oblique columella. Red line shows the incision. (From KLEINSCHMIDT)

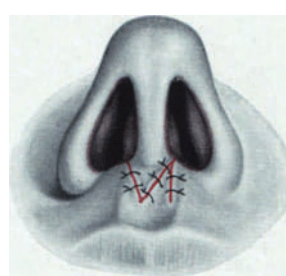


Fig. 158. Correction of oblique columella. Situation after repositioning the columellar attachment. (From KLEINSCHMIDT)

When such asymmetries of the columella are not very obvious, they are generally corrected by transfixion, severing of the subcutaneous parts, and fixation of the covering in the proper position using mattress sutures (Figs. 123, 146, 147).

6. Correction of nasolabial angle and of hidden columella

If the nasolabial angle is *much more than 90⁰* it should be corrected. This can be done either from the oral vestibule or from the nostrils. In the approach from the oral vestibule an incision is made in the sublabial fold and carried to the base of the columella. Sometimes from this incision, a very prominent maxillary spine can be removed as by GALTIER with the chisel or with a LUER forceps (Fig. 159). The fibers of the M. depressor septi nasi, as well as connective tissue, can be removed at the same time.

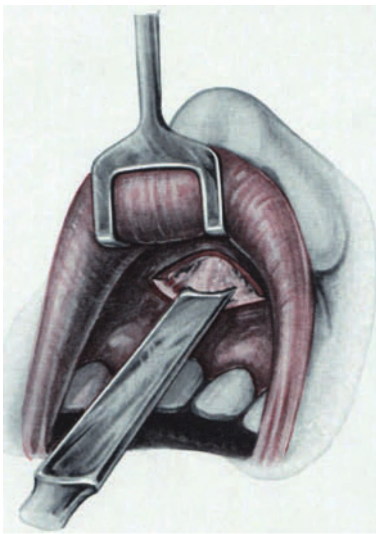
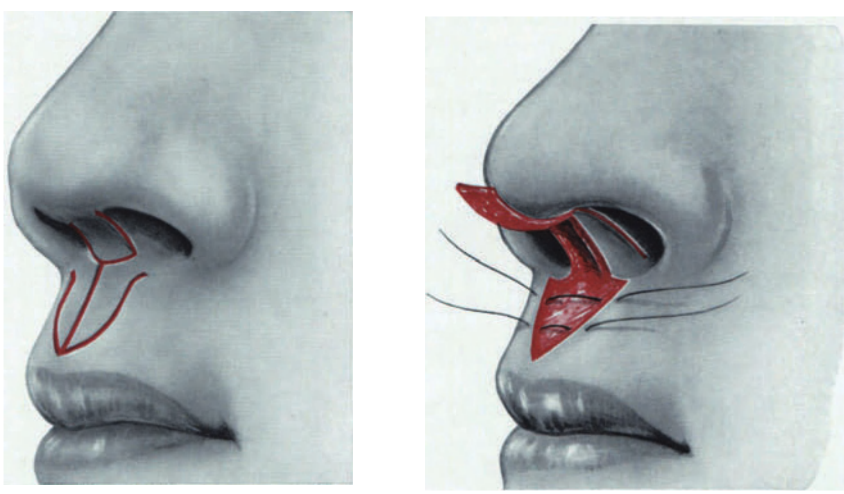


Fig. 159. Approach through oral vestibule for removal of maxillary spine with the chisel for correction of the nasolabial angle

Working from the nostrils, one uses either the transfixion incision as the approach (Fig. 94), or else small incisions are made bilaterally at the base of the columella. From here the respective connective tissue and, if necessary, portions of skin are removed. One can also use the so-called "lip-freeing technique" of FRED (Fig. 132). With this technique the M. depressor septi nasi is severed from behind and kept apart by interposition of cartilage (see also p. 100).



a b

Figs. 160a and b. Correction of hidden columella by means of transposition of two flaps from the philtrum, by STRAITH, Jr. a Incision. b Situation after transposition of the flaps for forward advancement of the columellar flap which has been swung upward. Sutures for closure of the donor site

If the nasolabial angle is too acute, i.e. *less than 90⁰*, correction is usually made by reinforcing the columella with stiffening material (cartilage, bone, plastic). This is done from the transfixion (Fig. 129) or from the oral vestibule. One can also insert larger pieces of cartilage under the columellar attachment. Young does this in cases of dish face with retruded upper lip and columellar base, with flat nose and prognathous chin. Converse grafts bone from the iliac crest, through the oral vestibule. In 1954 Straith and his colleagues published a method for advancement of the columella, especially at its base. They dissect the columellar skin and fold it upward. Then they rotate skin flaps from both sides of the columellar base onto the columella. The trunk-like flap of columellar skin is replaced and sutured in this new position (Figs. 160a and b).

One can proceed in the same way in case of pinching in or rearward displacement of the whole columella. Here, too, if scar tissue is present, the scar tissue may not be sufficiently elastic for an effective graft. In spite of this, pinching in can occur again and again. In *hidden columella* one must use the technique of Straith and his colleagues, or Gillies. In cases of pronounced cicatricious contraction in which vestibular skin or mucosa is lacking, we sever the columella at its base. We extend this incision rearward and upward into the cartilaginous septum and make a V-Y advancement here. This displaces forward and downward a small triangle of septal cartilage, a large part of the membranous septum, and the whole columella. One can extend or improve this method by pushing the upper part of the lip forward just under the columellar attachment. This can be done using an approximation suture or by reinforcement with a cartilage or bone graft.

VIII. Corrections of nasal septum in their relation to rhinoplasty

1. General considerations

In the literature about rhinoplasty the relation between external nasal deformity and simultaneous intranasal malformation has been discussed in varying ways. Opinions differ *whether a rhinoplasty should be combined immediately with an endonasal operation*, i.e. whether they should be performed in one sitting. This applies especially to septal surgery. Social reasons such as a reduction in cost of hospitalization speak in favor of elimination of an external deformity and endonasal, pathologic conditions in one stage. King, Ashley, Stovin, and more recently Erdelyi are against one-stage operation. Anderson, Fomon, Riggs, Caliceti, Sommer, Wieland and many others advocate it. But they make an exception in cases of very pronounced *septum deviation* with bending and traumatically doubled cartilage plates, or in septa widened by organized hematomas. Then the septum operation precedes the rhinoplasty by 1 to 2 months. Kaplan was the first to combine the two operations. This procedure has proved its value with us in most cases. Therefore we believe that one can make it a rule to perform the usual submucous septum resection and the rhinoplasty in a one-stage procedure. Conditions are often such that slight external deformity is augmented by making an intranasal operation by itself. Another objection is the fact that scar formation after the first operation can make the second one more difficult. This can be the case whether one does the septal operation or the rhinoplasty first. In a prominent hump nose, if one first performs the septal resection with rather extensive excision of cartilage upward toward the dorsum, it may happen during the rhinoplasty that an inadequate cartilage support remains after removal of the bony and cartilaginous dorsum. Only under certain conditions can we go along with the view of Aubry and Caliceti that one should never combine the operations in a case of saddle nose. If only a slight saddling of the dorsum is present, then one can take the material for filling the saddle directly from the dorsum. But when an extensive septum resection has already been done, no more material can be taken from the septum.

If, in addition to an external nasal deformity, there is also a *chronic sinus infection* which is favored by marked septum deviation, and which because of this deviation can not really be treated conservatively, then one must proceed in two stages if possible. First the septum deviation is corrected, thereby preparing the healing of the sinus infection. Only then with relatively healthy conditions can one undertake the external rhinoplasty. In *allergic and vasomotoric rhinopathies* this rule is not necessarily valid. Here functional and cosmetic improvements can be combined. EISENSTODT even operates on such cases at the peak of the season. He believes that the trauma of operation, as a shock, is of positive influence on the allergy. At any rate the view has generally been abandoned that rhinoplasty includes only purely esthetic operations which can only be performed on a completely healthy nose. One contraindication against a plastic operation of the nose is the presence of an inflammatory process. On the other hand *nosebleed*, which can not be cured completely with cauterization, is indication for a septum resection. Here, too, this can be combined with the rhinoplasty. It should be mentioned here that the surgical treatment of ozena with submucous grafting of all sorts of materials can be combined advantageously with the rhinoplasty as well also (see p. 70). Often the external surgery, which already produces a narrower lumen, aids considerably in the subjective and objective improvement of the ozena, so that the submucous grafts do not have to be so extensive.

In general wo do the *submucous septum resection at the beginning* of the combined operation. Depending on the conditions of the caudal part of the septum one can use the incision of KILLIAN or choose the transfixion incision from the start as the approach for the septum correction. A separate KILLIAN incision would then have to be made somewhat farther posteriorly than usual, so that an adequately wide cartilage strut remains between this and the transfixion incision. In the case of a luxation at the base the cartilage strut can be dislodged and repositioned.

The submucous resection can also be done *as part of a rhinoplasty*. This is done after the bilateral intercartilaginous incision at the limen nasi, after the décollement of the dorsal skin, after the transfixion incision, after a possible hump removal and after shortening the tip using a border resection on the septal cartilage. But it should be done before the lateral osteotomies, before reducing the size of the upper lateral cartilages and before remodelling the lower lateral cartilages.

A further important question in septal surgery is *at what age* surgery should be performed on children. Because of the relative size relationships of the nose, congenital septal deviations do not lead to noticeable functional disturbances until the age of 7 or 8. Only after this time are septal deviations an important factor in diseases of the nose and paranasal sinuses. This occurs especially if acute and chronic inflammation of the mucosa further limits the size of the cavity which is already narrowed by the septum deviation. It can also occur if the abnormal congenital growth tendencies are favored by traumas. Such traumas do not necessarily have to lead to septal fractures or luxations of the anterior part of the septum with a high degree of narrowing of one side of the nose. As NEUMANN has also determined, slight, often unnoticed traumata, or traumata considered unimportant lead to nasal obstruction. Unilateral and bilateral septum hematomas are to be observed often after such slight, blunt injuries. Without treatment these hematomas heal either with cicatricious thickening of the septum, or they can become infected and cause development of a septum abscess with all serious consequences, above all saddle nose. This leads to obstruction of nasal breathing to a high degree. Deformities of the external nose can also occur due to absorption in the region of the cartilaginous and bony septum, because the cicatricious tissue areas do not go along with the general growth.

Septal displacements or deviations are coupled with almost all facial assymetries. Also all forms of cleft lip and palate are found together with septal deviations. In general submucous septum resections are not advised in children. We feel, however, that with careful procedure one can help more than one can harm. If one leaves the usually traumatic changes, then they only become more pronounced in further growth. Therefore the old dogma of the 15-year-limit has been abandoned in the last decade, especially since OMBRÉDANNE demonstrated his successes in 50 operations on children from the ages of 5 to 12. HOLMES begins with 7 years of age. METZENBAUM, COHEN, SALINGER, CONVERSE, FOMON, and CALICETI also advocate surgery at an early date, but they recommend an conservative resection. Above all, when possible, no cartilage should be excised, but the septum should be remodelled only by slicing the cartilage, as GOLDMAN and his pupils, JENNES and PONTI, have recommended. In the technique of GOLDMAN (see p. 130) recommends vertical incisions which, however, do not sever the upper edge. The strips can be brought into midline and fixed with packing. Literature of recent years, especially American literature, has produced a great number of publications about methods of septum surgery. These are techniques which differ from the usual KILLIAN operation known to every ENT physician.

Since the first, simple septum operations were important for the entire *development of septum surgery*, they should be summarized briefly here. It is accepted today that QUELMALTZ made the first publications about septal deviations in Paris (1750). Articles about the surgical treatment of septum deviations first appeared in the 19th century. Very simple operations consisting of removal were known by LANGENBECK (1843), DIEFFENBACH (1845), HEYLEN (1847), CHASSAIGNAC (1851). These authors removed the cartilage together with the mucosa and did not worry about a postoperative perforation. RUPRECHT (1868) also published a perforating correction of septum deviation. In contrast to the various defective methods ADAMS (1875) proposed the thought of multiple fractures of the deviated septum which could be held in midline by packing to heal. This method, like those of HARTMANN and PETERS (1882) and of ASH (1890), consists of reinserting the resected parts of the mucosa and cartilage in better positions. The method was based on ideas which have been taken up again in new procedures only in the last decade.

BURCKHARDT (1885), BOSWORTH (1887) and KRIEG (1889) thought it possible to resect the septal structure between the septal mucous membranes. But KILLIAN (1904) was the first to perform this successfully. He was able to do it because of the construction of the septum forceps by HARTMANN.

The three functions of the septum are the support of the external nose, the regulation of the air flow, and the support of the mucosa. These important functions were first taken into consideration satisfactorily in this KILLIAN operation. As explained above the methods used before his disregarded the functional points almost without exception. Without regard for the extent of the mucosa destroyed, protruding parts of the septum were sawed and chiseled away and perforations ignored or produced intentionally.

TRENDELENBURG was probably the first to correct a deflected nose (1898). In 1928 JOSEPH described a method of *septal correction in deflected nose* by pulling the mobilized septum to one side using a silk suture passed through a hole drilled in the maxillary crest. For more pronounced deviations he used a special shaper which was applied for 3 months after mobilization of the septum. In 1931 BLAIR recommended fixation to a tooth using wire. The operations of JOSEPH and BLAIR were derived from those of ADAMS and ASH, which consisted of fracturing and repositioning the septum.

2. Submucous resection of the septum (KILLIAN)

Around the turn of the century KILLIAN and FREER, at about the same time and independent of each other, described the submucous resection of cartilage

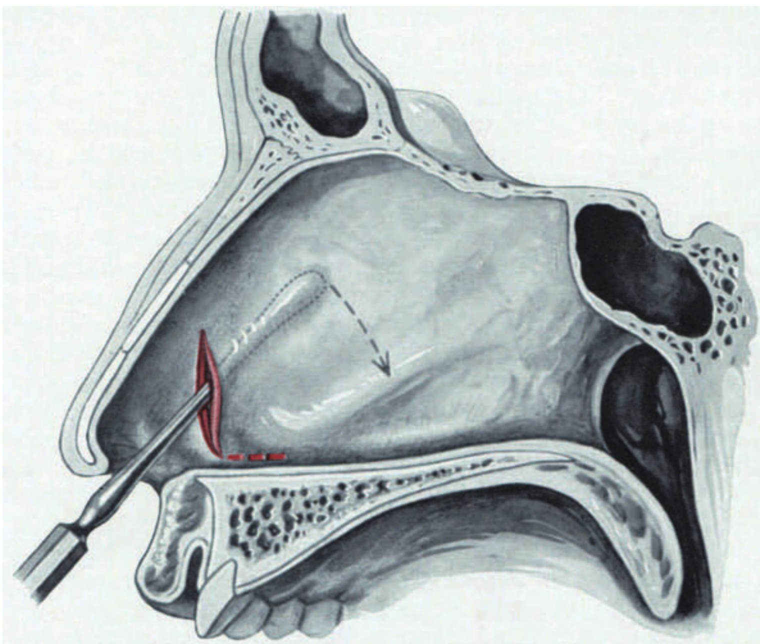


Fig. 161. Incision in submucous septum resection. The dotted red line shows the later rearward extension of the mucosa incision. The septum elevator is introduced to separate the perichondrium and the mucosa from the cartilage. (From H. J. DENECKE)

and bone, FREER called ROE, INGALS, KRIEG and BOENNINGHAUS originators of the idea. KILLIAN left a strut at the caudal part of the septum as well leaving a ledge at the dorsum. FREER retained only the support at the dorsum.

The *technique* of KILLIAN is the basis for the different septum plasties. Thus it is appropriate to describe it here: The incision of the mucosa is made in various places by individual surgeons, but an incision at the level of the maxillary spine and perpendicular to it is generally best. If one finds this incision inadequate, one can extend it posteriorly along the floor of the nose (Fig. 161). In any case it should be located in front of the angling of the septum. In luxation of the septum the incision runs along the anterior border of the luxated septal cartilage. The incision should go through the mucosa of one side and the cartilage at the same time. Injury to the mucosa on the other side must carefully be avoided. In order not to injure it, one determines the position of the point of the knife with a finger of the free hand in the other nostril (Fig. 162).

If one has inadvertently perforated the mucosa of the opposite side, then one undermines the mucosa on the side of the incision somewhat farther back. The incision through the cartilage runs parallel to the first one but a few millimeters behind it. The cartilage is then resected from this point (SEIFFERT, DÖDERLEIN).

The mucosa-cartilage incision is about 2 cm long. When it has been made at the point described above, one introduces a septum elevator between the perichondrium and cartilage and separates the two layers. The sharp edge of the elevator is toward the cartilage (Fig. 161). The pocket is extended as far as the edge of the vomer. Then the elevator is introduced through the cartilage incision and under the perichondrium of the other side. The latter is likewise undermined as far as the edge of the vomer. Here, too, the sharp edge of the instrument is

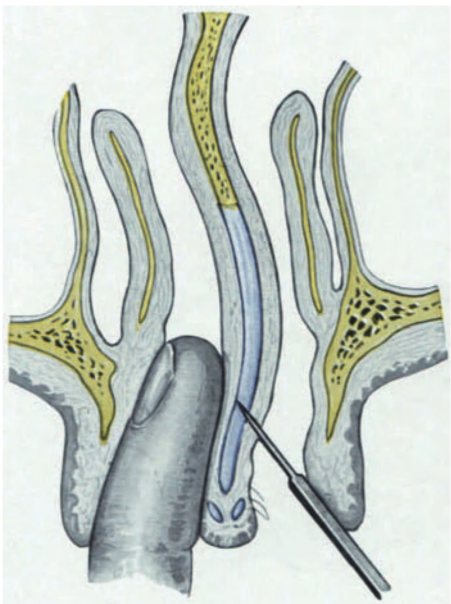


Fig. 162

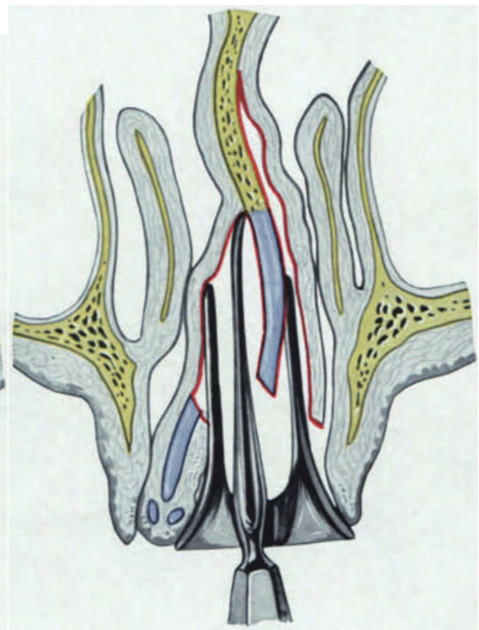


Fig. 163

Fig. 162. Submucous septum resection. Using the septum knife one cuts through the mucosa and cartilage working from one nostril while one determines the position of the point of the knife from the other nostril by palpation. Horizontal cross-section of the nose. (From H. J. DENECKE)

Fig. 163. Submucous septum resection. Separating the mucosa from the cartilage and bone. The sharp edge of the instrument lies against the cartilage and bone. Horizontal cross-section of the nose. (From H. J. DENECKE)

placed against the cartilage (Fig. 163). The position of the elevator can be checked by introduction of a nasal speculum in the respective nostril. If the instrument is in the correct layer, that is between cartilage and perichondrium, the undermining of the perichondrium usually can be done well and a performation of the mucosa is easily avoided. When one is in the right layer of tissue it feels like peeling an orange.

When the separation of the perichondrium from the cartilage has been completed, a medium KILLIAN nasal speculum is used. The blades of the speculum are introduced one on either side of the cartilage through the mucosa incision into the septum, and the periosteum of the vomer is undermined. The periosteum often adheres quite strongly along the upper edge of the vomer. The elevation is easier if one works upward from the elevated periosteum of the floor of the nose.

When the perichondrium and periosteum have been elevated, the cartilage is removed with the BALLENGER swivel knife. The knife is guided inward along the lower border of the cartilage and drawn back around the top. The piece of cartilage resected is removed with a forceps. Instead of using the BALLENGER swivel knife, one can also use the septum knife to cut from back to front through the cartilage in the respective area at its upper limit. Then one can remove the cartilage piece by piece with a BRÜNINGS or HEYMANN forceps.

If the deviation extends to the anterior, upper part of the septum as well, then one does not break off the often wide cartilage below the cartilaginous dorsum with a forceps. With use of forceps there is danger of formation of a duck-bill nose. The cartilage should be narrowed with the knife. One must not go too far upward

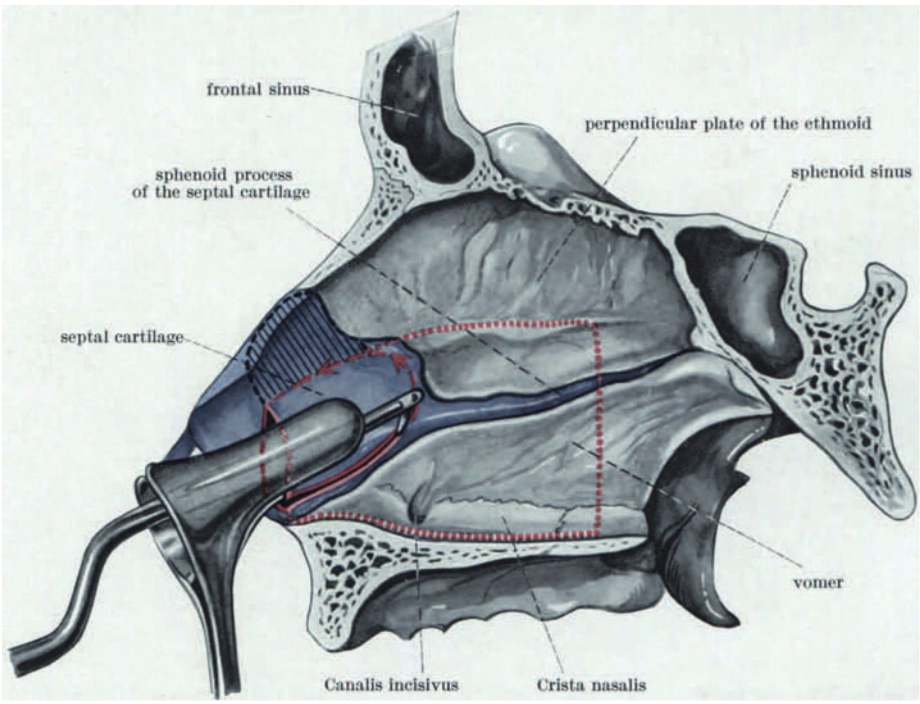


Fig. 164. Submucous septum resection. The septal cartilage is between the arms of the speculum. With the swivel-knife of BALLENGER one excises the cartilage as shown by the red line in the direction of the arrows. — Dotted red line shows the part of the septum to be excised. — In the area shown by black hatching the resection should not extend too close to the cartilaginous dorsum. (From H. J. DENECKE)

when resecting cartilage in this region, because otherwise the thin arch of cartilage bends slightly and changes the profile of the patient (Fig. 164).

After removal of the respective part of cartilage, the lower anterior part of the perpendicular plate of the ethmoid and the upper anterior part of the vomer are fractured bit by bit with a BRÜNINGS or HEYMANN forceps and removed (Fig. 165). The ridge on the floor is removed with the curved nasal forceps after CRAIG (Fig. 166) or, if necessary, with a chisel. To prevent injury to the hard palate the chisel is held at a very flat angle to the nasal floor. With a little practice one can hold the nasal speculum and the chisel with one hand while using the mallet carefully with the other hand. The chips of bone are removed with the nasal forceps under direct vision in order to avoid any injury of the mucosa by sharp edges of the bone.

At the end of the operation the septum is straightened by approximation of both mucoperichondrial flaps in the region of the cartilage and bone so that they are straight, vertical and adjacent to each other (Fig. 167).

3. Septum plasty

In extreme crookedness of the bony nasal crest or in luxations of the cartilaginous plate at its junction with the bony groove of the vomer, one can undermine the mucoperiosteum and mucoperichondrium *working from the oral vestibule.* A horizontal incision is made bilaterally from the maxillary spine. From here the septal bone and cartilage can be exposed. KRETSCHMANN described this approach to the piriform aperture and the anterior septum in 1909, after ROUGE, LONER and WINCKLER had recommended it even earlier. COTTLE, LOEBELL and others have taken it up again in recent years for cases of traumatic nasal stenoses in adolescents.

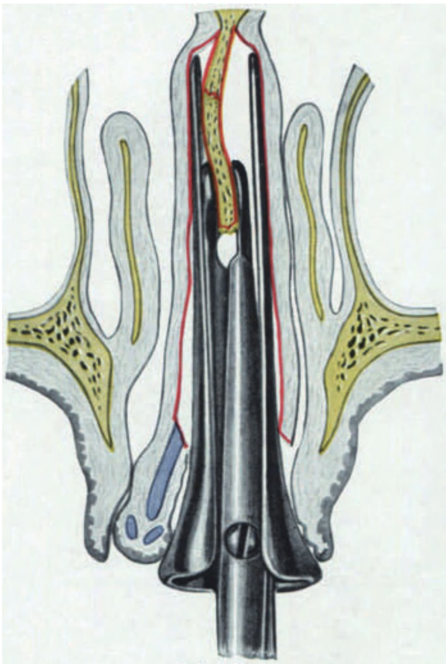


Fig. 165

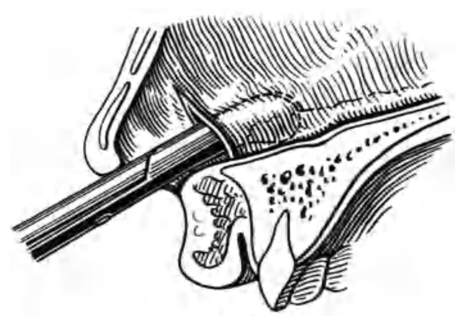


Fig. 166

Fig. 165. Submucous septum resection. After separation of the mucous membranes from the vomer, parts of the vomer are broken out with the nasal forceps. Horizontal cross-section of the nose

Fig. 166. Submucous septum resection. Removal of the maxillary crest with the curved forceps of CRAIG. (From H. J. DENECKE)

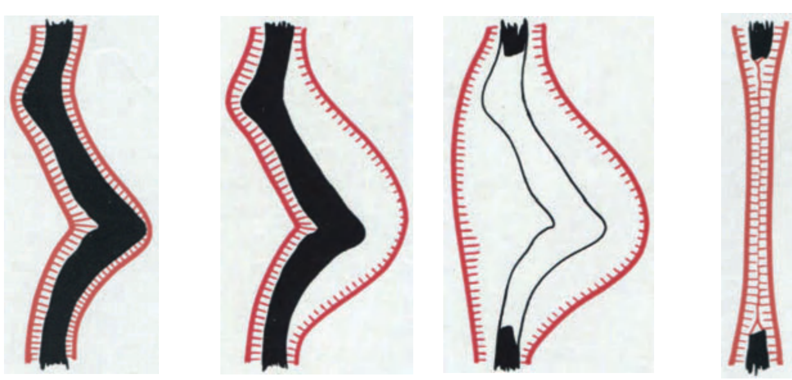
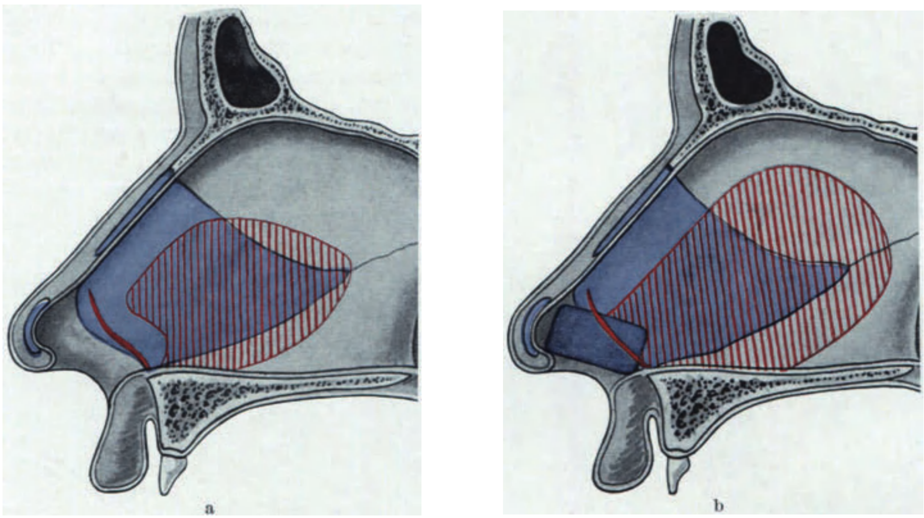


Fig. 167. Vertical cross-section of the septum. Schematic representation of the submucous resection by KILLIAN. (From LAUTENSCHLÄGER)

METZENBAUM (1929) was the first to recognize that a caudal anterior deviation of the septal cartilage, which also causes a bend of the nasal tip, could not be corrected by resection of cartilage, but only by the so-called *swing-door method.* In the method of METZENBAUM the part of the cartilaginous septum bowed out to one side is mobilized through an L-shaped incision in the mucoperichondrium. This part is then repositioned to midline and pushed into a pocket in the columella. The incision must not perforate the mucoperichondrium of the opposite side. Thus the part of the septum in front of the incision can be swung like a door into midline and fixed there. The incision is closed with sutures and the straightened



Figs. 168a and b. Septum correction by PEER. a Red hatching shows area to be resected. b Warped anterior cartilage support also resected. Cartilage plate reimplanted in the columella as anterior support

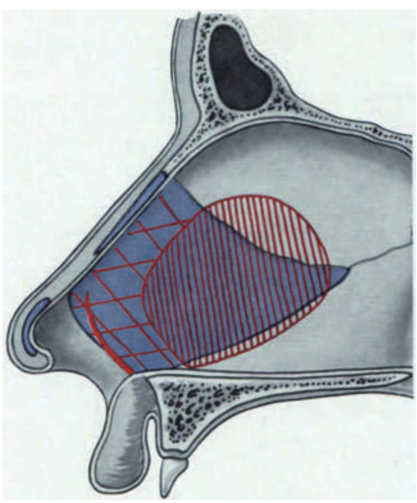
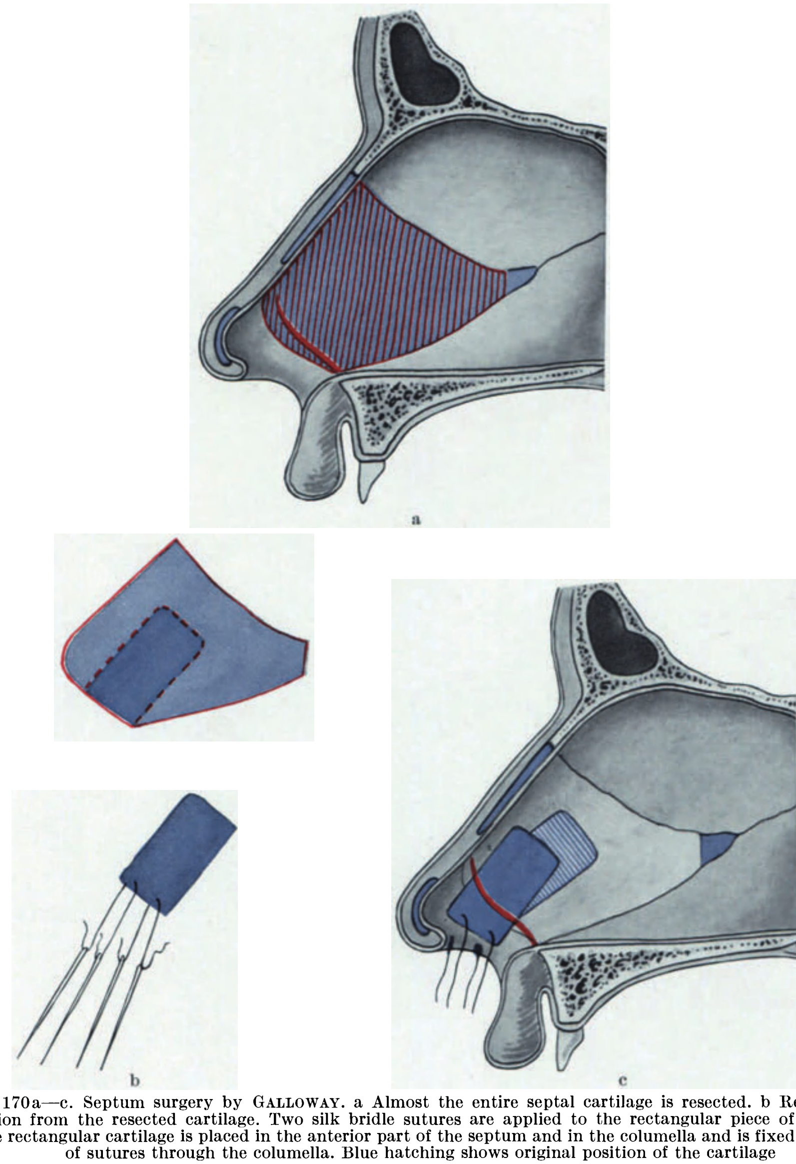


Fig. 169. Septum surgery by MALINIAC. Crosshatching of remaining cartilage

septum held in place by bilateral packing. Several authors ascribe this method to SAFIAN as well. This method should not be used in cases in which the deviated lower anterior part of the cartilage is fixed in place with scar tissue or in which a strong angling presents a completely different situation.

In 1936 PEER described a complete resection of the malpositioned free anterior caudal end of the septal cartilage and replacement of the same with a cartilage plate from the middle or posterior portion of the septal cartilage. Thus he makes an *autogenous strip graft* of cartilage *for the support of the columella.* He recommends the method for cases in which an extremely curved anterior cartilage can not be drawn into a columellar pocket for support and thus be held in place by means of mattress sutures (Figs. 168a and b). HUET (1927) and later OMBRÉDANNE had the idea of reimplanting cartilage in the anterior septum region after resection of the luxated or highly deviated cartilage.

MALINIAC (1940) makes either vertical strip excisions of cartilage or else *crosshatches* the cartilage in the area of deviation. He does this from one side, protection the mucoperichondrium of the other. In more pronounced deviations the deviated cartilage plate has to be approached from a horizontal incision at the base. According to MALINIAC's instructions, a long THIERSCH graft is to be applied here later, because the mucosa no longer reaches to the floor of the nasal cavity (Fig. 169).



Figs. 170a—c. Septum surgery by GALLOWAY. a Almost the entire septal cartilage is resected. b Rectangular excision from the resected cartilage. Two silk bridle sutures are applied to the rectangular piece of cartilage. c The rectangular cartilage is placed in the anterior part of the septum and in the columella and is fixed by means of sutures through the columella. Blue hatching shows original position of the cartilage

A further interesting method of operation comes from GALLOWAY (1946). He resects almost all of the cartilage with the border at the dorsum. He *replaces a rectangular piece excised from that plate* and fixes it to the columella and sometimes to the anterior edge of the dorsum using mattress sutures. For proper placement of the reimplanted piece of cartilage he passes two silk pilot sutures with straight needles through the columella (Figs. 170a—c). The pilot sutures are then immediately removed. Lierle and Huffman (1957) leave these pilot sutures for a few days and tie them around gauze rolls at the columella. — The Galloway operation naturally has its disadvantages. Often the sharp edge of the plate of septal cartilage can be noticed at the columella, or the cartilage graft is pulled to one

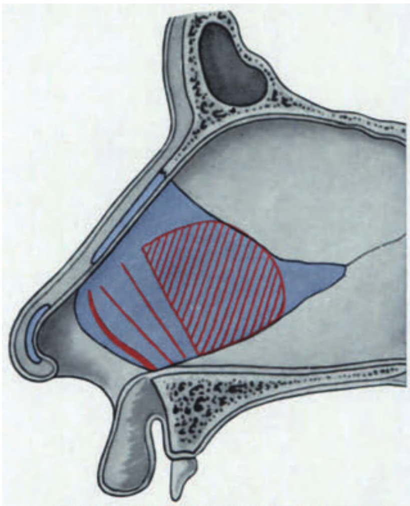


Fig. 171. Septum resection by Salinger

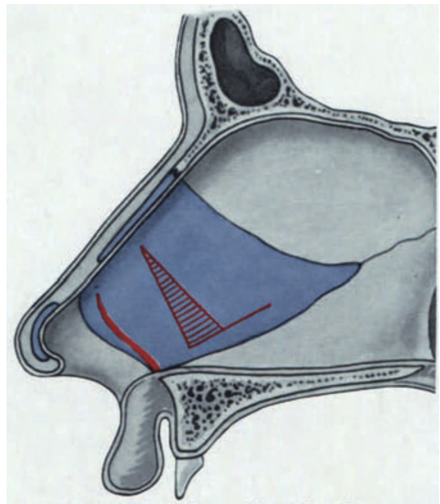
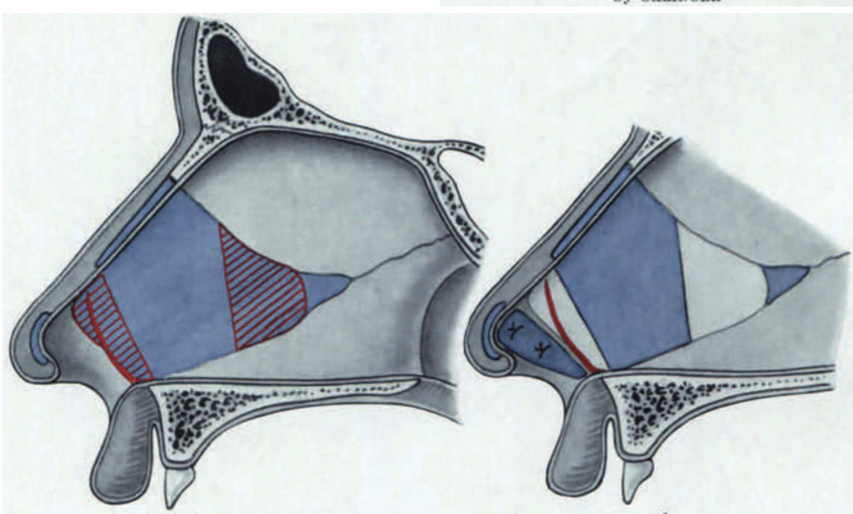


Fig. 172. Triangular excision of cartilage by Salinger



a b

Figs. 173a and b. Septum resection (a) and reimplantation (b) of the anterior border of the septal cartilage in the columella, by Salinger

side by unsymmetrical scar formation in the soft parts. At any rate the columella is somewhat stiff in nasal mimics. This is sometimes disturbing and gives the impression of a nose which has undergone surgery. Stovin has emphasized the importance of retaining flexibility and elasticity in the membranous septum. He states that the membranous septum acts as a buffer between the columella and the cartilaginous septum. The method of Salinger (1939) is also derived from that of Metzenbaum. An incision is made at the anterior border of the septum on the side of the septum concavity. The mucoperichondrium of the opposite side is elevated as far as the maximum convexity. Then the septal cartilage is incised vertically. Behind this incision, after bilateral elevation of the mucoperichondrium, a piece of cartilage is excised. If the remaining anterior piece of cartilage is strongly curved, it is shaped after parallel incisions running vertically or diagonally (Fig. 171). In many cases SALINGER restricts himself to a *triangular excision of cartilage* (Fig. 172) *in the region of maximum deviation.* As the last step the caudal border of the septal cartilage is resected, reinserted into a pocket in the columella as METZENBAUM does and fixed with mattress sutures (Figs. 173a and b). — The method of SALINGER can be combined very well with hump removals and anterior resection in long noses.

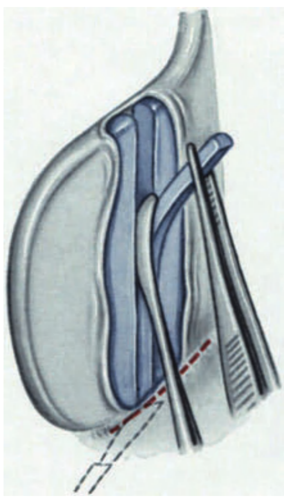


Fig. 174

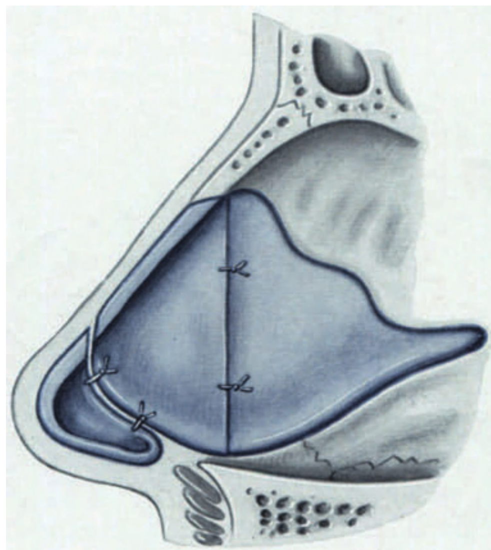


Fig. 175

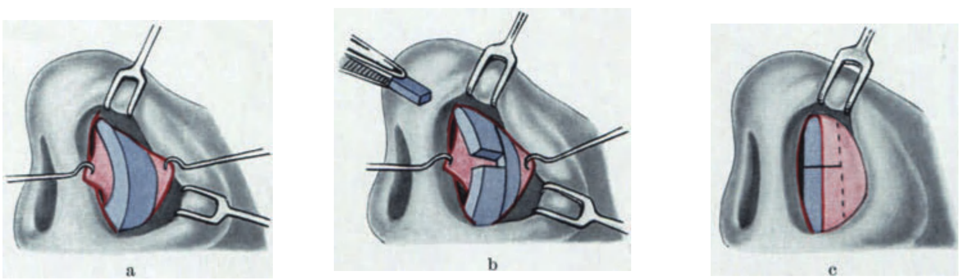
Fig. 174. Correction by SELTZER. Submucous resection of a strip of septal cartilage 1 to 5 mm wide is made from the nasal dorsum to the nasal floor at the level of the deviation. Then the septal cartilage is severed from the nasal floor (dotted red line). (From H. J. DENECKE)

Fig. 175. Correction by SELTZER. The pieces of cartilage are sutured together in the new position. (From H. J. DENECKE)

In 1944 SELTZER further developed and refined the so-called "swing-door" method of METZENBAUM and SAFIAN. He calls his modification the "*swinging door technique*". At the caudal border oft the septum he uses the customary transfixion incision. This makes maximal mobilization of the free caudal end of the septum possible. From a lateral incision in the mucosa just in front of the maximum convexity he elevates the mucoperichondrium on this side. Then either with the FREER knife or with his instrument constructed especially for this purpose he excises a vertical strip of cartilage 1 to 5 mm wide (Fig. 174). He does this without injuring the mucoperichondrium of the other side. Still working from the same side he cuts the cartilage through the mucosa as far as the mucoperichondrium of the other side, which again is protected. The cut runs forward as far as the transfixion. Above, the junction of the septal cartilage and the upper lateral cartilage is incised lengthwise close to the edge of the septum. Now the deviated anterior plate is completely mobilized and can be pulled to both sides like a swinging door. Finally the mobilized septum is fixed to the columella at the transfixion incision by means of mattress sutures (Fig. 175).

Many authors, including KAPLAN, FOMON and ROWLAND have (later) altogether abandoned the Killian incision as the approach for septal surgery and use the transfixion incision. This is supposed to make the approach for elevating the mucoperichondrium easier, prevent postoperative crust formation at the incision, and reduce the danger of a postoperative perforation. The transfixion incision is closed either with mattress sutures or better with bilateral lateral silk or nylon single sutures.

THOMAS (1945) uses a different method. He *resects practically all of the septal cartilage* and replaces it between the membranes of the mucoperichondrium. He sometimes combines this operation with partial surgery of the external nasal structure. Still other radical operations have been developed on the model of the method of THOMAS. ELSBACH (1946) operates after the technique of PEER. But he leaves both the strip of cartilage along the dorsum and a support just behind the maxillary spine running diagonally forward and upward. He reimplants only a small piece of cartilage anteriorly, just behind the columella.

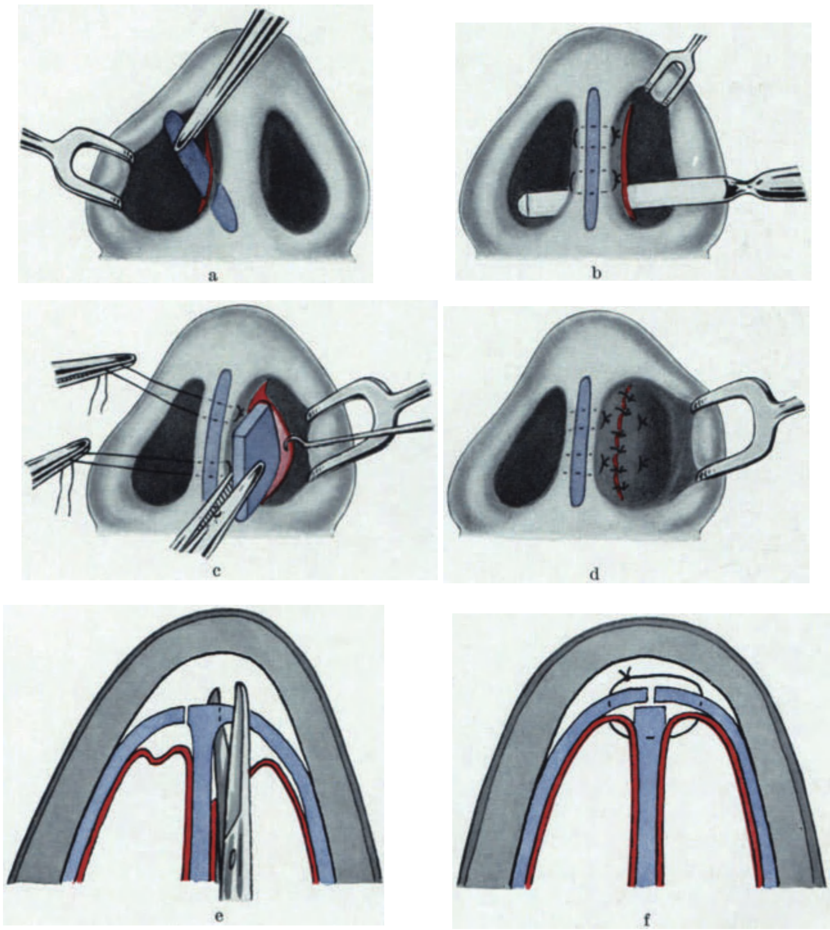


Figs. 176a—c. Septal surgery by BERSON. a Exposure of the deviated septal cartilage through the transfixion incision. b Strip excision across the middle of the septal cartilage. c Situation after straightening the cartilage

In 1947 STEFFENSEN modified the swinging door method of METZENBAUM-SELTZER. In the same year EISENSTODT combined the techniques of PEER and SELTZER in his own operation. BERSON (1945) proceeds in a manner similar to that of STEFFENSEN for the correction of anterior deviations of the septum. He forms a swinging door by undermining bilaterally and dividing the exposed cartilage plate in half with a strip excision perpendicular to the caudal border (Fig. 176).

FOMON (1948) describes a conservative operation. He and his colleagues incise the columella at one side and make a pocket, working forward from the incision. They place a strip of cartilage from the cartilage bank into this pocket. The strip has been preserved in an aqueous solution of merthiolate (1:1000). This *columella strut made of cartilage* is 2 to 4 mm thick and, according to the length of the nasal tip, $2^1/_2$ to 3 cm long. It is supposed to prevent shrinking of the columella. The strut is fixed in the columella with two silk mattress sutures. Following this the dorsal skin is elevated bilaterally through an intercartilaginous incision. The transfixion incision is made behind the mattress sutures of the columella and in front of the caudal border of the septum and a thin strip is resected from the caudal border of the septum. This is followed by the submucous cartilage resection. The excised cartilage can be replaced in the anterior part of the septum either whole, as suggested by GALLOWAY (see p. 123), or in smaller pieces. — Finally the reimplanted cartilage is fixed between the mucoperichondrial flaps with mattress sutures. The lateral incision is approximated with single sutures (Figs. 177a—d). — Opinions vary concerning the *support function of the anterior part of the septum* for the lower portion of the external nose. Most rhinologists

(AUBRY and others) share the view of the anatomists that the anterior septum determines the shape of the fibrocartilaginous lower portion of the dorsum and of the nasal tip. FREER, FOMON, SYRACUSE, BOLOTOW, PULLEN and others state that the upper lateral cartilages together with the lower lateral cartilages by themselves can give adequate support to the dorsum and tip. They like to prove this by saying that the saddling of the dorsum after too extensive a septum



Figs. 177a—f. Septal surgery by FOMON. a Implantation of a cartilage strip into the columella. The cartilage is from a cartilage bank. b Situation after fixation of the cartilage graft by means of mattress sutures. Transfixion in the membranous septum. c Reimplantation of a cartilage plate in the anterior part of the septum after submucous septum resection. d Situation after fixation of the reimplanted cartilage. e Submucous separation of the upper lateral cartilages from the septal cartilage. f New formation of the cartilaginous vault in the region of the upper lateral cartilages using mattress sutures

resection occurs only after some weeks and months due to contraction of the tissue, and not immediately after the surgical removal of the support. In spite of this we believe that the septal cartilage has an essential support function, since the postoperative contraction does not become obvious at all if the cartilaginous support is intact.

According to FOMON the reimplantation of pieces of cartilage is not for support but rather to prevent a contraction of the soft tissues. In pronounced C- and S-shaped deviations of the septum the upper lateral cartilage must be separated from the septum bilaterally and then reattached to the reimplanted piece of cartilage with mattress sutures (Figs. 177e, f). This restores the cartilaginous vault of the nose. In rare cases a strip must be excised from the upper lateral cartilage on one side after its separation from the septum in order to provide symmetry in this vault as well. — BOURGUET had this idea previously, while DUFOURMENTEL and MAUREL made a unilateral resection of cartilage in the lower lateral cartilage to obtain symmetry.

COTTLE has developed the method of FOMON even further. He especially emphasizes that when *separating the upper lateral cartilages from the cartilaginous septum* one must protect the mucous membranes which bilaterally line the vault of the nasal cavity. This is important particularly in cases in which hump removal is to follow. The edges of the upper lateral cartilage are to be sutured together in midline. In the combination of rhinoplasty with conservative septum surgery

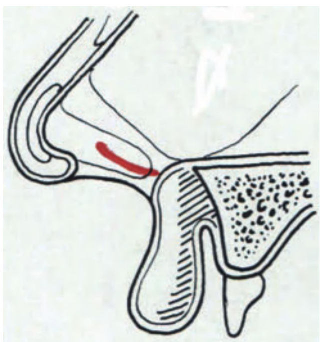


Fig. 178

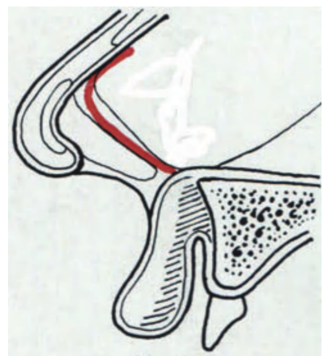


Fig. 179

Fig. 178. Partial transfixion by COTTLE. The incision should not affect the lower lateral cartilage but should be placed behind them

Fig. 179. Incision by PULLEN

complete transfixion is necessary. In COTTLE's opinion this is not appropriate in combination with more radical surgery in which the whole septal cartilage is resected and reimplanted. For such cases he suggests a so-called partial transfixion (Fig. 178), where only the basal part behind the columella is incised, the connection between columella and septum remains in the tip section. Thus the intercartilaginous incision, the approach for the décollement of the skin over the dorsum, is not connected with the transfixion incision. The medial crura of the lower lateral cartilages are severed at the dome and sutured together. This helps to stiffen the columella. COTTLE also points out the importance of packing both nasal cavities before reimplanting the pieces of cartilage.

PULLEN has described his own incision at the caudal border of the septum. It is shaped like an upside-down L. The short arm of the L comes as close as possible and parallel to the dorsum. The long arm is cut where the membranous septum becomes the mucous septum (Fig. 179).

In 1948 LAMONT likewise published an operation derived from the methods of PEER and SELTZER. He elevates the mucoperichondrium bilaterally from the transfixion incision and resects the anterior caudal part of the septal cartilage posteriorly almost 2 cm from the anterior border. He replaces this with a cartilage plate which he obtains from the posterior caudal part of the septal cartilage. With LAMONT as well, the reimplanted cartilage is positioned in a columellar pocket and fixed between the medial crura of the lower lateral cartilage with a mattress suture (Figs. 180 and 181).

Evans (1949) mobilizes the septum along the nasal floor by removing a minimum of cartilage and bone. He *fractures the septum and brings it into midline* (Fig. 182).

In addition to his technique with *marginal incisions in the cartilage remaining after resection* (Fig. 183) Converse (1950) also advocates the method of Metzenbaum-Seltzer, the swinging door technique. He combines this with a strip graft of septal cartilage in the columella. The graft is inserted through an incision at the vestibular rim on the columella, just in front of the anterior border of the medial crus on one side. In the septum correction he thinks it is important to elevate the mucoperichondrium bilaterally at the posterior part of the septum and to obtain a particularly good mobilization in the region of the transition to the nasal floor. He sometimes works from the side toward the septum through an incision in the nasal floor.

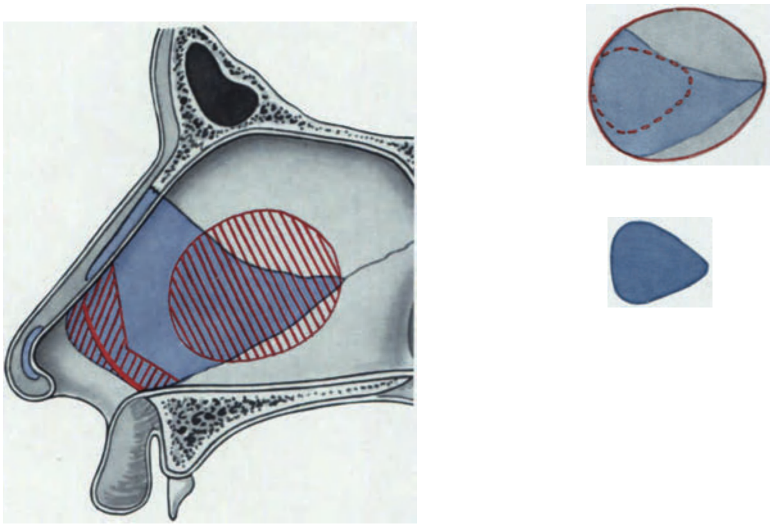


Fig. 180. Septal surgery by Lamont. Resection in the anterior and posterior part of the septum (red hatching). A piece to be reimplanted is taken from posterior part of the cartilage

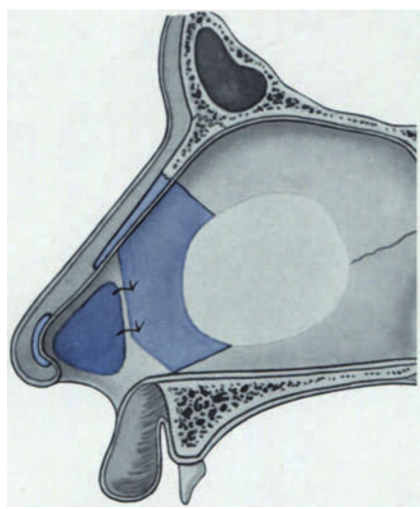


Fig. 181. Septal surgery by Lamont. Reimplantation of a triangular piece of cartilage in the anterior part of the septum. Fixation with mattress sutures

O. Becker (USA) (1951), like Evans, uses a horizontal incision at the transition to the nasal floor in cases where the entire vomer and thus also the septal cartilage are moved to one side along their whole length. From this horizontal incision he elevates the entire mucoperichondrium and lifts it up to make an incision in the cartilage or excisions in the anterior part. He *pushes the entire bony and cartilaginous septum into midline*. This causes a section of bone on the floor to remain exposed. The defect is covered with a strip of oral mucosa or mucosa from the inferior turbinate from the same side, or still better, with a composite graft of cartilage and mucosa. This graft is held in place by means of a wax mold and additional packing. If it is necessary to sever the upper lateral cartilages from the septum, they can be incised lengthwise in the medial part, but the mucoperichondrium must be protected. They can also be freed completely with a curved incision laterally at the border. — In the anterior part of the septum

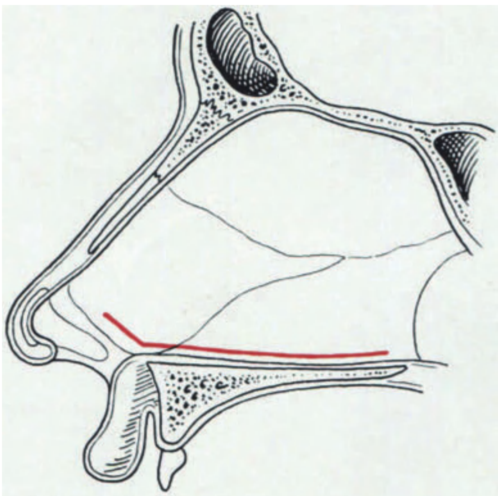


Fig. 182. Septum incision by EVANS

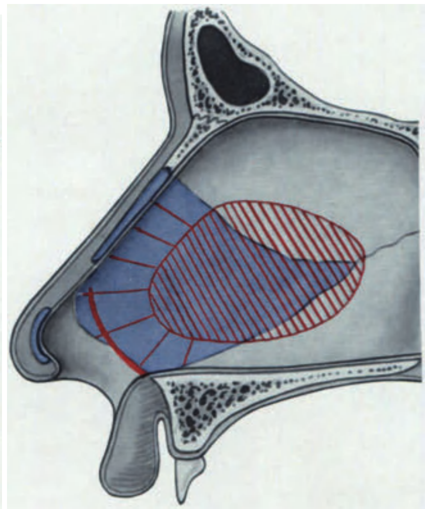


Fig. 183. Septum resection and marginal cartilage incisions by CONVERSE

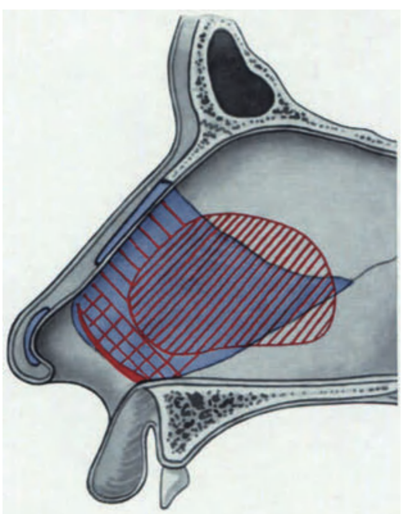


Fig. 184

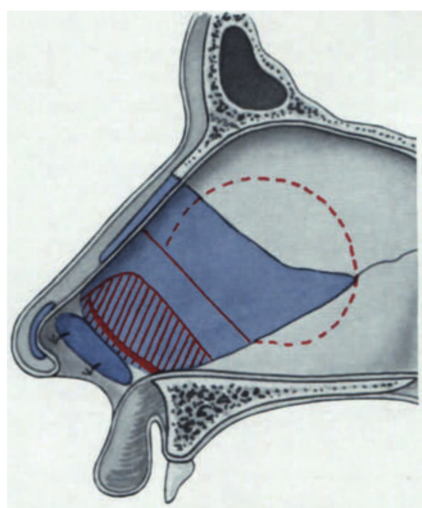


Fig. 185

Fig. 184. Septum resection with crosshatching of remaining cartilage by BECKER (USA)

Fig. 185. Septum resection and reimplantation of cartilage in the columella with fixation by means of sutures according to BECKER (USA). Red hatching shows resection of the cartilage. The area enclosed within the dotted red line may also be resected

parallel or crosswise incisions can be made according to the curvature of the cartilage (Figs. 169, 171, 183), as MALINIAC and other authors do, or one can use techniques similar to the swinging door with or without reimplantation (Figs. 174—176). The procedure of BECKER is based on those of STEFFENSEN (1947), MALINIAC (1948) and FERRIS SMITH (1950) (Figs. 184—186).

The method of GOLDMAN (1952) is almost the same as the method of BECKER. A mattress suture is passed through the base of the columella. This is used as a retractor to pull the columella forward while the usual transfixion in front of the cartilage edge is made for the purpose of exposing the latter. After elevating the mucoperichondrium one cuts two 0.4 to 0.9 cm wide strips of cartilage behind the transfixion incision and parallel to it. The submucous septum resection is done behind these strips, using a KILLIAN speculum (Fig. 187). After removal or straightening of the maxillary crest or the spine, the anterior septum strips are likewise straightened, if necessary with additional incisions or excisions. The strips are fixed in their new position with several silk mattress sutures. Then the columellar skin is sutured to the anterior septum strip with single sutures. The

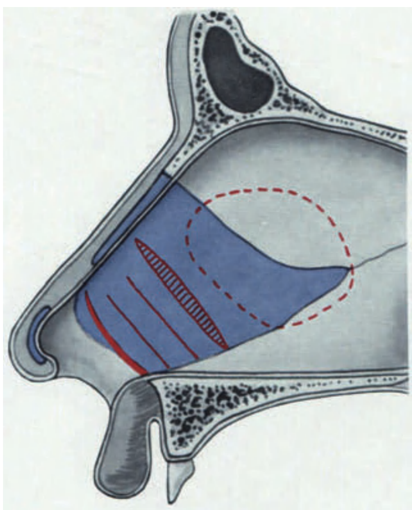


Fig. 186

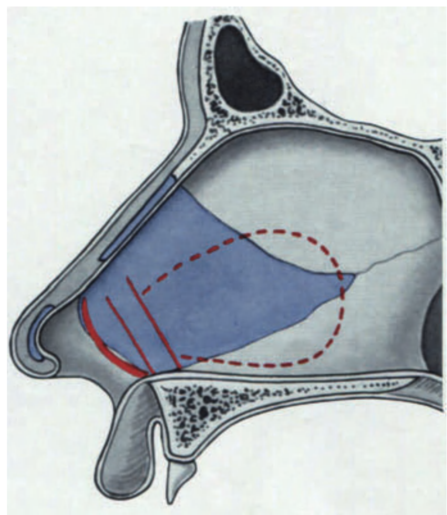


Fig. 187

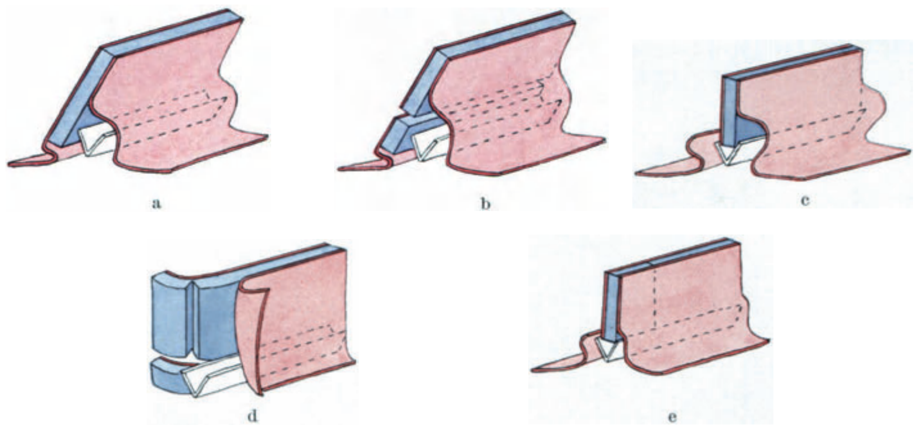
Fig. 186. Septum resection by BECKER (USA). Red hatching shows small cartilage excision; dotted red line encloses area to be resected

Fig. 187. Septal surgery by GOLDMAN. Working from the transfixion incision one forms two strips of cartilage which remain attached above

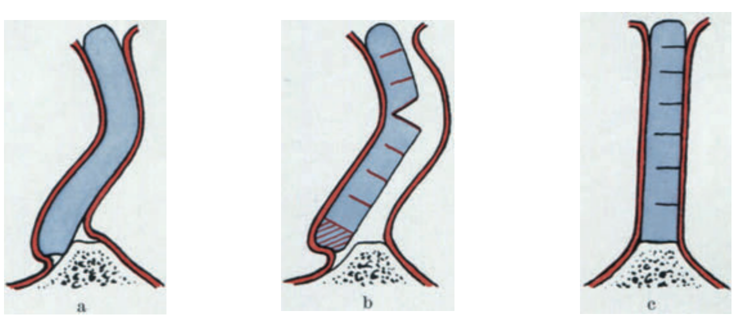
mucoperichondrium on the nasal floor is incised horizontally to prevent lateral pulling later. If necessary the gap in the mucoperichondrium is now covered using a graft as in BECKER'S method (see p. 129). The fixation of the mucosa in the new straight position is accomplished with celluloid plates which are pressed against it bilaterally and held there with packing.

RIGGS and WILLIAMS (1953) advocate COTTLE'S method of partial transfixion. A further variation of the incision at the anterior border of the septum comes from ZORZOLI (1953). ZORZOLI reimplants large pieces of septal cartilage. — In 1953 STOVIN published an operation which he calls a septum plasty. He makes an incision at the anterior border of the septal cartilage, usually on the left, and excises all of the cartilage. He only leaves a small strip of the perpendicular plate of the ethmoid at the dorsum and fractures the latter. He does not elevate the mucoperichondrium of the other side in the area in question. To avoid a depression of the dorsum he replaces one or more pieces of the excised septal cartilage and sutures them in place with mattress sutures. The portion of the septum consisting of connective tissue behind the columella is to be kept intact if possible. This gives the nasal tip its flexibility. — KRISTENSEN (1954) again takes up the technique of METZENBAUM and modifies it only so far as to incise the cartilage from the concave and not the convex side of the septum.

FUCHS proposes the following procedure for *correction of traumatic septal deformities* in which the cartilage has been luxated out of its maxillo-vomerine groove (luxation of JARJAVAY along the "ligne maîtresse de POTIQUET", see p. 6). He carefully elevates the mucoperichondrium on the side not narrowed by the luxation (Fig. 188). Then he incises the mucosa and cartilage horizontally on the



Figs. 188a—e. Septal surgery by FUCHS with a luxation of the septal cartilage according to JARJAVAY. a Mucoperichondrium separated in the region of luxation. b Horizontal incision in the septal cartilage. c Cartilage placed onto the bone; lower border of cartilage removed. d Correction of anterior luxation by means of almost vertical incision. e Replacement as "swinging-door"



Figs. 189a—c. Septal surgery by DINGMAN. a Luxated position. b Cartilage incisions and basal excision; red hatching shows cartilage to be removed. c Septum repositioned

other side above the basal cartilage spur. The longitudinal cartilage spur is removed, if possible without mucoperichondrium, and the cartilage plate is repositioned in the basal groove. If, in addition to the luxation, a deflection of the septum in the vertical axis toward the side of the luxation exists, then FUCHS also uses the swinging door mechanism in a vertical direction and fixes the repositioned cartilage with mattress sutures. He splints the corrected cartilage with two metal plates which he inserts bilaterally, as BECKER does with wax and SALINGER and COHEN do with strips of X-ray film. To counteract a retrusion of the columella he builds an angled metal splint into the dorsal dressing. The columella can be pulled downward and retained by sutures attached to this splint.

DINGMAN treats this septum luxation at the maxillary crest in much the same manner. He too resects the protruding lower edge of cartilage and repositions the cartilage plate in the septal groove. Along with this he scores the septum with parallel incisions or with crosshatching and excises a strip horizontally as well as vertically in the manner of the SELTZER swinging door method (Fig. 189). F. WIRTH has modified this technique by supporting the repositioned but unstable cartilage with a thin plate of cartilage lying flush with it (Fig. 190).

PERRET (1956) describes a maximally radical septum resection which he derives from the procedure of PEER. After the bilateral décollement over the upper lateral cartilages from the intercartilaginous incision and after transfixion, he elevates the mucoperichondrium bilaterally on the septum. In this he leaves the septal mucosa attached to that of the upper lateral cartilages, as FOMON does. The perpendicular plate of the ethmoid is almost completely resected. In this

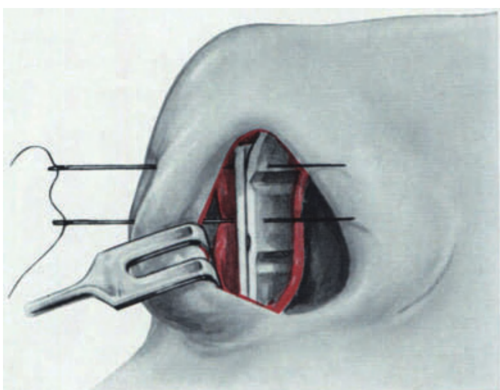


Fig. 190. Correction of cartilaginous septum deviation in the manner of DINGMAN according to F. WIRTH. The originally warped cartilage is straightened following excision of prism-shaped strips and is fixed by means of reimplanting a cartilage plate flush with it

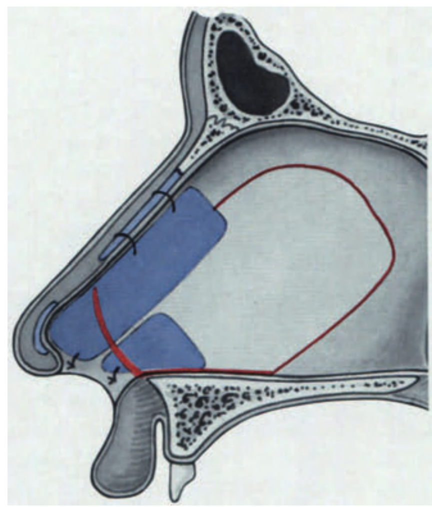


Fig. 191. Septal surgery by PERRET. After extensive cartilage resection two pieces of cartilage are reimplanted, one at the nasal dorsum, the other at the maxillary spine

way he obtains straight parts of the septal cartilage which he reimplants. The perpendicular plate of the ethmoid, the vomer, and the maxillary crest are resected as far as necessary. Two pieces of cartilage as large as possible are reimplanted in the anterior area of the septum. The upper one is attached to the upper lateral cartilages by mattress suture, and both grafts are attached to the columella with steel wire sutures. The grafts are placed between the mucoperichondrium after packing of both nasal cavities (Fig. 191).

Surgical improvisation, with which one can adapt to every situation and every condition of deformity in the septum, is important, particularly in this branch of surgery. A main requirement for this is of course the knowledge of the many possibilities and of the advantages and disadvantages of tested methods. As a rule we do not proceed too radically in deformed noses. We (MEYER) begin, if possible, with décollement of the deviated dorsum over the upper lateral cartilages, working from the intercartilaginous incision. If a correction of the bony vault is necessary, we continue the décollement upward to the glabella and over and beyond the sides of the nose to the frontal processes of the maxilla. The bilateral intercartilaginous incision is extended to the transfixion incision. Then we proceed to the actual septum correction and follow this with the external rhinoplasty as the third step of the operation. In the septum operation one must be absolutely certain that the spring of the cartilage-bone plate is broken. Only then will it not spring back once it has been repositioned. It should not have to be held into its new median position by force. Usually we use techniques in the manner of SELTZER's "swinging door". We elevate the mucoperichondrium only on one side almost to the point of maximum convexity. Here we remove the vertical strip of cartilage and after severing the cartilage on the top and bottom we obtain the swinging door. Behind the strip excision in the axis of the door we elevate bilaterally and bring the bone and cartilage plate into midline. This is done by means of incisions, fractures and necessary excisions. We make several mattress sutures with 2/0 or 3/0 nylon in the "hinge" of the door as well as in the columella. With short, straight needles, which are pressed against the open end of a suction tube held at the other side of the septum, one can make more mattress sutures farther back on the septum as well (see Fig. 123). Very often, especially in more radical submucous cartilage resections, we reimplant one or two strips of cartilage fastened together with fine catgut. These are placed under the dorsal skin as a precautionary measure against saddling. — Advances in plastic surgery of the septum are great and gratifying. However one should be absolutely certain that the proper airway is guaranteed in the constructive procedure with reimplantations.

4. Correction of bony and cartilaginous deflected nose in combination with septum operation

One can classify deflected noses as 1. deformities restricted to the external nasal skeleton; 2. deformities of the inner skeleton; and 3. deformities affecting both. The second category has already been discussed in the chapter about the septum. In the first and third categories it is necessary to bring the displaced nasal bones into normal position. Where the bony lateral nasal wall is too long, a *wedge or strip excision of bone* at the base of the pyramid or at the dorsum must be made. TRENDELENBURG, GOODALE, JOSEPH, LEXER, LAUTENSCHLÄGER and HERLYN have taught the basal excision. Today surgeons prefer bone removal at the dorsum. LAUTENSCHLÄGER even recommended grafting the bone excised on the wide side to the narrow side. In addition to the wedge excision, osteotomies are necessary for mobilization of the nasal bones. With a paramedian wedge excision, lateral (see p. 50) and transverse (see p. 57) osteotomies are to be made on the wide side. With a lateral wedge excision, the paramedian (see p. 68) and transverse osteotomies are also made. One should always make the paramedian, lateral, and transverse osteotomies on the narrow side of the nose (Fig. 192). — In a deflected nose with hump one must saw the dorsum asymmetrically in order to obtain a median wedge resection at the same time. The saw cut in hump removal (see p. 43) must then be directed downward from the narrow side to the wide side. In *deflected noses with bony hump and saddling* in the cartilaginous part the resected hump can simply be pushed downward to fill the saddled portion of the dorsum. In certain cases of bony deviations with pronounced saddling in the cartilaginous part, a graft must be implanted (see p. 179) after straightening the bony vault. Here one should point out a technique of *realigning the bony structures* which is suitable for correction of deflected nose. LOEB modifies the old procedures of TRENDELENBURG and JOSEPH of realigning fractures with the osteoclast or rhinoclast (see p. 64) by using a 2-beveled chisel placed properly. A wide, flat chisel is introduced through the intercartilaginous incision and is placed flush against the lateral portion of the bony nose. The assistant administers mallet blows on the firmly held chisel which extends from the nose. This breaks in the bony plate while protecting the skin.

The procedure of MALBEC should be mentioned here. In this the bony structure is made pliable with two to three parallel, diagonal osteotomies bilaterally. After this the nasal pyramid can be moved and shaped adequately.

Along with the work on the external bone it is also important to have adequate *mobilization of the septum* in the cartilaginous portion as well as in the bony part. We often sever the bony base of the septum from the front rearward using the ROWLAND forceps. If possible we leave one of the two mucoperichondria (Fig. 193). Otherwise the septum deviation can be treated in the usual manner. As a rule the *external cartilaginous structure* must be corrected at the same time. The

Fig. 192

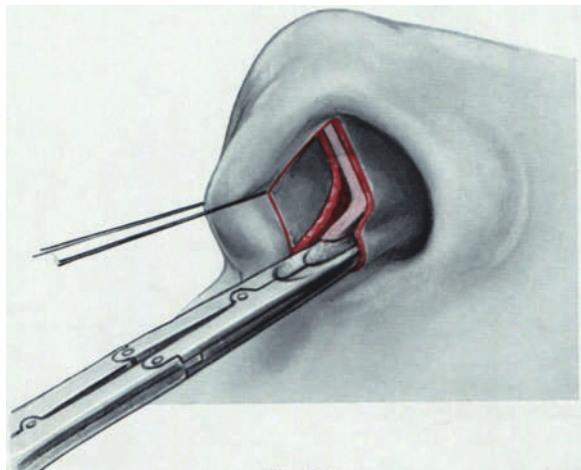


Fig. 193

Fig. 192. Deflected nose. Hatching shows wedge excisions. With wedge excision made laterally paramedian and transverse osteotomies are required. With paramedian wedge excision lateral and transverse osteotomies are required. On the opposite side paramedian, lateral and transverse osteotomies are required

Fig. 193. Basal severing of the septum through the transfixion incision with the ROWLAND forceps for extension of the correction of deflected nose

techniques applied are: lateral mobilization of the upper lateral cartilage as by BECKER (USA), severing the upper lateral cartilage at the junction with the septum (Fig. 75), reduction of the upper lateral cartilage on the side opposite the deviation after BOURGUET, or severing and reduction of the lower lateral cartilage of the side opposite as by MAUREL and DUFOURMENTEL. Formerly V-excisions of skin and cartilage were made as well on one side, as indicated, for example, by MARTIN. Today one makes at most a sickle-shaped excision of skin at the alarfacial junction (Fig. 137). Usually the décollement and modelling of the lower and upper lateral cartilages is sufficient to restore the symmetry of the soft nasal structures.

Fixation in the new position is an important problem after correction of deflected noses. In the septum chapter several simple fixations are mentioned like those of O. BECKER (USA), SALINGER, COHEN, GOLDMAN and FUCHS (see p. 131ff.). In addition there are more complicated methods like that of LAFITTE-DUPONT. He sticks a needle made of gold into the nasal bone and leaves it in the dorsum. This procedure already seemed to be obsolete when STRAITH took it up again. STRAITH, Jr. and his colleagues insert a KIRSCHNER wire into the frontal bone at the glabella and use this to determine the line of direction for the dorsum (Fig. 194). The wire is left in place for 2 weeks.

JOSEPH anchors the anterior base of the septum in the new position with a silk traction suture attached in the region of the piriform aperture (Fig. 195). BLAIR immobilizes it similarly with a wire around a tooth (Fig. 195). Both methods

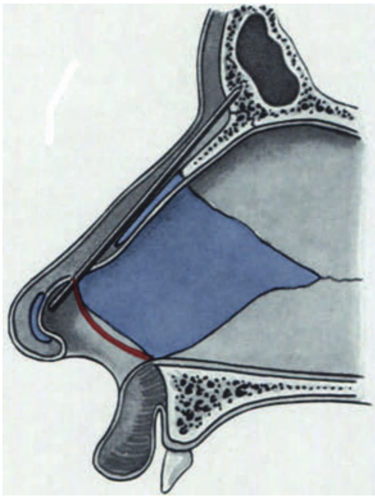


Fig. 194. Fixation of deflected nose by STRAITH, Jr. using KIRSCHNER wire which is inserted into the frontal bone

Fig. 195. Anchoring the base of the septum by means of thin wire to the piriform crest according to JOSEPH, or to a tooth according to BLAIR

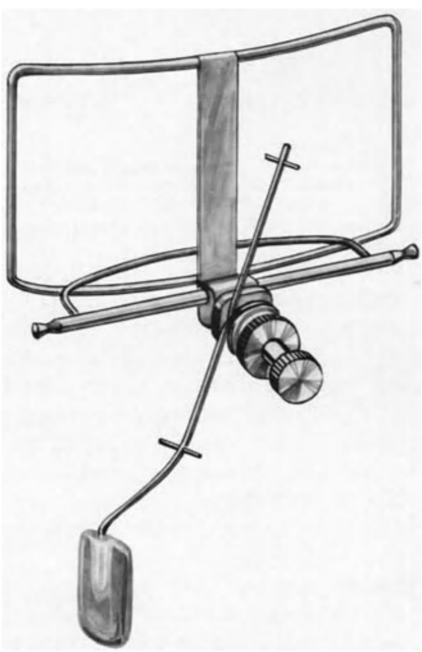


Fig. 196. Splint for use in corrected deflected nose with pressure pad and forehead anchoring, according to KAZANJIAN

Fig. 197. Modified splint for fixation of corrected deflected nose in place, according to KAZANJIAN

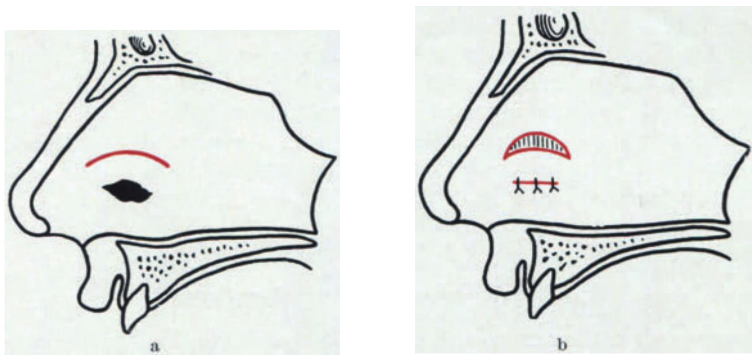
of fixation seem to be too uncertain and too complicated. Similarly impractical is the fixation of the respositioned lower and anterior septal cartilage to the columella as suggested by RANZOLIN and JOST. A mattress suture is passed between the medial crura of the lower lateral cartilage and is tied over the columellar skin. The danger exists that the columella and the membranous septum could both be displaced. In our experience X-ray film cut to size and applied bilaterally to the septum and held in place with packing has proved to be very successful. — In addition to the inner immobilization there are the external methods of fixation, such as plaster dressings, splints with pressure pads, and similar procedures. These will be described in the chapter on dressings. An original method of retention by GORLIA should be pointed out here. GORLIA made a very simple device. A pad which lies against the side of the nose is anchored to a forehead bandage above the glabella by means of safety pins. It exerts the proper pressure on the nose by means of a lateral tension-band. The horizontal traction is gained by fastening a band to the bandage behind the ear, also with safety pins. JOSEPH and GALTIER also developed a similar device with forehead bandage and pad. But the nasal splint of KAZANJIAN is more stable. Its pad is attached to a spring system (Figs. 196 and 197). — A plaster fixation dressing should be left in place for 10 to 14 days.

5. Closure of septum perforations

Perforations of the septum can be caused traumatically by accidents or as a result of surgery. They can also be manifestations of syphilis, tuberculosis or rhinitis atrophicans with nutritial disturbances. Correction of perforations is not always indicated, but repeated bleeding at the perforation border, excessive crust formation and pronounced whistling represent an indication for surgery.

Smaller perforations, which usually occur in the anterior part, are closed by means of *advancement plasty of the mucosa* (Fig. 198). Larger defects can be repaired by rotation of a mucoperichondrium flap on both sides of the septum. To do this the flap on one side is rotated over the perforation from the front or from below, and on the other side from the rear or from above. If necessary a *piece of cartilage* can be *rotated along with one mucoperichondrium flap* (Fig. 199). To close perforations about 1×1 cm in size we (MEYER) have our own method. In this the mucosa below the perforation and at the nasal floor is elevated together with perichondrium and periosteum and advanced upward as a wide bipedicled bridge flap. This is done on both sides of the septum. The mucosa must be incised bilaterally along the lateral border of the nasal floor. Spindle-shaped excisions are made in the mucosa around the perforation to make the adaptation of the advanced bridge flap possible beyond the upper rim of the perforation. One can cover the resulting defect at the nasal floor bilaterally with a free skin or mucosa graft (from the mouth) or one can let it granulate closed. All of these flaps must be sutured with painstaking care. We prefer nylon for these sutures. — CABRERA-TRIGO and IAPALUCCI described a similar procedure, but from an oral approach.

We (MEYER) have developed an even more extensive advancement plasty for covering larger anterior perforations. One must expose the anterior and lower border of the septal cartilage. This is done after the bilateral intercartilaginous incision, décollement of the dorsal skin and after the transfixion incision and separating the upper lateral cartilages from the septum at their medial attachment. This enables one to undermine the whole mucoperichondrium around the perforation, like a wide frame. The mucoperichondrium can then be advanced rearward as far as is necessary for the anterior part of the mucosa to cover the perforation. On the other side the mucoperichondrium is undermined from the upper septal border and advanced forward over the perforation. To relieve tension a vertical incision about 2 cm farther posteriorly makes this advancement possible. As a result the perforation is covered by the mucosa from posteriorly on one side and from anteriorly on the other. — CLIMO likewise recommends an extensive elevation of the mucosa around the perforation together with similar flap advancements. ZAOLI leaves a disc of cartilage attached to the mucoperichondrium which is to be advanced forward. He cuts around this disk and separates it from the other side. This congruent closure of the perforation with the cartilage



Figs. 198a and b. Closure of recent septum perforation following submucous septum resection (SEIFFERT). a Mucosa incision through mucous membrane above the perforation. b Situation after closure of the perforation. (From H. J. DENECKE)

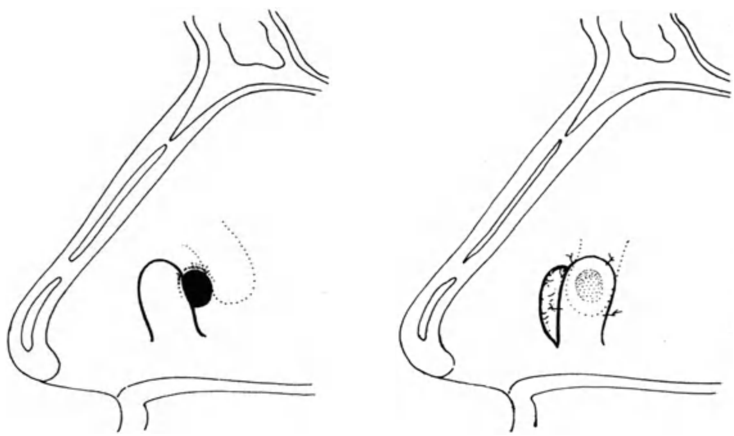


Fig. 199. Closure of a small septum perforation by means of two transposition flaps from the neighboring mucoperichondrium. Dotted line shows flap on the opposite side

has the effect of moving the perforation rearward. But there it is entirely covered from one side by mucoperichondrium. SEIFFERT has recommended two methods in which mucosa from the inferior turbinate is pulled over for closure of the perforation. In one method a *mucosa flap from the turbinate* is cut, turned into the perforation and sutured (Figs. 200, 201). If the perforation is at the level of the inferior turbinate, then the perforation can be closed as in the second SEIFFERT procedure by the temporary formation of a *synechia of septum and turbinate*. If it has not already been done, one now performs a submucous resection of the septum. Then the perforation border and the corresponding part of the turbinate are freed of their epithelial lining, and the septum is held against the concha with packing until they are healed together (Figs. 202—204). When vascularization is assured, the mucosa of the turbinate in the region of the perforation is separated from the turbinate. In larger defects this should be done gradually. The septum then springs back to its median position.

In 1951, independently of each other, LINK and MEYER described a simple procedure for the closure of septal perforations. LINK has *obturators* of Supramide

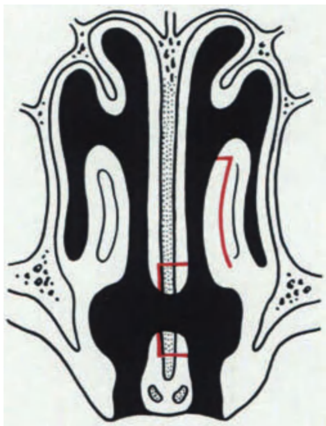


Fig. 200. Closure of a septum perforation by means of a flap swung across from the inferior turbinate, by SEIFFERT. The red lines show the region to be prepared on the septum and the flap to be formed on the inferior turbinate. (Horizontal cross-section of the nose.) (From H. J. DENECKE)

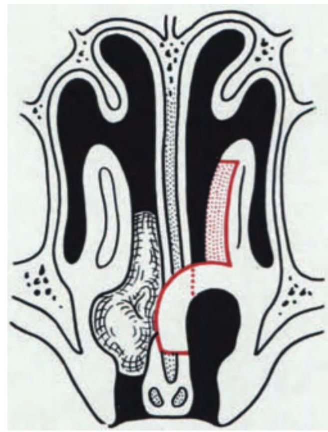


Fig. 201. Closure of a septum perforation by means of a flap swung across from the inferior turbinate, by SEIFFERT. A mucosa flap from the turbinate closes the septum perforation. (Horizontal cross-section of the nose.) (From H. J. DENECKE)

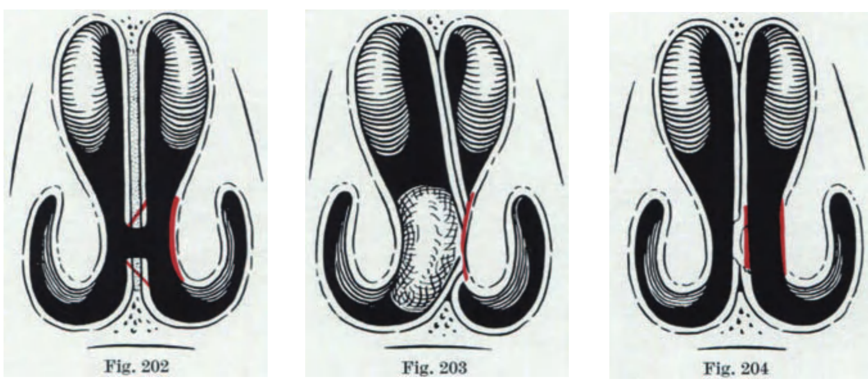


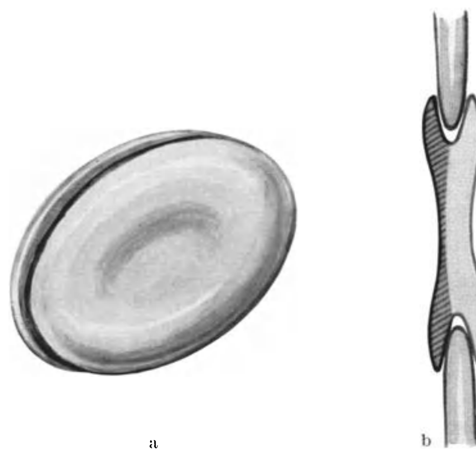
Fig. 202. Closure of a septum perforation by means of synechia formation, by SEIFFERT. Septum and inferior turbinate are prepared as indicated by the red lines. (Vertical cross-section of the nose.) (From H. J. DENECKE)

Fig. 203. Closure of a septum perforation by means of synechia formation, by SEIFFERT. After submucous resection of the septal cartilage the septum is packed against the raw surface of the turbinate to form a synechia. (Vertical cross-section of the nose.) (From H. J. DENECKE)

Fig. 204. Closure of a septum perforation by means of synechia formation, by SEIFFERT. After complete union of the septum with the inferior turbinate, the septum is separated from the turbinate. (Vertical cross-section of the nose.) (From H. J. DENECKE)

made for the perforations, while the two-layered obturator by MEYER is made of nylon. Under topical anesthesia a wax impression of the perforation can easily be taken. A model of the obturator is shaped out of pink wax. A wheel-shaped button made of the appropriate artificial material can easily be manufactured with this model (Figs. 205a and b). For the closure of larger perforations one layer of the obturator can be made of acrylite, an acrylic acid methylester. This can be polymerized together with the other layer which is made of rubber-soft nylon (Fig. 205b). This makes one half of the disc stiff and the other flexible. We have had the experience, however, that the all-nylon obturators are tolerated better at first and become harder after a few years. Thus they are preferable to the two-piece ones. — In very large perforations which can not be closed with local plastic procedures and in which the nostril is too small for the insertion of the obturator, the approach must be enlarged by severing the columella at the base and making an incision as far as the perforation.

For information concerning reconstruction of the septum sacrificed in the removal of a tumor together with the columella and the nasal tip, the reader is referred to reconstruction using distant flaps. This is found in the chapter on replacement surgery of the nasal tip (see p. 365).



Figs. 205a and b. Obturator of plastic for closure of septum perforations (R. MEYER). a Side view of obturator. b Vertical cross-section of the septum perforation with obturator in place. Dark hatching shows part of obturator which can be made of solid plastic

6. Skin grafting (dermoplasty) on nasal septum and in nasal cavity

To combat *nosebleed in hereditary teleangiecstasia* (Osler's disease), resection of the mucosa in the nose and replacement with split-thickness skin grafts is used. W.H. SAUNDERS folds the alae upward after incision in the alarfacial junction and removes the mucosa at the septum and floor of the nose while protecting the perichondrium and periosteum. He begins the dissection at the nasal tip and at the posterior edge of the vestibular skin. The mucosa is elevated as far as possible, at least in the region of the anterior half of the septum, down to the nasal floor. The exposed surface is covered by a split-thickness skin graft applied bilaterally to the septum and the floor of the nose. In addition, one replaces the mucosa of the lateral nasal wall with skin behind the border of the vestibular skin, particularly in the anterior part of the inferior turbinate. The grafts on the septum and on the lateral nasal wall are carefully sutured to the vestibular skin with catgut. One is then assured that the sutures will hold the skin firmly when the nose is subsequently packed with strips of ganze. The packing should be left in place for at least 4 or 5 days. According to SAUNDERS, mistakes in the plastic surgery of the lateral nasal wall are likely to result in recurrent bleeding. The operation can be done using local anesthesia. The bleeding can be reduced by using additional vasoconstrictive agents within tolerable limits.

LEWY and HAMMOND have expanded the technique of SAUNDERS by opening the nasal cavity wider. By means of lateral osteotomy the bony nasal pyramid is folded back. With protection of periosteum and perichondrium, broad areas of the septum and the nasal cavity are then freed of mucosa and resurfaced with skin. With the extensive approach in the manner of a lateral rhinotomy, this operation can first be done on one side only. The other side is treated similarly a few weeks later. According to observations by SAUNDERS, crusts form in the nose for 1 to 2 months afterward. The discomfort can be made tolerable with the use of boric acid powder and lanolin ointment. Since the patients are afraid to blow their nose for fear of renewed bleeding, the crusts are removed only minimally. However, they are aided considerably by the complete cessation or the reduction of nasal bleeding. Flaps chosen too large can lead to necroses of the excess skin. These are sloughed off after a short time. Since not all parts of the nasal mucosa can be replaced by this procedure one must of course reckon with recurrent bleeding, as already mentioned. But this bleeding should occur to a greatly reduced extent. — Dermoplasty (skin grafting) represents considerable progress in the treatment of nosebleed due to Osler's disease, even if it only helps to do away with a bothersome symptom. In bleeding as a result of septum perforations, the method with the THIERSCH grafts has not been successful, because the perforations do not remain closed, due to necroses (LEWY).

IX. Correction of saddle nose

1. General considerations

Saddle nose is one of the most common nasal deformities. It can be congenital or acquired. Acquired saddle nose is usually of traumatic origin. The syphilitic saddle nose, only seldom encountered in Europe, is due to a complete depression of the bony vault as a result of bone necrosis. In these cases the saddling affects especially the upper part of the nose. But usually pronounced flattening of the whole nasal structure is present. In Europe today, tuberculosis is as rare as syphilis as a reason for the breakdown of the nasal structure. More often unspecific inflammations like septum abscesses with cartilage necroses — usually following traumatic hematomas — are to blame for saddling. Then the saddle affects the lower part of the dorsum. Traffic accidents, boxing, gymnastics, ball and winter sports are primarily responsible for traumatic occurrence. The development of a saddle nose due to multiple trauma is common among young boxers. ZORZOLI has studied this traumatology particularly. Birth trauma also plays a certain role. Unfortunately postoperative saddle noses are rather common. They occur after septum resections in which no cartilage support has been left in the lower part, in the "weak triangle" of CONVERSE in midline at the lower end of the upper lateral cartilage. MALINIAC, SELTZER and others have dealt especially with these problems (see also Fig. 1 and Fig. 164).

Many patients with saddle nose complain about *obstructed nasal breathing*. As a rule it can be observed that the nasal cavity is free and wide enough, but both vestibules are narrowed. The normally long, oval, slit-shaped inner nostril at the transition from the vestibule to the nasal cavity is flattened from above. The lumen is round or a flat oval. This diverts the air flow downward toward the inferior meatus; normal physiological conditions direct the air flow upward to the middle meatus and to the olfactory organs (see Fig. 14). This abnormal condition can be relieved by correction of the saddle nose, so that a functional indication exists along with a cosmetic one in such cases (MALBEC, MALINIAC, COTTLE, SELTZER, LEGLER and others). The round or flat oval inner nostril is to be found especially in those postoperative saddle noses in which a hump removal has been made after a submucous septum resection. If the cartilage remaining at the dorsum after the septum resection is not adequately high, then, with the subsequent hump removal, depression of the vault and cicatricious contraction occur readily. This can not be counteracted by any cartilaginous support.

With few exceptions the question must be answered affirmatively whether *several deformities of the nose* existing simultaneously can be corrected in one sitting. With simultaneous saddle nose and wide nose, saddle nose and deflected nose, or saddle nose and drooping tip, both deformities are corrected in one sitting. The chapter on septum corrections discusses the procedure in simultaneous saddle nose and deviated septum (see p. 115). It should be pointed out here briefly that less extreme saddling of the dorsum should definitely be corrected together with the septum deviation, since the cartilage excised is, as a rule, sufficient to fill the saddle. With more pronounced saddling, as well, the one-sitting procedure is recommended.

First the correction of so-called *pseudo-saddle-noses* is to be discussed here. They are noses which display an overly long, overly prominent tip with an otherwise normal bony structure or which have a slight hump in the bony dorsum together with prominence of the nasal tip. In the first case the tip is reduced by means of resections in the lower part of the cartilaginous septum and by reshaping the lower lateral cartilages in the anterior angle (Figs. 119, 120). In the second case the small bony hump is removed (see p. 43) and the tip is corrected as in the first case. If necessary, the nasal bones are repositioned toward midline (WOLFE).

If a *true saddle nose* is present, there are many ways to correct the saddle. The choice of procedure depends first upon the degree of saddling, and secondly on the grafting material available. Because of better "take", one should always strive to use autogenous tissue — best of all from the nose itself — and only in special cases to use foreign materials.

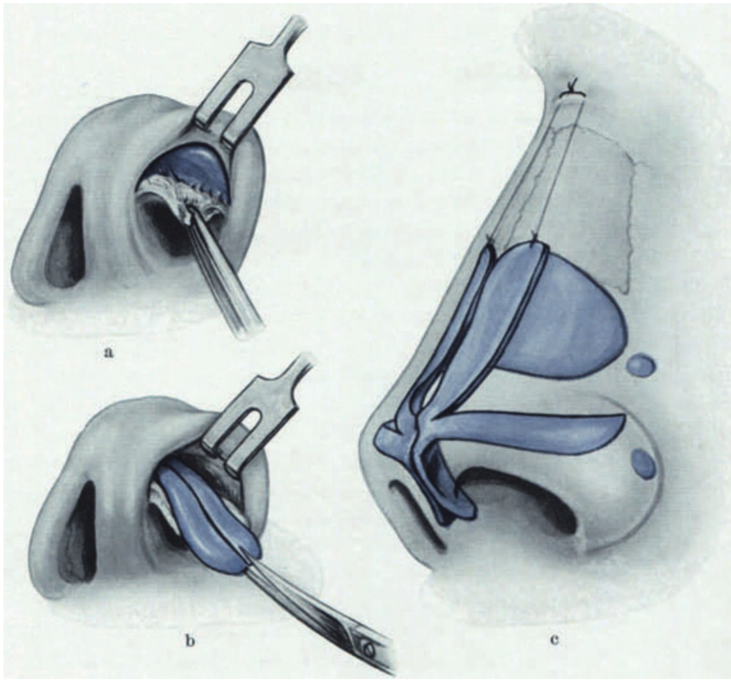
2. Correction of saddle nose of slight degree using tissue from nose itself

a) Correction with septal cartilage

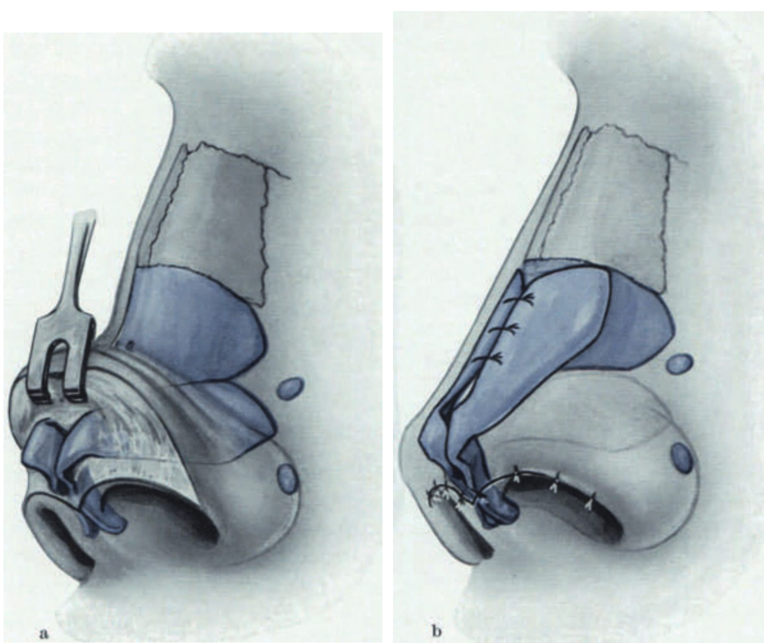
If the septal cartilage is still present, first the submucous septum resection is done in the typical manner (see p. 118). In doing this one should try to remove the cartilage in pieces as large as possible. The cartilage is then fitted to the shape of the saddle. Very small saddles can be built up with simple placement of a piece of cartilage fitted to the proper length and width. As a rule one will have better results in relatively slight saddling if one lays several pieces of cartilage one above the other. The procedure of SHEEHAN has proved to be practical (CONVERSE, SOMMER, SCHUCHARDT and others). SHEEHAN ties the shaped pieces of cartilage into a bundle with fine catgut before inserting them under the saddle. In this way the individual pieces of cartilage are kept from sliding apart.

b) Correction with lower lateral cartilage

If not enough material can be obtained from the septum, or none at all, then one can use parts of the lower lateral cartilages to make the small bundles of cartilage. Often one can resect a strip several millimeters wide from the *cephalic border of the lower lateral cartilage* bilaterally without changing the external nasal shape. In wide nose this procedure even leads to a desirable narrowing of the tip. To obtain the strip of cartilage from the lower lateral cartilages one uses either the eversion method or the luxation method (see pp. 81 and 84). One should be



Figs. 206a—c. "Flying wing" procedure of KAZANJIAN for correction of saddle nose of slight degree. a Exposure of lower lateral cartilage from vestibular rim incision. b Splitting the lateral crus of the lower lateral cartilage. c The upper half of the lateral crura are swung upward to the nasal dorsum. Fixation to the nasal root by means of suture passed subcutaneously



Figs. 207a and b. Correction of saddle nose of slight degree by LOZA. a Exposure of the lower lateral cartilages from a bilateral alar rim incision. b Swinging the entire lateral crura of the lower lateral cartilages upward to the nasal dorsum absolutely certain that no remnants of the vestibular skin are left on the grafts. These remnants sometimes cling quite firmly. On the other hand, the perichondrium should be retained. — Since the strips of lower lateral cartilage are angled between the medial crus and lateral crus one should break the spring in the cartilage strips by scoring them several times.

Incision in the nose, formation of the pocket, insertion and fixation of the graft are all described below. Here one should first mention a few other methods of filling the saddle using the lower lateral cartilages and without the aid of tissue foreign to the nose.

Wegener recommends placing the cartilage obtained from the lower lateral cartilage crosswise *as a curved rider*, rather than lengthwise. With this the angle of the lower lateral cartilage at the junction of the medial and lateral crura is used to form the prominence at the nasal dorsum. But this method has a disadvantage as opposed to the lengthwise insertion of the cartilage pieces mentioned above. The result is a relatively wide dorsal line. And in filling small saddles, in which a slight widening of the dorsum usually exists, it is particularly a matter of obtaining a narrow dorsum.

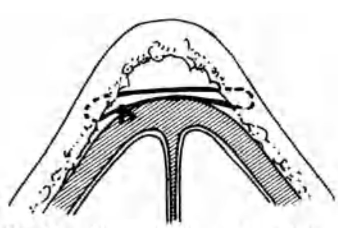


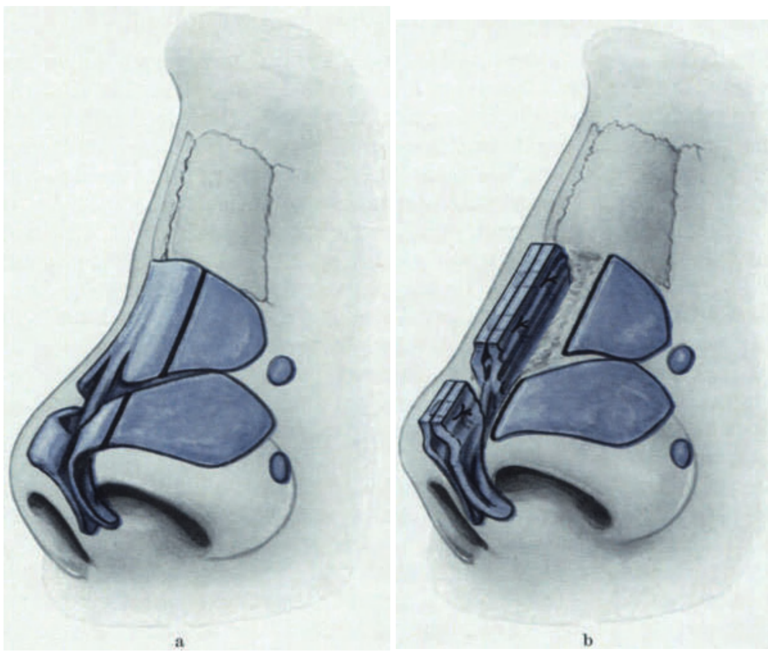
Fig. 208. Subcutaneous endonasal mattress suture of Link in saddle nose of slight degree

In depressions of the supratip area, the lower lateral cartilage is split lengthwise, and the cephalic border is rotated vertically upward to the edge of the dorsum. It can be sutured together with the similarly rotated cephalic border from the other side and thus fixed in this position. This method was described by Kazanjian as the "*flying wing procedure*" (Fig. 206). Schuchardt recommends this procedure in combination with the horn-shaped skin excision at the alarfacial junction for shortening the nasal tip. Winkler and others like to combine it with cartilage strip grafts from the septum to the dorsum. This procedure proves to be quite good. In order to pull up the mobilized cartilage flaps and for their fixation, a fine nylon mattress suture through the dorsal skin in midline is recommended (Dingman and others). It is better, however, to make this suture subcutaneously. This can be done well bilaterally through the intercartilaginous incision and also from the vestibular rim incision. In some cases, particularly if additional corrections are still to be made on the columella, exposure of the entire cartilaginous structure of the nasal tip by means of folding back the skin after Réthi, Šercer or Loza is recommended (Fig. 124). Gonzales Loza also suggests rotating the *entire lateral crura* of the lower lateral cartilage upward like the pages of a book and suturing them together with three catgut mattress sutures like the ridge of a roof (Fig. 207).

c) Correction by narrowing

For the elimination of slight saddling *in the region of the upper lateral cartilages*, Link has described a method with neither graft nor transplant. After bilateral décollement over the saddle as far as the inner canthus, the glabella and the adjoining soft parts of the cheek, the skin over the saddle is pulled together in the middle by means of a subcutaneous, endonasal mattress suture. The defect is alleviated by tying the suture tight (Fig. 208). It would seem difficult to achieve a good symmetry of the dorsum with this technique. In addition the danger exists that external depressions might occur at those points where the suture is subcutaneously situated, or that the suture would tear loose since it can only be passed through connective tissue. — SCHMALIX proceeds similarly to LINK, but he only pulls the skin together using strips of adhesive tape: After décollement of the dorsum in the area of the saddle, and after separation of the caudal end of the septum from the columella. the nasal skin is pulled together by means of adhesive tape strips from below and from both sides toward the middle. This method does not seem effective enough either. It might be usable in extremely rare cases.

Depressions *in the bony part of the dorsum* can be corrected by means of osteotomy, median displacement and raising of the nasal bones. Thus, in slight cases,



Figs. 209a and b. Correction of saddle nose or flat nose of slight degree by KAZANJIAN and STRAITH. a Incisions in the cartilage. b The median parts of the upper and lower lateral cartilages are folded upward subcutaneously and sutured together

one can do without grafts, or one can additionally use smaller autografts from the septal cartilage or from the lower lateral cartilages. Here also, it is important that the lateral osteotomy be done as far laterally as possible. In the median repositioning, the bony plate should not be wedged in and depressed, as in the correction of wide noses or hump noses (see p. 68). Instead, the bones are raised somewhat. Endonasal packing can help in doing this.

d) Correction with upper lateral cartilage

According to STRAITH the nasal tip is raised by folding it back and suturing together the dome portions of the lower lateral cartilages. The same is possible farther up *bilaterally with rectangular flaps from the upper lateral cartilages* (KAZANJIAN). The cartilage flaps are likewise rotated toward midline and sutured together. The sutures should be tied subcutaneously and not penetrate the skin like mattress sutures. The paramedian incisions for formation of the cartilage flaps to be rotated are parallel to the midline and 2 to 3 mm laterally from it. This is to be done on the lower lateral cartilages as well as on the upper lateral cartilages

(Fig. 209). The spring of the cartilage can be broken by scoring. For better viewing, MAY begins this procedure with the well-known RÉHTI incision at the columella (Fig. 124). JOUNG has performed the operation of KAZANJIAN successfully on a seven-year-old child. DINGMAN modified the procedure of KAZANJIAN. He approximates the lateral stumps of the upper lateral cartilages like a roof over the upturned medial cartilage flaps and sutures them together. According to MALINIAC the *upper lateral cartilages, which have been completely freed* laterally, can be rotated upward so that their edges overlap to raise the dorsum.

3. Correction of saddle nose with implants

To eliminate a pronounced saddle nose one must implant subcutaneously an appropriate replacement piece as a support. On the other hand, if the nose is shortened and disfigured by destruction of the soft structures and by extensive scar formation, then a larger plastic operation with additional replacement of skin appears to be necessary. We differentiate between saddle noses with normal tip position and saddle noses with depression or reduction of the tip. In the first, only the dorsum is built up by means of a supporting implant. In the second, an additional support in the tip and columella is necessary. Both supports can be made in one L-shaped piece, or they can be composed of two pieces which are jointed in some way in the nasal tip. As support material auto-, homo- and heteroplastic grafts, as well as alloplastic grafts, can be taken into consideration. Cartilage, bone, and skin (dermal grafts) are considered to be autoplastic material for the nose. Dermal grafts in rhinoplasty are only autoplastic. In the nose heteroplastic grafting (from animals) is done only with cartilage or a Kiel bone graft.

Before discussion of the various graft and implant materials, a few general reasons for subcutaneous nasal implants should be mentioned. If cicatricious processes in the area of the saddling at the dorsum are present, then neither at the dorsum nor at the nasal tip should the skin be stretched by the supporting material. If a saddle nose gradually is formed after a traumatic or postoperative septum abscess, then one should not wait until the saddling process due to cicatricious formation has come to completion. Instead one should eliminate the depression of the dorsal skin at an early date be means of grafts from the rest of the septal cartilage or by implantation of alloplastic material. With regard to this HANSEN recommends the replacement of the destroyed cartilage with implantation of a graft made of Polystan.

a) Historical review and general remarks concerning preparation of grafts

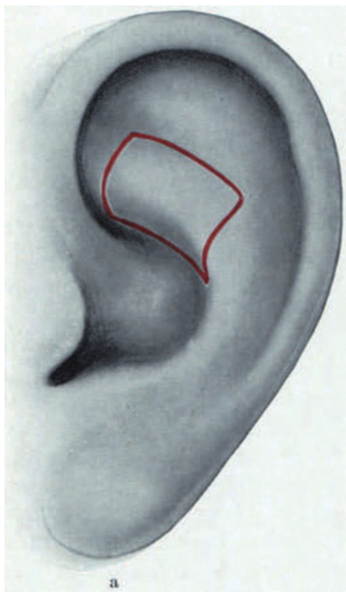
α) Cartilage

Since LEOPOLD (1881) it has been known that in animal experiments homografted cartilage lives much longer than all other homografted tissue. In 1913 DAVIS found that in animal experiment there is practically no difference between autografted and homografted rib cartilage. This was confirmed by GORBUNOFF. With a successful graft of rib cartilage from one boy to another 6-year-old, PEER showed in 1955 that the cartilage had grown after four years and that the chondrocytes were still living. In one area the cartilaginous tissue was absorbed and replaced by connective tissue. PEER and other authors like KIRKHAM and YOUNG have previously seen that autografted cartilage retains its normal structure. It has become apparent that homografted cartilage as well does not undergo any particular change. This is contrary to all other tissues. This fact was explained in that chondrocytes do not come into direct contact with the host tissue because of the matrix surrounding them, and that the matrix does not form antigens, at least not in individuals of the same species. Naturally cases have also been described in which a complete absorption of the homografted cartilage has occurred. GIBSON and DAVIS and PEER do not ascribe this to an antibody-antigen reaction, but are of the opinion that the cartilage did not "take", as can be the case in autografts as well. PEER (1945) thinks that poor nourishment due to inadequate vascularization during the first days after the grafting, with subsequent dying of the chondrocytes and slow absorption of the matrix are to blame. According to SCHOFIELD a hematoma around the graft is supposed to favor absorption of the cartilage. According to PEER, with regard to the absorption of the cartilaginous tissue, it does not matter whether the graft is covered with perichondrium, either in homografted or autografted cartilage. Although ROLLO (1930) and FISCHER (1882) stressed the importance of leaving the perichondrium on the graft, PEER, like MANNHEIM and ZYPKIN, is of the opinion that the perichondrium should absolutely be removed (quoted from CRAIGMYLE). Since homografted cartilage more or less acts like autografted cartilage, homografts are advocated strongly everywhere. Cartilage cells are said to outlive bodily death by three days, so that it also appears practical to preserve cartilage from the deceased and to use it as a graft material.

Cartilage bank. Cartilage can be kept up to six weeks at a temperature of $+4^0$ C. Therefore cartilage banks have been formed in many large hospitals. The cadaver from which the cartilage is to be removed must be young, so that no areas of calcification are present in the cartilage. In addition the deceased must not have suffered from an infection or a malignoma. The cartilage must be removed with aseptic and antiseptic care. It should be preserved in a sterile, if possible, an antibiotic solution. — Among the Americans, STRAITH and SLAUGHTER have shown that in the nose equally good results can be obtained with homografted rib cartilage as with autografted cartilage. These authors use merthiolate as a preservative solution. It is a mixture of one part 1:1,000 aqueous merthiolate combined with four parts of sterile normal saline as in the formula of C. W. PIERCE and G. D. O'CONNOR. SCHOFIELD uses 1:4,000 merthiolate in normal saline at $+1^0$ to $+2^0$ C. He transplants only cartilage from cadavers. Perichondrium and the uppermost layer of the cartilage are removed. The usual serologic and bacteriologic test must be negative. SCHOFIELD emphasizes the importance of precise position of the grafted bank cartilage in the pocket of tissue and precaution against subsequent bleeding, and in some cases, fixation by means of catgut sutures. Especially, in rhinoplasties in children he thinks the method expedient in which, according to his opinion, new grafts are always necessary after a certain time due to the growth. — Like O'CONNOR and PIERCE, BROWN and MCCARTHY DE MERE (1948) gave exact data concerning the preservation of cartilage in the cartilage bank using a 1:1,000 merthiolate solution. Merfen solutions and Celex solutions have also been suggested as preservatives. RICCA and KISELEVA report on preservation in 70% alcohol. KISELEVA leaves the graft material which has been freed of soft tissues and perichondrium for 1 year and longer in alcohol. He makes the material workable after placing it for ten minutes in warm normal saline solution. HOFFMANN goes his own way with regard to preservation of cartilage. He embeds the cartilage in the acrylic, Palavite, and can preserve it there for months. We preserve our pieces of cartilage in a 1:1,000 aqueous merthiolate solution in a refrigerator.

Obtaining cartilage from the ear as autograft. From an incision on the retroauricular surface, a piece of cartilage of corresponding size and shape is removed from the region of the antihelix (Fig. 210a) and is used to build up the upper part of the dorsum. Since the graft must "straddle" the dorsum after its insertion into the prepared pocket, the graft must be shaped appropriately (Fig. 210b). The shaping and smoothing of the inner surface can be done with a knife or a burr. In this procedure the edges of the inner surface should be made smooth.

Diced cartilage as autograft. In addition to the use of larger pieces of cartilage for filling saddle noses, another form of cartilage graft has been known since 1943. According to PEER small pieces of 1 to 4 mm thickness are chopped from the cartilage removed and are used as autografts or homografts for replacement of the nasal structure or of other cartilage and bone defects. PEER called this type of graft the "*diced cartilage graft*". With this manner of grafting he needed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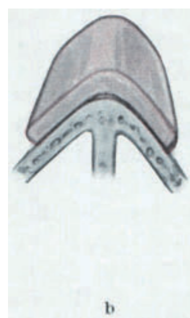

b

Figs. 210a and b. Autograft from the auricle in the nasal dorsum in saddle nose of slight degree. a Cartilage graft from antihelix outlined in red. b Auricular cartilage in place on the dorsum

a relatively large opening for the insertion of the cartilage pieces into the soft tissue bed. DE KLEINE has modified this method of PEER. He injects the very finely chopped cartilage under the skin through a small incision by means of a heavy metal syringe with a large gauge needle. He calls this cartilage injection device the "chondrojet" (Fig. 211). One can use this method for autografting as well as for homografting. Recently, however, the method has been abandoned for building up the dorsum, but in plastic reconstruction of defects of orbit, maxilla, etc. it has remained a practicable method.

Meniscus cartilage as homograft. A further innovation in cartilage grafting was the use of meniscus cartilage as a homograft in the correction of saddle nose. The method was published in the same year (1952) by MIR Y MIR and by VIDAURRE, while it had been suggested in Argentina ten years before by DELLATHIANE RAWSON and by ARES PAGOCHAGA (quoted from MIR Y MIR). In 1953 MIR Y MIR reported 22 successful cases of meniscus cartilage grafts (Fig. 212). He describes the meniscus consisting of connective tissue cartilage as the optimal material for homografts. This cartilage is very elastic and does not become brittle when dried as hyaline cartilage does. Later bending, as is often the case with grafted rib cartilage, has allegedly not been noticed with this material. — VIDAURRE obtains his cartilage from the orthopedic department and uses it as soon as possible after storage in aqueous merthiolate for one month. Due to the already triangular shape of the cross section, much shaping work is unnecessary. — However this graft material has not become very popular. Discussion of this method ceased, probably because the results were not satisfactory after all. According to personal information, MIR Y MIR has also abandoned his method.

Heterografting of cartilage. KOENIG (1896) was the first to autograft living cartilage. Homografts of cartilage were first introduced much later by PEER in 1939. In 1933 STOUT described the grafting of ox cartilage for nasal reconstruction. He preserved the cartilage in formaldehyde and rinsed it before use in sterile water. This heterografting was also tried by SPANIER (quoted from FRÜHWALD), but the method only became generally known later when WARDILL and SWEENEY published their results in 1947 (quoted from GIBSON and DAVIS, 1953). These authors used cartilage from the xiphisternum of the ox, placed it for 1 minute in boiling water and kept it in 1:4,000 merthiolate solution. GILLIES and KRISTENSEN (1951) report on the further trial of this grafting in the same hospital. They had already made 65 grafts of ox cartilage in the nose with very satisfying results. In 95% of the cases the grafting to the nose was successful. Histologically it was shown that a connective tissue capsule formed around the heterograft. The absorption of cartilage was only insignificant, so that the method of the two authors could be recommended.

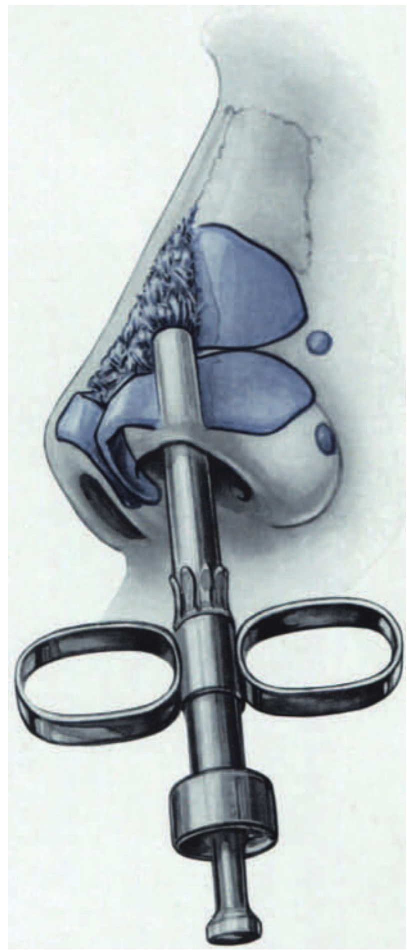


Fig. 211. Correction of saddle nose of slight degree by means of lining with diced cartilage using the "chondrojet" of DE KLEINE through a small vestibular rim incision

In 1952 and 1953 COTTLE, QUILTY and BUCKINGHAM made further reports about successful use of ox cartilage in rhinoplasty. Their success was about 80%. They too place the cartilage from the sternum of the ox in 1:4,000 merthiolate solution which is changed weekly. In children they could obtain equally good results with human and with ox cartilage. 10% to 20% absorption is always to be expected. They consider the *early filling of a shrinkage saddle* following septum hematoma and septum abscess very important. This should be done before the two mucous membranes have fused together inseparably with scarring, i.e. 8 to 10 days after trauma or infection. It is true that the grafted cartilage is said to dissolve, but one thereby gains space for a definitive graft 1 to 2 years later. We have had the same experience. For this reason we likewise recommend an early correction of the hematoma or abscess nose. But in this case we consider grafting of plastics simpler and better, since it actually is only a matter of a temporary solution. — In 1953 NORTH wrote with little enthusiasm about his experience with ox cartilage as graft material at the hospital of KILNER in Oxford. According to his investigations, in spite of good success at first, the later absorption of cartilage was said to be so considerable that he advised against routine grafting of ox cartilage. He was able to determine that the postoperative absorption of cartilage was very great, especially in children. In patients under 20 years of age complete absorption in 71% of the cases was confirmed, in older patients 50%.

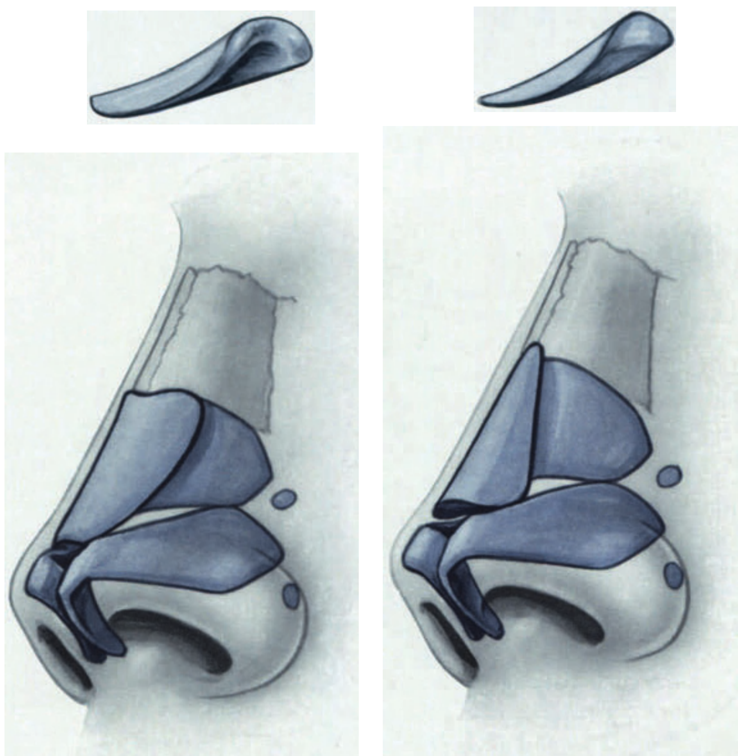


Fig. 212. Lining saddle nose of slight degree in the cartilaginous structure by means of meniscus cartilage according to MIR Y MIR

In 1953 GIBSON and DAVIS made further studies concerning the absorption of ox cartilage. These two authors could always determine a slight absorption of the grafted ox cartilage. It occurs first by superficial erosion and replacement by connective tissue, later by active breakdown of the cartilage. The speed of the absorption is inversely proportional to the area of the surface and to the thickness of the graft. This is an objection to the method of PEER using diced cartilage. GIBSON and DAVIS explain how cartilage grafts can now and then survive for years by assuming that with the first superficial erosion an avascular capsule of connective tissue is formed which prevents further absorption. Their investigations of ox cartilage coincided with similar ones on pig and sheep cartilage. In spite of the negative conclusions drawn by NORTH and by GIBSON and DAVIS, good results with ox cartilage are being reported continually. Thus KOSTEK considers calf cartilage the choice for graft material. He uses the cartilage of young and fetal animals and after its sterile removal keeps it in pre-frozen glass jars at -30^0 C for several days. Before the operation the frozen pieces of cartilage must be warmed for a few minutes. To favor adaptation, Kostek perforates the pieces of cartilage. The 3 cm thick hip joint cartilage is said to be best for rhinoplasty. O. Becker (USA) uses ox cartilage in his so-called *"mixed grafts"* along with striplike autogenous grafts of septal cartilage and septal bone. Peer can eliminate slight irregularities on the dorsum with the more readily absorbable and carring ox cartilage graft.

We reject the use of heterogenous cartilage, in spite of the various good results. We consider autografting of cartilage the best. Only in cases in which a fresh rib graft can not be considered for various reasons, or is declined by the patient, do we use the homograft of cartilage. Our third choice is the plastic graft. Our cartilage bank consists of septal cartilage, which has been stripped of perichondrium, and of pieces of cartilage remaining after the removal of a rib cartilage craft. These are kept sterile in the aqueous merthiolate solution in the refrigerator.

Homografting of cartilage. Only the most important information is summarized here from the many histologic studies about homografting of cartilage with which Peer particularly distinguished himself. Hyaline cartilage, elastic cartilage and connective tissue cartilage retain their characteristics after grafting. The cells of homografted cartilage survive the grafting several years (4 years demonstrated). This is because the surrounding tissue is avascular and because the gelatinous matrix is rich in mucoprotein, which affords the cells a certain protection. This matrix which represents a protective wall has the characteristics of a diffusible membrane in animals as well as in humans. As such it prevents the penetration of serum antibodies and of connective tissue cells from the host. Perhaps in humans antibodies enter, but alone they are unable to destroy the chondrocytes.

As animal experiments show, both host cells and antibodies must be present to break down the chondrocytes. But the matrix is gradually absorbed. Now when the chondrocytes have been robbed of their protective wall, they are destroyed. They are no longer visible among the ingrowing fibroblasts. A dead or dying chondrocyte has never been observed. On the other hand, the lingering of chondrocytes is important for the support of the non-living intercellular matrix. Thus the resistance of the matrix is again dependent on the cells. Cartilage grafts which have been treated with heat and which have dead cells generally show the tendency toward replacement by connective tissue. In animal experiment it was shown that the homografted chondrocyte can not build a new matrix because the host tissue robs the chondrocyte of the hyalin structure necessary for it. The life capability of the chondrocytes in grafted material could be tested with radioactive sulfur. Radioactive sulfur is only absorbed by living cells.

β) Bone

Instead of cartilage one can also graft bone in saddle noses. Many plastic surgeons prefer this grafting material. Bone has the advantage that it does not curl or warp postoperatively as cartilage does. When the surface of the bone graft comes into direct contact with the freshened surface of the nasal bones, a strong bond with the underlying tissue is formed so that the graft remains immovable. Of course this is an advantage only to a certain extent, since one would rather have the lower half of the dorsum somewhat mobile. One disadvantage of bone is that it is not as easily shaped. As has been mentioned, bone is also more readily absorbed, especially where the bone is subjected to the pressure of the overlying skin. — The three shapes described for cartilage are used principally in bone grafts as well. They are the simple straight graft for the dorsum, the two-piece dorsum and columella graft, and the one-piece, L-shaped, angled graft intended as support for columella and dorsum. With bone as well, autografting and homografting are used, while heterografting is practically unknown in rhinoplasty. Only TANTURRI reported (1925) on grafting rabbit rib in the nose.

Autografting of bone. The first bone grafts were made with fragments from the frontal bone. In 1875 HARDIE brought about fusion between a de-skinned finger bone and a saddle nose. In the second stage the finger was severed from the hand. Naturally this method was not imitated. In 1896 ISRAEL transplanted an autogenous tibia graft to the nose. In American literature one finds bone grafting in the nose for the first time in 1911, by CARTER. He was very much against the use of foreign material. During World War II bone grafting was practiced extensively. The material was taken primarily from the iliac crest, from the tibia and from the bony rib. Pieces from the bony septum, the nasal bones and the turbinates also were grafted to the dorsum. In the last 10 years it has been found that the bone from the nose, from the septum (vomer and ethmoid) and from the turbinates retains its calcified structure after grafting without periosteum, whereas bone from the rib, the tibia or the hip, with or without periosteum, is absorbed in a bed of soft structures (PEER). Other bones of the face and skull probably have the same characteristics as the bones of the nose already mentioned. Along with tibia grafts JOSEPH also used bony parts from the frontal process of the maxilla. He corrected saddle nose with a so-called "Umlagerungsplastik". That is, he sawed out the necessary piece of bone together with periosteum from the frontal process of the maxilla and positioned it in the dorsum after preparing a pocket. STUCCHI as well makes use of the advantages of the bones in the nasal region. He uses vomerine bone as autograft material (Fig. 213). Of course the vomer bone is not adequate for the formation of an angled graft.

Autografted and homografted bone in the nose. Today the view is generally prevalent that autografted bone is better than homografted bone. It has also been shown that periosteum is not important for a successful graft. In the grafted bone the calcified matrix and the osteocytes are gradually replaced by new matrix and new osteocytes from the host bone or from the surrounding connective tissue. This happens in autografted bone as well as in homografted bone. Only the cells in the autogenous bone tend to survive the grafting longer and to retain their specific, calcified matrix under normal conditions and functional activity. The bone union between the graft and the freshened nasal bone takes place by means of callus formation at the surfaces in contact with each other. In about 6 months, bone from the rib, the tibia and the ileum is replaced by connective tissue. This applies to cortical as well as to cancellous bone. Some experiments of graft research reveal that the cancellous grafts probably still contain living cells, but these have lost the capability of retaining their calcified matrix or their intercellular structure (PEER). Other authors like KOECHLIN maintain that with good vascularization of the host tissue, these bones could survive also, and that the cancellous bone could become cortical bone, even without contact with the other bone. KOECHLIN has placed tibia bone under the nasal skin, whereby this was rejected as a sequester, but in the meantime new bone hap formed. Thus opinions of the experimenters still diverge in several subjects concerning bone grafting. This is true although bone grafting has been common practice among surgeons for a long time and although the theoretical and practical problem of bone grafting seems to have been solved since LEXER'S day.

Homografting of bone. Since INCLAN reported the successful use of preserved bone grafts in 1942, grafting of bone tissue has received considerable impetus. The numerous reports about experimental investigations (MAATZ, ROTH, LENTZ and others) have still not been able to create a unified picture of graft conditions of bone tissue. There are also diverse views (ROTH, LENTZ, E. GOHRBANDT) about the best methods of preservation of bone grafts. BONFIGLIO and his colleagues recently showed that bone grafts cause an immune-allergic reaction just as skin grafts do. The cause of the failure of many homografts of bone is said to lie in the difference in protein bodies. In the protein molecule of the individual cell the sequence of the adjacent amino acids is specific for each human. Because

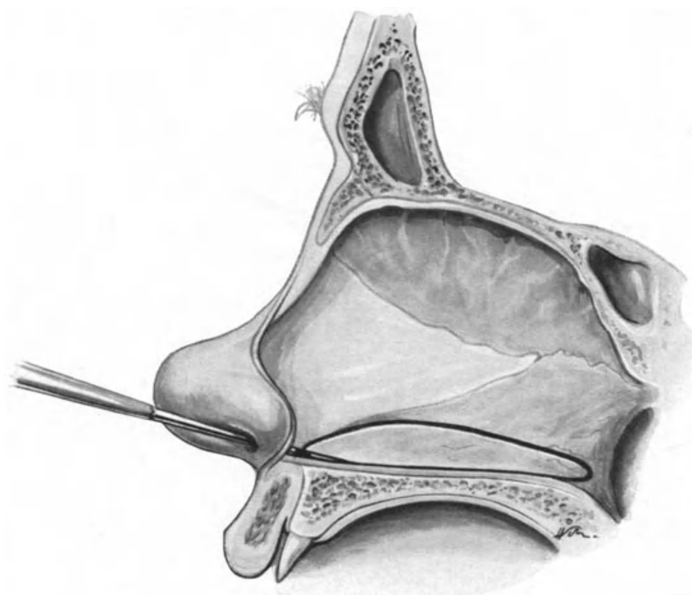


Fig. 213. Removal of a bone graft from the basal crest of the vomer for correction of saddle nose, according to STUCCHI

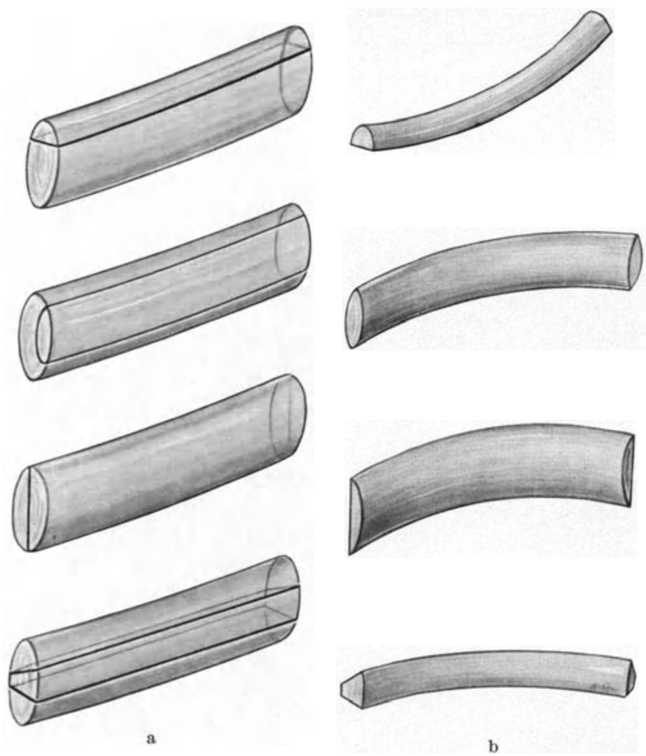
of grafting cells meet whose protein molecules consist of different polypeptide chains, and these are not compatible with each other. Antibodies are formed in the host which attack the graft when its cells begin to divide. It is a matter of systematic immunity in which the local reaction appears only as one of its manifestations. — In the last 200 years there has been much discussion and much has been written about the question of the osteogenetic property of the periosteum. The problem still has not been answered completely. A second question which has also not been answered completely concerns the further possibility of growth of a bone graft. Even in the last century MACEWEN stated that grafted that bone continued to live. ALBEE, KIEHN, FRIEDELL and MCINTYRE later also believed in the ability of grafted bone to continue to live. MOWLEM likewise assumed that grafted cancellous bone would continue to live. BARTH, LERICHE and POLICARD, as well as HUTCHISON and HAM opposed this idea. They said that viable tissue no longer existed in autografted and homografted bone.

Since we prefer cartilage grafting to bone grafting in the nose and have had better results with it, we do not have the large amount of experience with bone grafting that other plastic surgeons have who choose bone as their graft material. The good results of these surgeons will be discussed later (see p. 167).

b) Removal, shaping and insertion of grafts

α) Cartilage

Rib cartilage is most often used for larger grafts for which the septal cartilage is insufficient. The first grafting of rib cartilage was described in 1900 by MANGOLD, while the first autogenous graft in the dorsum was in 1887 by ISRAEL, who used a tibia graft. BERSON was the first to describe the grafting of an angled piece of cartilage. Among the well-known plastic surgeons who have used or still



Figs. 214a and b. Bending relationships of various cartilage grafts from the rib according to GIBSON and DAVIS. a Incision for removal. b Corresponding grafts after effects of internal stress

use rib cartilage are SHEEHAN, SPANIER, BECKMANN, SALINGER, BLEGVAD, FINK, HAUBERRISSER, REHM, CONVERSE, SMITH, DUFOURMENTEL, BROWN, MCDOWELL, SELTZER, PEER, BECKER (USA), AUBRY, WINTER, BARSKY. RÉTHI uses rib cartilage for pronounced saddle nose and plastic for slight depressions. Most plastic surgeons, especially the Americans, agree that cartilage from the same patient is still the best of all replacement materials which can be used in rhinoplasty. It is more resistant than bone and can much more readily be subjected to the pressure and pull of the surrounding tissue. It is absorbed less. Autografted cartilage absorbs plasma and lymph from the vicinity by osmosis and needs no vascularization for renewal. One must be sure to use no ossified cartilage nor cartilage which has degenerated. In spite of the viability of cartilage, the graft should *never come under pressure or tension,* because otherwise there is danger that the overlying tissue will become necrotic or that the graft will be absorbed. Thus one should never attempt too much with regard to tension in the area of the nasal tip, especially when scars are present. One should rather be satisfied with a partial cosmetic result than risk an atrophy and later necrosis of the skin as a result of circulatory disturbances. In any case one should give preference to cartilage, above all other replacement materials, in those cases in which a certain tension of the skin over the nasal tip can not be avoided. BECKER (USA) almost always uses cartilage. He chooses bone only in special cases in which large alae are present and the skin of the tip is not under the slightest tension. Autoplastic cartilage continues to live after grafting and retains a certain elasticity. Thus the nasal tip can still be moved somewhat laterally. But autografted cartilage, like homografted cartilage, has two disadvantages: the graft tends to curl. It also has a certain tendency to slip laterally from the midline and rock

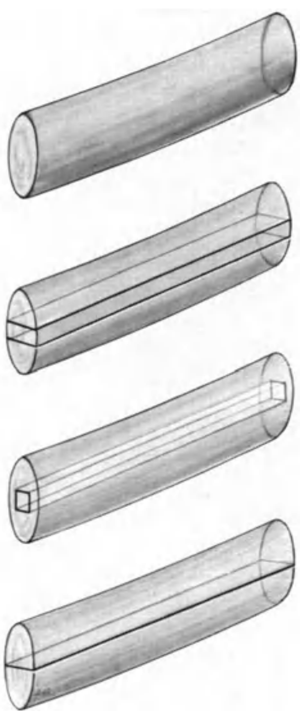


Fig. 215. Incisions for removal of balanced rib grafts according to GIBSON and DAVIS

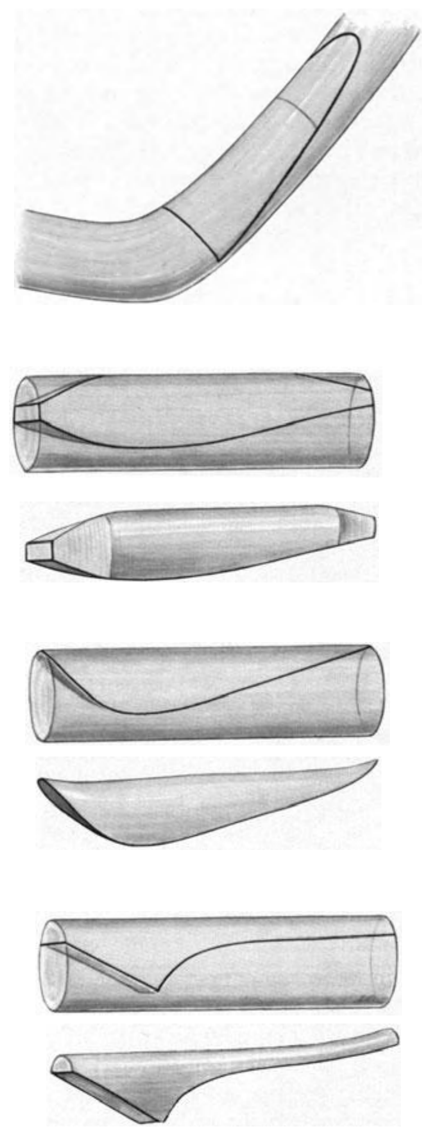


Fig. 216. Shape of various balanced rib cartilage grafts according to GIBSON and DAVIS

because it can not become fused with the bony support. According to MANNHEIM and ZYPKIN, the softer the tissue of the host bed, the greater the vitality of the autografted cartilage. According to BRUNNER the degenerative change of cartilage cells is less important than the ingrowth of connective tissue from the surrounding tissue. Thus the fate of the grafted cartilage is determined less by its degeneration tendency than by its resistance toward the surrounding connective tissue. Therefore cartilage covered with perichondrium is supposed to have greater resistance than cartilage which has been denuded. In addition to PEER and BRUNNER, IGLAUER, GILLIES, KILNER, and above all the two Englishmen, DAVIS and GIBSON have dealt with the absorption conditions and with the curling of grafted cartilage. DAVIS and GIBSON determined that an absorption process of cartilage takes place at every point where the surface of the graft is not covered with perichondrium. But this happens only during the first weeks after grafting. At an early date FR. BURIAN had started to remove a wide perichondrium flap together with the cartilage. This flap was as large as the graft and was wrapped around it. GILLIES and BARSKY, as well as most of the English and American plastic surgeons remove the perichondrium. The fact that *larger cartilage grafts often show the tendency to curl* or warp is handled by NEW and ERICH in the following manner. After sterile removal of the piece of cartilage from the rib, they boil the cartilage in a test tube for 10 minutes in an aqueous solution of sodium ethyl-mercuri-thiosalicylate (merthiolate). Treated like this the graft is supposed to undergo no postoperative change. GILLIES pointed out that the bending of the cartilage graft occurs particularly when the perichondrium has been left on only one side. The graft bends like a "bow with a bowstring". Although he recommended removing the perichondrium in all cartilage grafts, the grafts bent anyway. McINDOE and MOWLEM had the same experience. Even if the cartilage was previously implanted for a certain time under the skin of the abdomen, it still showed a tendency to bend in the nose. Of 91 cartilage grafts in the nose in one test series by MOWLEM on the patients of KILNER, only 30 grafts had remained completely straight. With regard to postoperative bending of cartilage, GIBSON and DAVIS were able to show that perichondrium makes practically no difference. According to these authors the stability of the graft depends more on whether or not a certain balancing of its cross-section has been obtained. Thus a graft will bend with or without perichondrium, for example, if it is in a border area of the rib. The two authors have schematically illustrated the shape of so-called balanced and unbalanced cross-sections (Figs. 214—217). With this they have depicted an approximate method which one can use for the proper shaping of rib grafts. All of their 46 nasal grafts have remained straight. Naturally the principles of GIBSON and DAVIS can not always be followed, since rib cartilage does not permit many ways of shaping larger grafts or angled grafts. In recent years, in order to prevent postoperative bending of the cartilage, we have either split the grafts and inserted the two halves placed back to back, or else we have scored them lengthwise a few millimeters deep on all sides. We have had relatively good results with these methods. The lengthwise scoring also can be made when the graft is already in place. An unscored graft can be inserted more easily into the pocket.

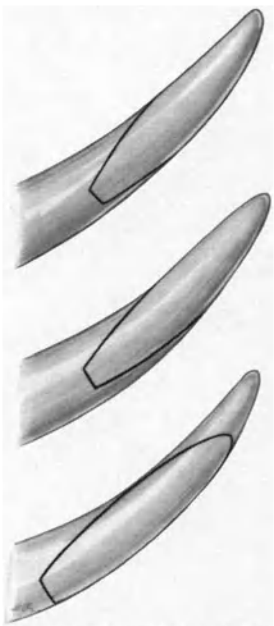
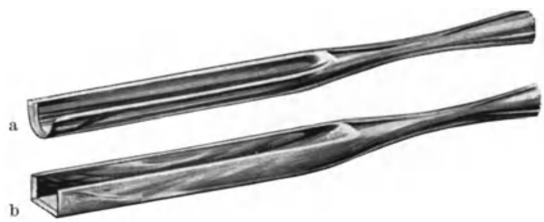


Fig. 217. Balanced cuts for rib cartilage grafts according to GIBSON and DAVIS

Removal of cartilage from the rib. Usually the 6th, 7th, 8th, and 9th ribs are chosen as donors for cartilage grafts. The 7th normally reaches the sternum, but the 8th and 9th do not. For the removal of *smaller straight grafts,* which are only supposed to build up the dorsum, we choose either the cartilaginous part of the 7th, 8th or 9th rib which runs diagonally toward the sternum, or else the almost horizontal, lateral part of the 7th rib, where the cartilage changes to bone. COHEN was the first to try to remove a piece of cartilage in the region of the transition from cartilage to bone. This is much practiced today, especially by the French plastic surgeons. In German-speaking countries this was published by ANDINA. Such small grafts are cut from the rib with the knife, or one can obtain them by means of a hollow chisel of SANVENERO-ROSSELLI (Fig. 218b). There are corresponding hollow chisels in various shapes. These come originally from MCKELLY (Fig. 218a) and are also known in the variation by VIRENQUE. We usually choose the free end of the 8th and 9th rib as the donor for such smaller, straight cartilage grafts. These ribs are joined by connective tissue with the cartilaginous part of the 7th rib. In this removal of cartilage, one can follow the advice of GIBSON and DAVIS and make a graft of pieces of cartilage which have a balanced cross-section. The medial part of the 7th rib, which runs diagonally toward the sternum, or the ends of the 8th and 9th ribs, can also be used for the removal of two-piece cartilage grafts, as recommended by GILLIES,



Figs. 218a and b. Concave chisels for obtaining cartilage grafts from the rib, by MCKELLY (a) and SANVENERO-ROSSELLI (b)

BARSKY and GALTIER. The two pieces of cartilage which are to support the dorsum and the columella are jointed in some way. The two parts of the graft devised by GILLIES are joined by means of a piece of perichondrium left in place (Fig. 223d). This keeps the joint mobile. But if one wants to remove a one-piece, fixed, *L-shaped, angled graft,* one must choose the less curved medial part of the rib cartilage (Fig. 219). In various papers and textbooks concerning surgery and plastic surgery there are illustrations of the removal of angled cartilage pieces from the straight part of the rib. This is impossible or impractical because that way the columellar portion of the graft is too small. E. SCHMID has shown the most favorable donor site and indicated two possibilities for obtaining a one-piece cartilage profile support. For this he chooses the 6th and 7th ribs, and in some cases the 4th, 5th, and 8th ribs (Fig. 219). We generally choose the 7th rib. We approach it from a diagonal incision about 8 cm long in the skin to the right and below the xyphoid level. If necessary, the M. rectus abdominis is incised laterally. Sometimes, if it is thin, it is possible to push it as far medially as is necessary for obtaining the graft. In this case, only its aponeurosis is incised. Thus the angulation of the 7th rib is exposed. The perichondrium is incised over the middle of the rib and is pushed upward and downward. The intercostal muscles and the vessels just beneath the rib are pushed aside also. Now one has two possibilities for removing the graft, as SCHMID shows. One method has the longer arm of the L toward the medial side of the rib angulation, that is, in the longer cartilaginous part. The other has the long arm of the L extending laterally beyond the cartilage-bone junction. The latter is desirable in some cases if the upper end of the graft should consist of bone (Fig. 219). Our cases, as well, have shown that the upper cartilage-bone junction on the angled graft does not bend postoperatively. The piece obtained should always be as large as the necessary graft, the shape and size of which have been determined previously in a model (Fig. 220). Such models are used by most plastic surgeons who use angled grafts. The models are made of the most diverse materials, such as sheet metal, thick canvas cloths, and wax and paraffin either carved or kneaded. With the knife, the rib is incised to such a depth that a layer of cartilage about 2 mm thick remains attached to the perichondrium adjacent the pleura. In the excision, the border of the long arm of the L is incised diagonally through the cartilage as in Fig. 219 to about $^{2}/_{3}$ the depth of the cartilage. Longitudinally at the border of this incision, a cartilage prism is cut out. Then the rib of the recumbent patient

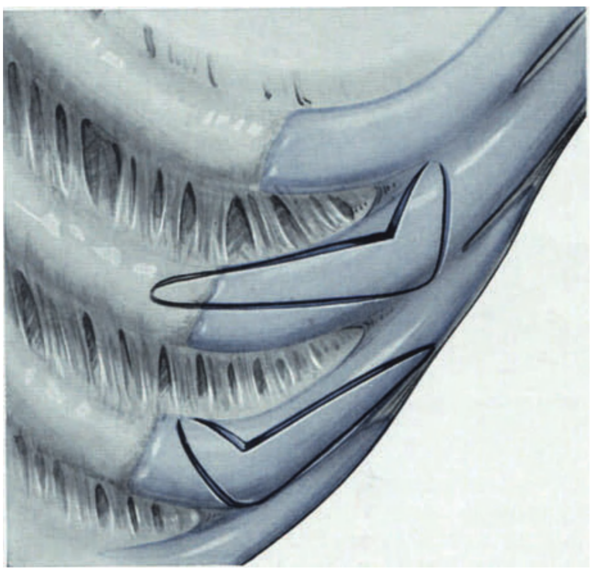


Fig. 219

Fig. 220

Fig. 219. Removal of angled grafts from the seventh and eighth ribs on the right. The upper graft includes bone; the lower graft is in the less curved portion of cartilage (see text). Where the cartilage of two ribs meets, the union is syndesmotic

Fig. 220. Making the model of the nose to shape a graft

can be incised as horizontally as possible, i.e., almost parallel to its surface. With a sharp Joseph elevator the two incisions situated opposite each other at about the same depth are joined beneath the graft. Since a cartilage plate about 2 mm thick has been left over the pleura, it is practically impossible to injure the pleura. Then one proceeds to the mobilization of the smaller arm of the L. Finally, the piece to be excised remains attached at the most tricky spot, the angle between the edges of the two arms of the angled graft. Here along the lower border of the angulation of the 7th rib, there is usually only a crevice-like syndesmotic union with the curve of the 8th rib (Fig. 219). This is not always to be shown in the illustrations of anatomy texts. This narrow crevice must be found carefully with the raspatory and the graft loosened slowly. At this point it is easiest for injuries to occur either to the pleura or to the bend in the cartilage. It is best to remove a piece of the 8th rib analogous to the exposure of the cephalic edge of the graft so that the 7th rib can be better undermined. Thus, by cutting carefully with the elevator, one can separate the graft completely from the underlying tissue and lift it out. Finally the perichondrium is sutured together over the donor site, the fascia of the rectus abdominis is fixed to it with a few catgut sutures, and the skin incision closed. We consider this method for removal of a piece of cartilage from the rib to be good. With respect to protection of the pleura it is safer than the technique with the DOYEN rib elevator used by chest surgeons (Fig. 221). In the area of the bone-cartilage junction, if some bone is to be removed as well, then one often is not able to sever this part with the cartilage knife or with the elevator of JOSEPH and must resort to the chisel. Otherwise the cartilage can be incised with the usual Parker No. 15 or with the special cartilage knife (Fig. 222). Since the graft is

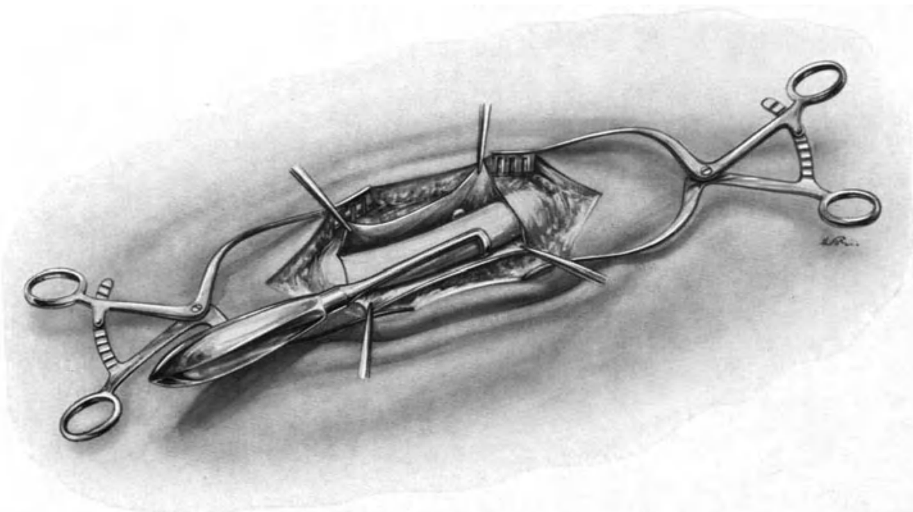


Fig. 221. Obtaining a rib graft using the Doyen elevator. The perichondrium is split open. The ring-shaped elevator of DOYEN is introduced around the rib for mobilization

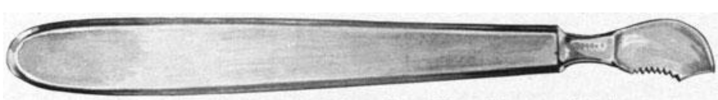
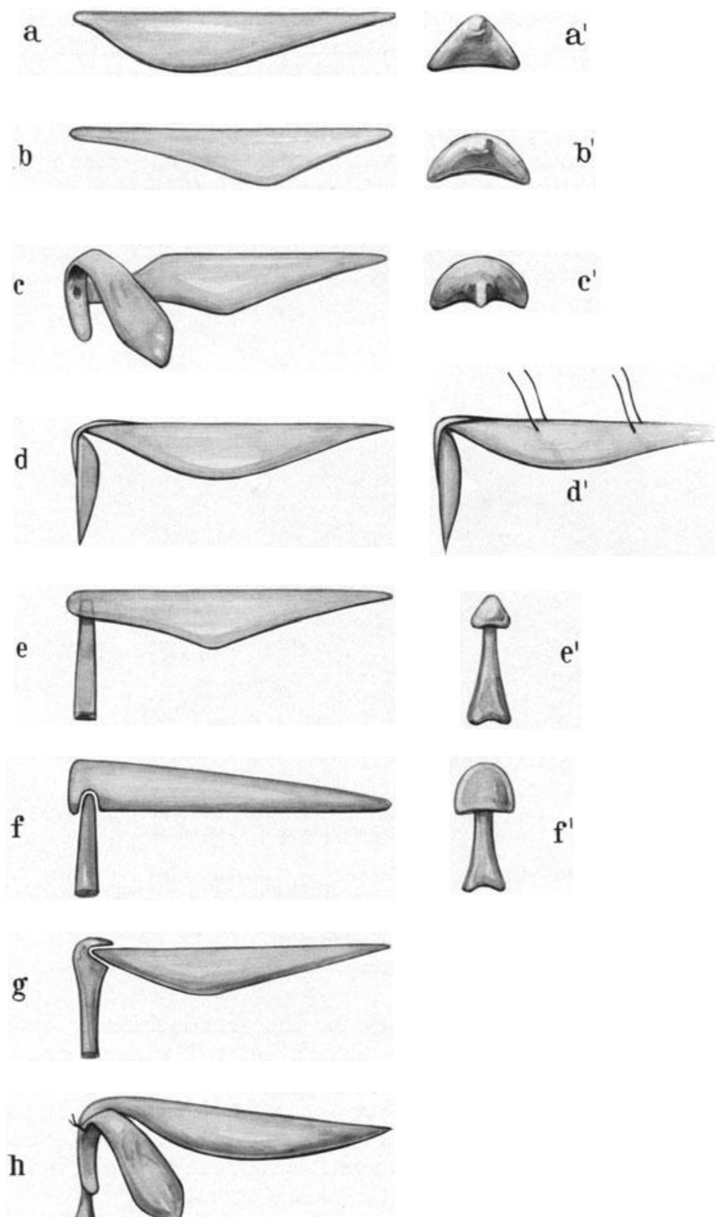


Fig. 222. Scalpel for obtaining rib cartilage (3/4 normal size)

removed gradually, it is not necessary for the skin incision to extend much beyond the length of the graft. The skin is sutured without drain. After a recommendation by BARSKY, in recent years we have saved the pieces of cartilage left over after carving the graft. Before the chest skin incision is closed, these pieces are placed in a lateral pocket of subcutaneous fat formed by undermining the skin. This material forms a reserve graft which can be useful in later corrections or even to repair the failure of the plastic operation.

Shaping the graft. The shape of the cartilage graft has already been described. There are principally three forms: a straight graft, which should fill only the saddle in the dorsum; a two-piece structure composed of dorsal and columellar graft; and an L-shaped graft which is the same as the second type, but made in one piece.

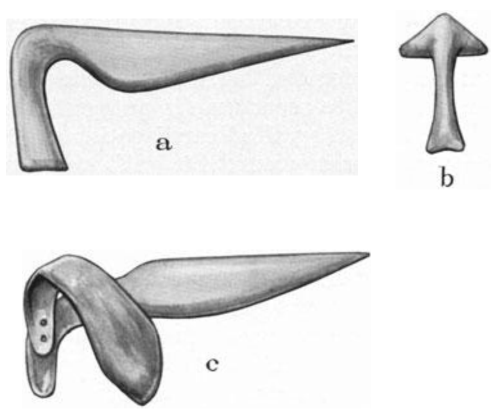
The first graft, the *straight, one-piece shape*, is usually shaped like a spindle or a shuttle (Figs. 223a, a′). This shape is used if the nasal tip is not retruded and the columella is straight and needs no support. We usually shape the lower tip portion of the straight graft somewhat like a bayonet, so that the grafted cartilage does not lie directly under the skin but more as the intact lower lateral



Figs. 223a—h. Variations in the shape of the graft. a and b Simple dorsal graft, side view. a′ and b′ Simple dorsal graft, end view. c Bayonet-shaped dorsal graft. Position in relation to lower lateral cartilage, side view. c′ Bayonet-shaped dorsal graft, front view. d Two-piece graft for dorsum and columella with perichondrium, by GILLIES. d′ Same as d with sutures for fixation through the skin. e, f and g Two-piece grafts with various methods of mutual support, side view. e′ and f′ Same as e and f, front view. h Angular graft with fixation to the medial crus of the lower lateral cartilage

cartilages naturally do. This is supposed to give the nasal tip a more natural appearance (Figs. 223c and c′). We bevel off the cephalic end of the graft along the surface which will lie just beneath the skin, as GIBSON and DAVIS also recommend.

For the *two-piece graft*, which also has a columella strut, joint-like attachment must be made at the point where the two pieces meet beneath the nasal tip. This is to keep the tips of the two grafts from slipping apart and lying next to each other. GILLIES devised the perichondrium or periosteum hinge joint already mentioned (Fig. 223d). BARSKY invented a more complicated joint. A much used principle is mortising the columellar strut in a small hole or in a small cavity at the anterior end of the dorsal graft (Figs. 223e and e′, f and f′). GALTIER has a special joint system. In this the tip of the dorsal graft is wedged into a mouth-like opening at the tip end of the columellar graft (Fig. 223g). BERSON provides the two-piece graft of GILLIES with silk "bridles" with which the graft can be fixed better in the nose (Fig. 223d′). Some surgeons make one or two small holes in the columellar strut through which the mattress sutures for fixation can



Figs. 224a—c. Shapes of one-piece angled grafts. a Usual shape, side view. b Same, end view. c Bayonet-type angled graft and its relation to lower lateral cartilage

be passed. When shaping the columellar strut, it is important to form a socket or tripod-like projection at the base which can rest on the maxillary spine. The *one-piece angled grafts* are shaped according to a model, as already mentioned (Fig. 220). In carving the L-shaped graft, we generally remove the entire perichondrium. The shapes are principally the same as those of the two-piece grafts. The graft is always widest in the area of the upper lateral cartilages, while toward the tip it must be made quite thin (Figs. 223h and 224a and b). Above all the columellar part must be carved very thin in the middle and tip section. Here we carve the dorsal part as a bayonet, in order to leave the vault of the lower lateral cartilages just under the skin (Fig. 224c). We only do this if the lower lateral cartilages have a predominant shape. The columellar part can be carved rather deep, that is, wide when seen from the side (Figs. 224a and c). This way it can extend far posteriorly into the membranous septum as far as the anterior border of the cartilaginous septum. This affords better stability of the graft. In particular, it keeps the graft from slipping laterally from the maxillary spine. A mistake which is often made in shaping the angulated graft is the choice of too great an angle. As a result the tip is not prominent enough and the columella is too steep. We generally choose an angle of 60 to 70°. Since the cartilage graft slips easily, it can be carved best if one wraps sterile gauze around part of it and wears cloth gloves over the rubber gloves. The No. 15 Parker knife is most suitable for this work as well. If a piece from the bony part of the rib or from the bone-cartilage junction is still attached to the graft, one works best with a coarse scissors or with the Kazanjian or Rowland forceps. We do not consider chisel, mallet and a wooden cutting board suitable.

Grafting autogenous cartilage naturally has the great disadvantage that an additional operation is necessary on the same patient.

Cartilage grafting in children and the aged. *In children,* if a graft operation must be applied, i.e., when it is inadvisable to wait with the correction until the growth of the nose is completed, then, if possible, no autogenous cartilage should be used for the correction. Besides, there would be too little rib cartilage available in children to make an adequately large graft. We have solved the problem in children with a plastic graft as a temporary measure. Formerly in many places, rib cartilage was grafted from the parents, as a direct homograft. Today grafting of preserved homologous cartilage has been advocated strongly in all countries, and preserved cartilage is also used on children in nasal corrections. — A certain value is placed on homografting of cartilage for plastic operations *in the aged.* In them as in children insufficient autogenous cartilage is available, and calcified cartilage areas are not suitable for grafting. In the homograft, more pronounced postoperative absorption is said to occur than in autografted cartilage; 40—60% absorption is claimed. If the homografted cartilage is not absorbed, this is due to the fibrous capsule which forms around the graft and prohibits the invasion of blood vessels and fibroblasts. The graft then acts like a well-borne foreign body. Homografted cartilage has less tendency to bend than autografted cartilage. In the course of the years alteration is said to take place in homografted cartilage. It is assumed that histiocytes and other cells penetrate from the periphery. Then they partially break up the matrix and form a new matrix. After months and years the cartilage is said to appear practically normal and only show lacunae and occasionally pyknotic chondrocytes.

The cartilage is kept either in 50 or 70% alcohol or in merthiolate diluted 1:4,000 with normal saline at $+1^0$ to $+2^0$ C. It is best after one week of preservation. Some surgeons prefer deep freezing.

β) Bone

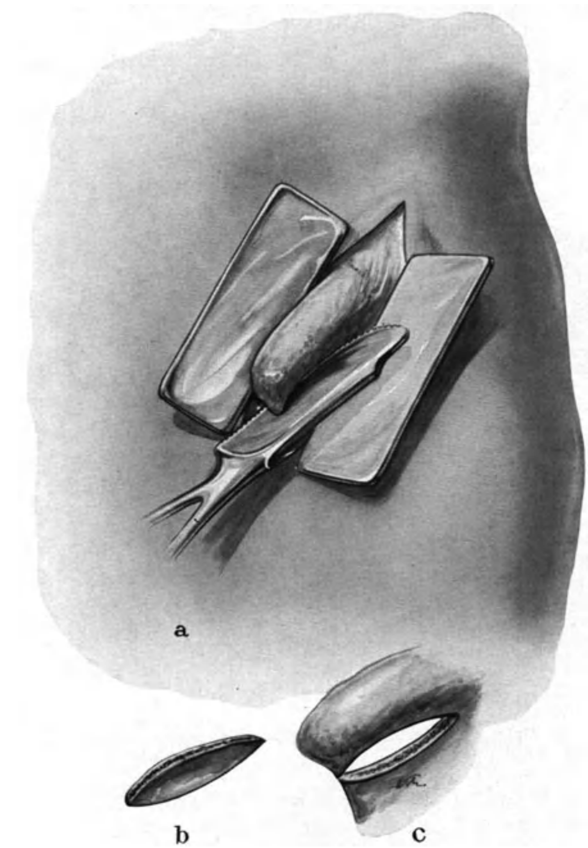
Bone for grafting is taken from the rib, the ileum and the tibia.

For removal from the rib, one does not proceed in quite the same manner as described above for cartilage. One incises the skin above the 7th, 8th or 9th rib somewhat farther laterally and more horizontal than for cartilage removal. The desired rib is found, the periosteum incised and pushed away on both sides. If only a small bone graft is desired, one uses the concave chisel of Kelly or Sanvenero-Rosselli mentioned above (Fig. 218). In the eastern European countries the blunt chisel shaped like a half circle after Woijatschek is used. But if a larger bone graft is necessary, then the entire thickness of the rib must be taken. The periosteum must be separated carefully around the entire rib in an area of about 8 cm. This is done best with the round Doyen elevator (Fig. 221). For severing the bone one uses surgical rib scissors or a bone forceps.

Removal from the iliac crest. The bone donor site most often chosen by plastic surgeons is the iliac crest. As a rule we use this site for bone grafts other than for the nose. The iliac crest is composed of an inner and an outer tabula and a layer of cancellous tissue between the two. The skin is not incised directly over the edge of the pelvis but somewhat farther caudally, so that the incision wound can heal better. For the removal the skin must be raised a little. The periosteum is pushed aside carefully. According to the size of the bone graft to be removed, either the whole thickness of the iliac crest or else only the inner tabula is exposed.

The separation of the periosteum on the inner side of the pelvis is easier than on the outer side. Removal is best done with sharp, straight chisels. One can also use a Ragnell saw which is also used for osteotomy in the nose (Fig. 55b). After removal of the graft the remaining sharp edges on the bone must be rounded off. The periosteum is sutured with chrome catgut and the wound closed.

An *L-shaped graft* can hardly be made only from cancellous bone from the pelvis. Therefore it is necessary to take more compact bone in addition from at



Figs. 225a—c. Removal of a bone graft from the pelvis just beneath the iliac crest, according to Robertson and Baron. a Sawing out the graft. b Shape of the graft desired for the saddle nose. c Remaining bone defect

least one side, either from the internal or external aspect. As already mentioned, the inner tabula is better for this. It is easier to expose this than the outer aspect. One has to undermine the periosteum on the inner side together with the M. iliacus. If one wants to leave the surface of the crest intact, one proceeds best as Robertson and Baron do (Fig. 225). In this one severs the bone just below the crest and swings the crest a little upward, without injuring the muscular attachments. The desired bone graft is removed beneath the crest, and the latter swung down again. — A bone graft can be obtained from the pelvic bone *in children* as well. We only use this to obtain small bone grafts for transplantation in cleft lip and palate. For this we separate the gluteal muscles from the bone farther to the rear and chisel out a small bone plate quite inward in the pelvis from the inner tabula (Fig. 226). In children it is important to leave the epiphyseal cartilage intact. — Like J. M. Converse and R. M. Campbell, it has been our experience that if the *entire thickness of the iliac crest* is removed, the patient has stronger pain and over a longer period than if the attachments of the glutaeus medius and minimus are protected by leaving the outer plate (Fig. 226). Also at the spina ilei ant. sup. one should not chisel through the entire layer of bone, so as not to injure the tensor fasciae femoris. *Bleeding* from the bone is sometimes considerable, so that drainage is required in order to prevent a large hematoma. Spongostan, Gelfoam, Thrombin powder or solution, or bone wax can be used locally against bleeding. It is also important that the periosteum and the fasciae of the muscular attachments are stretched and

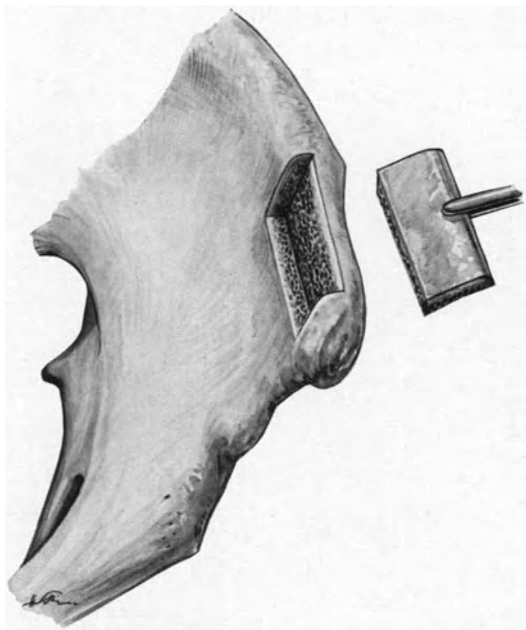


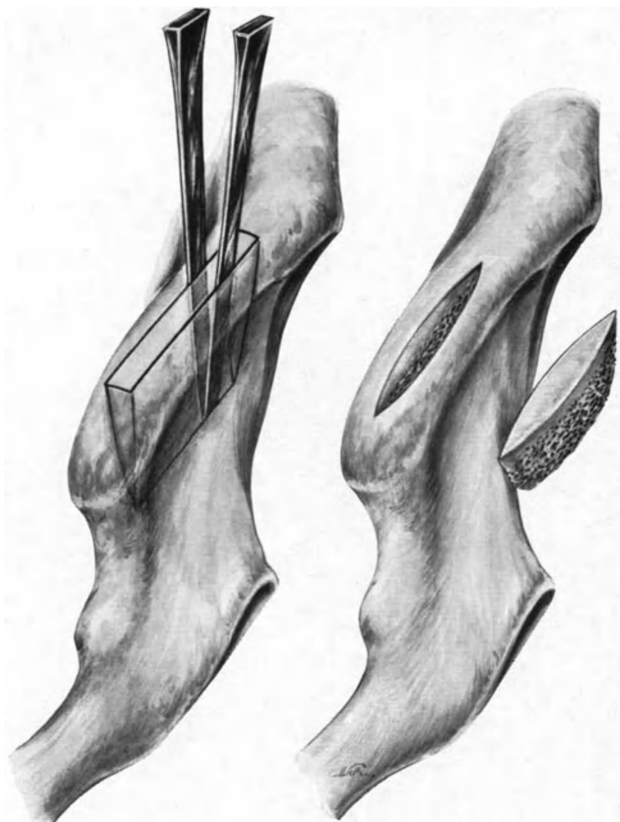
Fig. 226. Graft removal from the inner side of the pelvis (tabula interna)

sutured over the bone defect. Sometimes muscle bundles of the M. iliacus and the M. glutaeus can also be sutured together, as Dingman recommends.

Cancellous bone plates from the iliac crest can be removed so that practically no damage to the surface of the bone occurs. To do this one chisels two deep, almost parallel fissures into the bone of the crest and carefully lifts out the freed plate (Fig. 227). Seeley obtains his bone grafts for transplantation to the nasal dorsum and to the septum in a similar manner.

Removal from the tibia. A further source for the removal of bone is the tibia. From a longitudinal incision from the anterior edge of the tibia, the middle portion of the bone is exposed and freed of periosteum. Here one obtains practically only cortical bone. Joseph sawed out a bone plate with a bow saw. Today one uses either an electric circular saw or oscillating saw (Fig. 229) or else a chisel (Fig. 228) for this. The edge of the tibia should remain intact if possible. Otherwise there is danger of a fracture. Only when a very narrow graft is needed can one use the edge of the tibia, as Herlyn also suggests. According to him the removal of the tibia graft takes place about at the transition between the upper and middle thirds. A curved skin incision is said to give a better approach than a straight one. HERLYN leaves the periosteum on the graft. — For a while SCHMID obtained his one-piece grafts for rhinoplasty from the scapula. But he has abandoned this practice of bone removal.

Bone bank for nasal grafts. Bone banks can be kept in the same manner as cartilage banks. There is one in practically every surgical hospital, and there has been good experience everywhere with preserved bone. A usable method of bone preservation should not destroy the osteogenic substance, change the mineral



Figs. 227a and b. Removal of a bone graft from the iliac crest by SEELEY. a Wedge-like excision with chisels. b Situation after removal of the desired graft

composition nor affect the general mechanical characteristics of the bone. Alcohol, Dettol, paraffin and merthiolate are media of preservation. Zepheran chlorides are also used. Our hospitals preserve bone hermetically sealed, either normally refrigerated or deep frozen. Formaldehyde (Formalin) and alcohol were abandoned as media for preservation; the protein becomes denatured because of them. Today in America much 1:1,000 merthiolate solution is still used. Immersion is necessary for a longer time for homografts than for autografted bone. Every 2 weeks the solution should be changed. The pioneers of bone preservation are MACEWEN (1881) and CARREL (1908). In 1951 MARRANGONI and CECCHINI as well as KREUZ and his colleagues recommended refrigeration and drying. This method permits use of the bone after several years. The cells are dead, but the protein is not denatured. With KREUZ the bone is deep-frozen at

—15^0 C, dried in a vacuum at —40^0 C and stored in vacuum containers at room temperature. Weaver read a paper in 1949 about preservation of homologous bone grafts by means of deep freezing. He used bone grafts taken surgically from the living as well as grafts from recently deceased. Contrary to most other surgeons he did not remove the periosteum. Preservation by deep freezing is

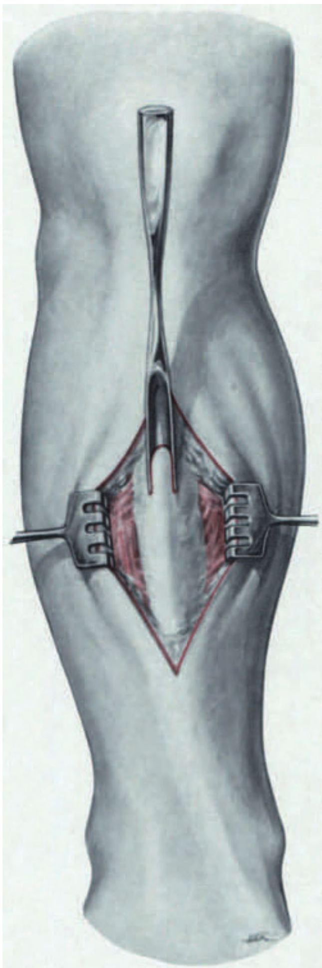


Fig. 228. Removal of a narrow tibia graft using the concave chisel

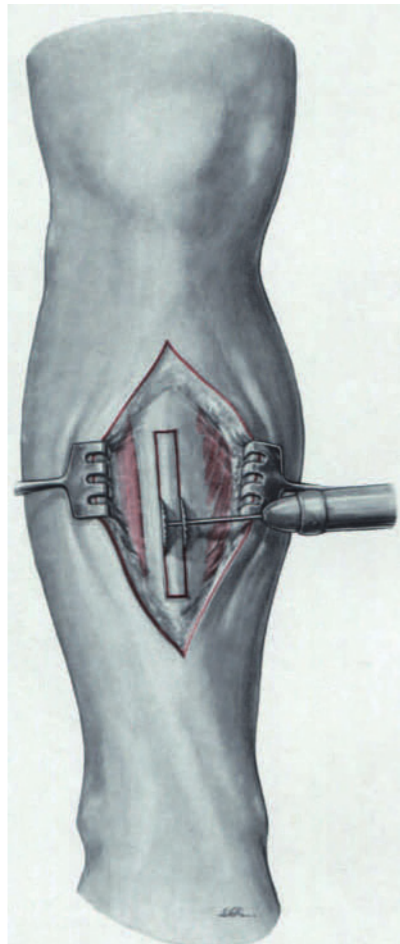


Fig. 229. Removal of a tibia graft with a double circular saw

done at —40^0 C or at —20^0 to —25^0 C. It has a bacteriostatic effect, but is not bactericidally reliable. Brown, de Mere and McCarthy suggested preservation in merthiolate solution. One year later Reynolds and Oliver published preservation of bone in the same solution. Solutions of antibiotics and chemotherapeutics have not been any improvement. Several authors have boiled bone or heated it in an autoclave before preservation.

Many surgeons believe that preserved bone is just as good as fresh bone. As early as 1947 Wilson wrote that refrigerated homografted bone "takes" just like autografted bone.

In recent years the *Kiel bone graft* ("Kieler Knochenspan") has been advocated as a grafting material in many branches of surgery. This is animal bone stored under sterile conditions. It has been subjected to an osteomalacic-proteolytic and a sterilization process. It is available for rhinoplasty in pre-cut shapes (angled and straight grafts). To what extent the pre-treated bone is suitable for the nose can only be learned in the coming years. HAAS has reported his experience with this dead heteroplastic material.

Grafting of minced bone. "Morcellement", bone chips (minced cancellous bone). The idea of the diced graft, worked out in 1944 by PEER for cartilage ("diced cartilage"), was applied to bone in the same year. MOWLEM coined the expression, "*minced cancellous bone*", and immediately found adherents like FOMON and BARSKY.

The vascularization of the surrounding tissue is of great importance for the graft, so that its nourishment and its ingrowth are assured. Cancellous bone is well-suited for this adaptation, best when it is diced. The division of a graft into small cubes also greatly increases its surface. This facilitates the growth of blood vessels from the surrounding tissue into the grafted tissue. The iliac crest is the best source for the cancellous bone necessary for this a method of grafting. Using fine and smooth scrapings from the iliac crest, one smooths the surface of the small heap of diced bone somewhat, so that the skin lies flat over it. We have not yet used this method in rhinoplasty. But we have often used it in filling bone defects in the area of the orbita, maxilla and forehead, and have had very good experience with it. One can imagine that minced cancellous bone is also quite suitable for saddle nose.

As a further development of these diced bone grafts, SHEEHAN and SWANKER created *gelatinized bone* 1950. Bone from the ileum is diced with the chisel after the periosteum has been removed. The pieces are saturated with a solution of fibrin and thrombin and are then put through a meat grinder. A brown, gelatine-like substance comes from the machine. This substance is again mixed with fibrin and thrombin until a cohesive mass is formed. The prepared bed in the nasal dorsum is now filled with this mass by means of a spatula. SHEEHAN and SWANKER use this procedure not only for rhinoplasty, but also for filling other bone defects. This type of grafting is said to be especially successful for reoperations in cases of failure with plastic grafts. ECKERT-MÖBIUS as well was able to report good results in 1951 in operations using macerated cancellous bone.

We prefer cartilage grafts and thus do not have much experience with bone grafts in the nose. Therefore we shall discuss good and bad results obtained by other surgeons.

Results of bone grafting in the nose. In 1948 MARTIN reported over 15 cases of successful bone grafting in the nose. These were angled pieces of cancellous bone from the iliac crest. In one case the graft "took" in spite of infection. MARTIN considers cancellous bone a better graft material than autogenous or homologous cartilage. MACOMBER shares this view. He reported in 1949 on his success with cancellous bone from the ileum. He considers graft removal from the iliac crest to be a smaller operation than resection from the rib.

In the same year SEELEY published his success with a boat-keel-shaped bone graft from the iliac crest which is placed vertically in the interperichondreal space in the septum.

In 73 cases GERRIE and colleagues (1950) reported thoroughly good "take". In 40 of these cases they transplanted straight grafts of cancellous bone, and in 33 cases, angled grafts, all from the iliac crest. Like MARTIN, GERRIE was also able to confirm formation of a cortex on the surface of the graft after 6 months. MARTIN was able to repair three graft fractures with steel or KIRSCHNER wire.

At the same time DINGMAN reported successful grafting of bone from the iliac crest.

FARINA, who has spoken out vehemently against the use of plastics, uses bone grafts with periosteum from the tibia. His statistics show a failure of 9.8% among 51 patients. Grafting success could be confirmed 6 years later by means of X-ray pictures. In most of the cases he was able to determine presence of bone rarefaction and callus formation. The later pictures showed only a minimal reduction of the graft.

It should be mentioned that the grafts of FARINA are straight and do not have a columellar strut. HOLMES is also of the opinion that correct shaping and insertion of the dorsal graft makes a columellar strut superfluous, if one uses bone and not cartilage. He too obtains the bone from the iliac crest.

BRUCK uses the L-shaped bone graft from the pelvis. In 1955 in a report on grafting in saddle noses, he emphasized the advantage of bone. Here he was mistaken when he said that bone is more stable and has less tendency to secondary fracture. He also stated that one can not obtain a sufficiently large piece of rib cartilage, and that the chest incision tended more toward keloid formation than the hip incision.

In 1956 BRYDON SMITH reported good results with two grafts from the iliac crest which he immobilized for 6 weeks with a metal nail.

In 1957 DE AMICIS was also able to report on X-ray findings similar to those of FARINA: in many cases a type of cortex had formed over the entire surface of the graft. The shrinkage of the bone grafts was only negligible. The shrinkage mainly effected a smoothing of the surfaces and a rounding of the points of the graft. The graft in the columella was usually more absorbed, probably because of the unfavorable nutritive conditions. For this reason DE AMICIS feels that one can also do without the columellar strut.

Now the negative results should also be mentioned.

In 1950 ALLEN and GOLDMAN reported on two cases involving autogenous cancellous bone grafts from the iliac crest. The grafts were destroyed by absorption and were not replaced by new bone. The failure was explained as being due to inadequate contact between the graft and the nasal periosteum and bone.

LLOYD-ROBERTS and JUDET consider a bone graft unsuitable if no good contact surface between the graft and host bone is obtained.

COTTLE and his colleagues promoted the use of ox cartilage. They have also experienced complete absorption of their autografts and homografts of bone within 2 to 4 months.

STUCCHI has had similar results with homografted bone which dissolved within 5 months.

CONVERSE and CAMPBELL analysed their grafting failures, which occurred three times as often with homografts than with autografts. They likewise came to the conclusion that adequate contact of the graft with the host bone is important for "take" of the graft. On the other hand, FOMON and his colleagues do not believe in the importance of such contact; they also have good results when the bone graft is not fixed at its upper end.

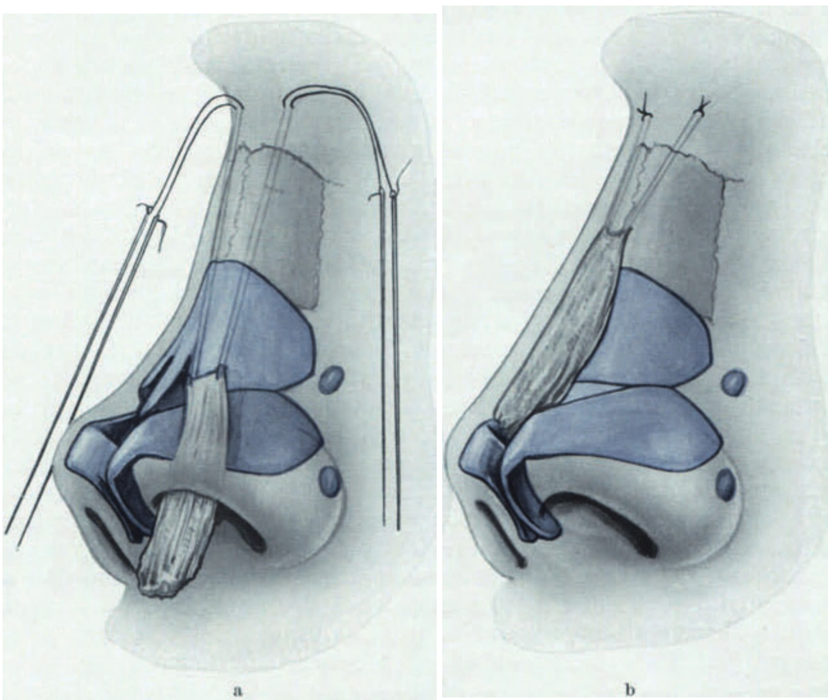
REIDY rejects the appropriateness of homografted bone for saddle nose corrections. The majority of his grafts, 13 of 18, were fully absorbed within 6 months.

On the basis of these contradictory reports one should be somewhat reserved with regard to bone grafts.

In our cases of bone grafting we have had good success. We have been able to determine a firm "take" of the graft with the nasal bone. This was also the case in the bone-cartilage grafts from the rib. However, we still prefer the cartilage grafts, because we are not satisfied with the rigidity of the new bony nose.

γ) Dermal flap as graft for saddle nose surgery

The dermal flap, i.e. the de-epithelialized piece of skin, should be mentioned as another graft material. This is a free full-thickness skin graft on which the



Figs. 230a and b. Correction of saddle nose of slight degree by means of lining with a dermal flap according to STRAATSMA and MALINIAC. Introduction of the dermal flap through the vestibular rim incision. The bridle sutures are drawn through the glabella. b Dermal flap in place. Bridle sutures tied

most superficial layer, the epidermis, has been removed. At the donor site where the graft will be obtained, an epidermal (OLLIER-THIERSCH) graft is removed with the THIERSCH knife or with a dermatome. Then the graft is removed from the de-epithelialized skin area consisting of only corium and subcutis. The abdomen, hip, or arm are chosen as donor areas. The fat must be carefully removed with scissors from the underside of the graft which has been cut out. According to the thickness necessary for the graft, two or three rectangular grafts can be laid on each other. The graft is then provided with two nylon or silk pilot sutures. These sutures are passed into the prepared bed with a straight needle and drawn through the skin. Thus the dermal flap can slide into the subcutaneous pocket like a sled and be placed properly there. The pilot sutures are removed and the approach incision closed. In figuring the size of the graft one must add a little extra as in bone and cartilage grafts. With dermal flaps, one counts on an absorption of from 10—20%. — This manner of grafting comes from STRAATSMA and MALINIAC (Fig. 230).

c) Alloplastic material for nose

α) Formerly used implants

As early as the turn of the century foreign implants, i.e. with more or less hard chemical materials, began to be used to correct saddle noses.

In 1899 in Vienna GERSUNY attempted to line the dorsal skin with *Vaseline*, after he had seen that Vaseline injections caused no reaction in angiomas.

One year after the publication of GERSUNY, DELANGER and ECKSTEIN introduced the use of *paraffin* as filling material (1900). DELANGER showed his successes at three French surgeons' conventions from 1901 to 1904. Soon people everywhere were enthusiastic about this method. At first the successes appeared very favorable, and the method was simple. The paraffin was injected under the depression usually from the vestibule in thin, semi-hard threads and modeled in this condition. A special syringe of BRÜNINGS was used to administer the paraffin. MOURE and BRINDEL (quoted by CLAOUÉ) used paraffin for submucous injections in the nasal cavity in ozena as well. But soon the first unpleasant effects appeared. The paraffin implants caused a local inflammation of the surrounding subcutaneous tissue and also started to migrate. With feverish conditions of the patient they became soft, thus destroying the correction obtained. Often nothing else could be done but to remove the migrated paraffin. ECKSTEIN hit upon the idea of using paraffin with a higher melting point, so-called hard paraffin. Its melting point is between 52 and 60° C, in contrast to the 42 to 43° C melting point of normal paraffin. But with this, too, the results were unsatisfactory. In addition one had to reckon with the danger of an embolism. Now and then it came to the formation of tumors through proliferation of the connective tissue in the area of the paraffin implant. BUCK and BROCKAERT (quoted by CLAOUÉ) called these tumors *paraffinomas* (1903). CLAOUÉ and CHWATT later combined the literature about these interesting new formations in a treatise, "Les Paraffinomes". Gradually this method of grafting was given up by surgeons. But even in 1934 ŠERCER recommended filling smaller nasal depressions with paraffin. He later abandoned the practice. W. T. CARRELSON was able to observe a large number of patients. Among 1,000 patients he found 104 failures, and in 55 patients an infection occurred postoperatively.

After these failures other materials were tried as implants. FINK performed 24 saddle nose operations with implantation of stones from the Black Sea, with complete success. In addition other materials like gold, silver, porcelain, aluminum, platinum and celluloid were occasionally tried. Over 40 years ago EITNER attempted to use *ivory* as an alloplastic implant material in rhinoplasties. Before him, VON GLUCK had brought ivory implants "to take" at other points on the body. Later JOSEPH, ZENO, MALBEC, AELVES, GANDELA, C. J. KOENIG, MALINIAC and ECKSTEIN took over the ivory technique, so that during the 1930's it was considered widespread. FRÜHWALD also, who first used rib cartilage and tibia grafts, went over to ivory implantation at that time. The ivory implant was shaped according to a plaster impression. FRÜHWALD used material from the tip of young elephants' tusks and had the necessary shape turned on a lathe. The turner also had to make holes in the implants. In the adaptation of the foreign implant connective tissue was supposed to grow through these small holes. This was important for the immobilization of the implant. The ivory implants were best suited for implantation along the whole length of the dorsum, from the nasal root to just behind the nasal tip. Short implants were of value only over the nasal root, i.e. over the nasal bones. Supratip depressions were not to be corrected as well with ivory. Nor was ivory useful as a support of the nasal tip and the columella. The thin implants broke easily or they punctured the skin. — The adaptation results for dorsal implants of ivory were consequently quite good at first. Of course it became apparent that ivory does not remain in the body unchanged. It becomes decalcified and the stroma is partially absorbed. The process takes place very slowly so that with proper preparation of the implant, one can count on durability of 30 years. In 1955 EITNER was able to report on very satisfactory 40-year experience. He recommended replacement of the implant after 30 years. He also used a chain of ivory implants of more than one piece, so-called "Gliederstücke", which were bound together with catgut. In 1956 SALINGER reported on good results with ivory. He presented a successful case with implantation of an ivory graft for 23 years. It was shown by X-ray that the ivory had not been attacked by the surrounding tissue. Of 115 cases, 85% were a complete success. In 7.6% the implant had to be removed because of reaction in the operation area. In 7.7% the foreign body irritation by the ivory was too great, so that adaptation did not take place. Rejection of the implant was favored especially by traumas or the influence of heat or cold. Today SALINGER has gone over to bone and cartilage grafting. He uses ivory for saddle-nose surgery only in cases in which not enough autoplastic material is available for filling the defect. However EITNER adopted the view that ivory was less tolerable to tissue than newer plastics and began using plastic. SPANIER, a student of JOSEPH, recommended preserved calf cartilage for the correction of saddle noses. He opposed the use of ivory. He pointed out as disadvantages its relatively heavy weight and that it is hard to model.

We too have had to remove several ivory implants grafted by other surgeons. The implants threatened to be rejected and had to be replaced by other material. In this as in the cases of EITNER it could be determined that the implant was enclosed in a connective tissue capsule. But we also know a few cases in which the ivory implant was tolerated well after 15 years and even after 20 years.

Since ivory has given way to new plastics in rhinoplasty, there are only a very few surgeons who still use it.

Cork was likewise recommended as an implant material. It is still used today as a lining material by HAUBERRISSER. Before implantation the cork is sterilized by being boiled 3 times, each time for 15 minutes, in an alkalinizing sodium phosphate solution. Implantation of cork like the implantation of *hard rubber* of BLEGVAD found few adherents. For the sake of completeness it should be mentioned that in 1925 MÜLLER implanted a woven copper wire graft covered with guttapercha solution in the nose. LIEBERMANN, POND, DOROSCHENKO and ROLLIN preferred *gold* in various forms. This material, too, found only a few adherents. Weight and cost, as well as foreign body irritation of the surrounding tissue were named as particular disadvantages. GRUNERT, VENARD and STUCK traced the tissue damage to electrolytic processes.

β) Implants used today

Hard plastics. For the first time in 1937, synthetic resins were introduced into rhinoplasty in England. They were the two plastics, polyethylene and methyl methacrylate. These synthetic resins are of high molecular weight. They are made from coal, wood, and lime and transformed into a hard mass by polymerization. Among the artificial resins there are also the so-called thermoplastic resins; they become soft when heated and harden upon cooling. In general they are not electrolytic and for the most part are corrosion-resistant.

With the increase of these artificial resins people also started to determine the *optimal characteristics* of the material *required* for implantation. For one thing, the desired material should be available in sufficient quantity and be inexpensive. The implant should "take" and have a consistency which permits easy modeling. In addition, it should not be absorbed, should not cause a foreign body reaction in the host tissue, should not have an allergizing effect, nor be carcinogenitive. Up to this time no graft or implant material has satisfied all of these requirements. That material will naturally be preferred which most closely approaches the points mentioned above. This consideration is the subject of continual controversy.

The question is still debatable whether foreign material can be injurious to the body. For this reason experiments have been made with all new materials with respect to tolerability and carcinogenitive effect.

Polyethylene came to America in 1943, and the material was introduced into surgery there at the same time. The neuro-surgeons needed it for duraplasties. Some of them, like INGRAHAM, ALEXANDER and MATSON emphasized that polyethylene caused no foreign body reaction (INGRAHAM, ALEXANDER and MATSON, quoted by RUBIN, ROBERTSON and SHAPIRO).

In 1948 RUBIN, ROBERTSON and SHAPIRO were able to report on their good success in the correction of saddle noses by means of implantation of L-shaped grafts made of polyethylene. Polyethylene is a milky-white plastic which is slightly flexible in thin pieces. It is difficult to carve it with a knife, and in our experience can be shaped best with a fine saw or with a dental drill. The place which is being drilled becomes viscous for a few seconds because of heat. This actually makes shaping easier. — In 1953 KRISTENSEN published his experience with polyethylene. In 5 of 41 cases the implant had to be removed later because of pronounced tension and shrinkage of the overlying skin. But due to the formation of granulation tissue the end result was an improvement over the preoperative condition.

Polyethylene is also manufactured in *sponge form*. This sponge can be shaped more easily, has a softer consistency, and in rhinoplasty is more suitable for smaller implants in the nasal tip or in the alae. Animal experiments for the carcinogenitive effect of these sponges were negative. — Our experience with polyethylene goes back to 1950. We have usually implanted L-shaped grafts made of this plastic and, only in a few cases, sponge. — Polyethylene is to be recommended when an autograft of cartilage or bone is not possible. Thus it is particularly suitable in children and adolescents in which temporary filling of the saddle nose is considered with later replacement using an autograft. Polyethylene also works well in the ozena operation described above (Figs. 88a, b and Fig. 89). It sometimes happens that months or years after the operation the implant at the piriform crest at the lateral wall of the entrance to the nasal cavity must be reduced or enlarged with additional material.

On this occasion we confirmed an area completely without irritation surrounding the polyethylene implant which was in a connective tissue capsule. In some cases of polyethylene implants in the nose in children we had to remove the graft because of pronounced irritative reaction in the surrounding tissues.

At about the same time as polyethylene, *methacrylates* came on the market, at the beginning of the 1930's. They have been known since 1931 in the British chemical industry. "Kallodent" was manufactured in 1933 as the first polymerized acrylic acid derivative. After this in many places, many acrylates were produced for dental prostheses. Soon these materials also found their way into surgery, particularly rhinoplasty. Articles about them were first published later. In 1949 RAPIN reported good grafting results with acrylates. In 1948 HOLT and LLOYD told about their success with angled implants of Acrylite. Reports from

JEREMIAH followed during the next year. — The methyl methacrylates had a disadvantage compared to polyethylene. They are very hard after polymerization. It is difficult for the surgeon to modify their shape during surgery. First a wax model must be made according to which the implant is formed. When the shape has been determined, then it can only be modified very slightly. Edges can be sanded off with the drill, portions thinned, and holes drilled which are supposed to aid the immobilization of the implant in the nose. HILDING (1952), ELCHANAN (1955) and GONZALEZ-ULLOA (1957) (Fig. 234) have made 2-piece acrylic implants and used them as dorsal and columellar struts. Ones like these were already shown in auto- and homografts (Fig. 223).

In 1955 DENCER described a shape for the dorsal support made from an English acrylic derivative. This has approximately the rudder-shape of the bone graft by SEELEY (see p. 164). He calls it a "flanged acrylic implant". He reports successes in 38 cases over 5 years with this material, which he feels is tolerated well. There are also reports from eastern European countries about successes with the material, methyl methacrylate or polymethyl methacrylate, which is compatible with tissue. ŠOLJAK makes his implants for saddle nose himself. He mixes a powder and a mass called AKR-7 (methyl methacrylate) cold, forms it with his fingers and makes it ready to use by boiling it for 30 minutes. As already mentioned, A. RÉTHI uses acrylate for replacement only in small depressions in saddle noses. Otherwise he autografts bone.

In England the plastics, Perspex and Lucite, were produced as polymerized forms of methacrylic acid esters. At about the same time in Germany the well-known *Plexiglas and Paladone* were developed from monomolecular methyl methacrylate by polymerization. Later such further polymethacrylates as Palapont and Palavite became common.

Actually this series of inventions with polymerization of the acrylic acid ester had its beginning with RÖHM in 1901. RÖHM and HAAS used Plexiglas (polyacrylic acid ester) for prosthetic purposes in 1930. This material was used as Gingivist (similar to Kallodent) and as Neohekolith for the manufacture of nasal epitheses by PLÜSCHKE. Paladone was introduced in 1930 as a material for fixed dental prostheses. It had been developed in that year by BAUER and ROTH. The other polymethacrylate, Plexiglas (Gingivist and Neohekolith) were available one year before that for dental prosthesis work. Paladone first proved its value as a material for epitheses, and was praised as such in 1941 by GABBERT. Plexiglas was used as implant material for rhinoplasties as early as 1943 by BRADTMÖLLER and later by SCHÖRCHER. KLEINSCHMIDT had already reported on the use of Plexiglas in skull surgery in 1941.

In 1948 after an observation period of 3 years, GÖDEL reported his good results with Paladone, which he had used in 30 facial surgeries. In 1949 BECKMANN reported good results with Paladone. He had determined the tolerability of the plastic in animal experiments and then tried it on humans. He sterilized the implant in a steam bath for 20 minutes and perforated the implant with many holes. Thus he was able to determine experimentally that the holes fill with granulation tissue. NEUGEBAUER reported in the same year that he had abandoned the use of Paladone implants, because after a period of time cracks developed in this material. For this reason he went over to using Paladone as a filling for lining the saddle. This was also recommended by ECKERT-MÖBIUS.

In 1950 KOCH and PIELER published their favorable observations with Paladone. On the other hand these two authors demonstrated clinically as well as histologically the lack of tolerability in tissue of Supramide, a super polyamide.

Favorable reports of the use of Paladone also came from Vienna from KLICPERA and FRÜHWALD. KLICPERA confirmed his successes again in 1955. He pointed out that Paladone implants, like other plastic implants should only be used in not too seriously injured subcutaneous tissue. This means that it should not be used in cases where considerable scar formation is present, such as in cicatricious processes after unsuccessful implantations, after paraffin injections and serious suppuration. Paladone implants are also contraindicated if the nose is being opened at another point at the same time.

In 1954, looking back over 3 years, BIENERT reported 11 good results with Paladone implants in saddle noses. He uses the plastic in cases where autoplastic material could not be used for various reasons. In saddle-wide-noses with simultaneous flattened and soft nasal tip he does not implant a straight graft, but an angled graft with an angle of 65^0 to 80^0, or grafts with only a hint of an L-shape, that is with a very small columellar strut. With regard to the technique of making grafts, BIENERT gives exact instructions for the physician. First a plastic dough is mixed from three parts polymethyl methacrylate in powder form and one part methylmethacrylate in liquid form. By slow heating over several hours under continual pressure, the mixture forms longer molecular chains, as is well known, and thus is polymerized to the compact, firm material. The resulting dough is thoroughly kneaded in a china bowl and allowed to stand covered for 10 minutes. When the mass is tough and one can draw threads, it is pressed into a plaster mold. The parts of the incubator are closed and put in a press for about 30 minutes. If properly prepared, Paladone can be considered to be practically without irritative effect. It is resistant toward tissue reactions and for the most part unbreakable. Because of its plasticity at higher temperatures, dry sterilization is not possible. Paladone is also attacked by ether, alcohol, gasoline (for cleaning purposes), and chloroform.

Various authors assume that monomer remainders can be irritative to tissue. BIENERT recommends eliminating the monomer remainders by means of 3-day vacuum distillation of the material using a water-jet pump. After the polymerization one should wait several weeks before implanting the Paladone graft. — WEGENER and GÜNTERT have also declared themselves to be adherents of Paladone implantation.

Supramide is another plastic commonly used in Germany for implantation purposes. It is a superpolyamide based upon phenol, and is thus chemically related to nylon and dacron. It was first recommended for rhinoplasty in 1949 by THEISSING. Although KOCH and PIELER (1950) described this plastic as being not particularly tolerable to tissue and were able to prove this clinically as well as histologically, over the years Supramide has proved to be a rather usable material. Like Paladone it can be sterilized well and is easy to model. In 1951 LINK reported successful use of Supramide plates for covering perforations in the nasal septum. This was the same procedure that we (R. MEYER) developed at the same time using acrylite and nylon (see p. 140).

In 1957 LEGLER had over 4 years' experience with Supramide implants in saddle noses in 70 cases. Only in two cases did he experience later rejection of the implant, and in only one case was an angled graft displaced postoperatively. LEGLER fused the two grafts, the dorsal and columellar supports, at their point of mutual contact under the nasal tip using a cautery. This was done, like the previous insertion of the grafts, through a median incision in the columella. — In recent years we have no longer used Supramide as we originally did.

More contested was the tolerability to tissue of a further implant material, Palavite, a self-polymerizing methacrylate. Chemically it is closely related to

Paladone and Palapont; the latter is used in dental prostheses. Palavite can be injected in viscous condition. Thus it has the big technical advantage that it can be injected as a viscous mass in the saddle with a special syringe during polymerization. This is done with local anesthesia or short narcosis. Thus the nasal profile can be shaped within a few minutes. The hardening process caused by polymerization takes from 3—5 minutes. HOFFMANN, who worked out this procedure, was able to demonstrate to us the good success he had at the beginning, which he published in 1953. Our experience was unsatisfactory. The disadvantages were apparent in tissue damage caused by development of heat during the polymerization process. HOFFMANN tested the tolerance by tissue in animals (rabbits). In this he detected a slight diffusion of the implant material or of the tissue-irritative monomers rejected afterward. GREVEN recommended Palavite only for lining the skin in minimal substance loss. One after the other, many people rejected it vehemently. In animal experiments, Palavite injections were well-tolerated in soft tissue. On the other hand in nonelastic tissue with hard underlying structure, such as on the septum and the hard palate, appearance of decubitus occurred (DÖRFEL and LEGLER). According to DÖRFEL and LEGLER, failure of submucosal injection in humans occurred in cases of surgical ozena treatment. Therefore there was warning against the general use of Palavite and other autopolymerizates.

In America animal experiments with *polyvinyl chloride* were made (GRINDLAY and WANG, 1951) and the substance was recommended for implant purposes in humans. Polyvinyl chloride is made from acetylene and hydrochloric acid by way of vinyl chloride. The plastic, Ivalon, a saturated polyvinyl alcohol, is known commercially in the form of fine sponge. It looks like white bread and can be cut easily with scissors and be shaped. It can be sterilized by being boiled for 20 minutes. In addition to being used in rhinoplasties it is also used for filling bone defects on the skull, for implantation under the nasal mucosa in ozena and even for plastic surgery of the breast. COTTLE, QUILTY and BUCKINGHAM reported in 1953 on Ivalon implants in the nose in ozena, and FREEMAN in 1955 on polyvinyl sponge implants in the face and breast; of these, four cases had complications due to infection.

Soft plastics. The field of dental health has developed plastics which remain soft for improving the lining of dental prostheses. REHM, WEIKART and others have reported on this. According to the experience of REHM, plastics with internal softeners, e.g. *Plastupulate*, appear to retain their soft consistency. Plastupulate is a methacrylic acid methyl-ester, chemically very closely related to Paladone. SEIFERTH and JATHO have tested this plastic. Since no support function can be entrusted to this plastic, its elastic consistency makes its use in substance defects in the nose suitable only if a certain firmness and the necessary support for the nasal tip is already there. According to WEIKART these soft plastics undergo a certain chemical change whereby they absorb water. In some circumstances this can lead to tissue damage and infections (L. B. SEIFERT and R. JATHO, quoted from GREVEN). It is quite possible that plastics with a softening core will have a future in implantation surgery, and thus in rhinoplasty. But for this to happen, their tolerability in tissue should be improved.

The widespread use of biologically inert plastics today in numerous surgical operations has given rise to the attempt to use *liquid plastics*. After several experiments in this direction it was determined that, from the biological and technical standpoint, the materials most suited for surgical injections are to be found in the group of dimethylpolysiloxanes. These silicone polymers have the stability of quartzes and salicylates, with which they are chemically related. On the other hand they are likewise related to certain organic substances, from which they have their plasticity, malleability, and impermeability to water. These materials can be injected with a syringe. FRANKLIN has done breast and facial surgery with it and after 2 years has had good results. This liquid plastic also is useful in rhinoplasty for filling small depressions in the dorsum and for balancing slightly uneven places.

Silicones (Silastic, Vivosil) have recently been used as implants in the nose and in other areas of the body. They come in sponge form or have a rubber-like consistency. ZÜHLKE has given directions for making a soft plastic on a methacrylate basis.

Chemistry of plastics. In closing here is a short survey of the chemistry of plastics, and a few experimental tests are described.

The high molecular compounds with almost exclusively a pure organic basis, which are called plastics, are either half-synthetic or fully synthetic. Celluloid is the most common of the half-synthetic plastics. The fully synthetic plastics are those mentioned above. They can be produced in various ways: 1. polycondensation, 2. polymerisation, and 3. polyaddition. Condensation denotes a chemical reaction between two different components with at least one responsive group in each. In this, along with the formation of water, ammonia, or similar small molecules, a new, larger molecule forms, which basically consists of the two components present at the start. If this process happens many times, one then speaks of polycondensation. The product of the reaction is a macromolecule. The most familiar polycondensates are bakelite, phenol resins, polyamides like American nylon and German Perlon, silicones, and polyethylene glycolterephthalates, which are known as Terylene, dacron, etc. in the form of fibers and films. The polymerisates are the largest and most significant group of plastics. Polymerization is the combination of many small, usually smallest chemical building blocks, molecules, into a macromolecule of linear or branched structure. Thus, for example, polymerization converts monomolecular ethylene of low molecular weight into polyethylene, which has a thousand times the molecular weight. There is no undesirable byproduct, like water, in polymerization, as there is in polycondensation. Not only similar molecules are polymerized, but also different molecules, and these produce mixed polymerisates. The polymerisates are thermoplasts, almost without exception, i.e. they become pliable with heat. These properties are used advantageously in working and shaping the material. With cold, or at normal temperatures, they become firm again and assume their usual properties. With thermoplasts this process can be repeated again as desired. It is reversible, while with duroplasts it is irreversible, i.e. the hardened materials can not be softened again. The best known of the polymerisates is polyvinyl chloride, which is used for the manufacture of pipe, plates, and containers. The hard plastic can be made soft by the inclusion of softeners, usually oil-like liquids. These soft polyvinyl materials are used for the manufacture of artificial leather. A further polymerisate is the polyethylene mentioned above, which we use in rhinoplasty. It is a polymerisate of ethylene. Plexiglas, Perspex, Lucite, and Acrylite are polymerisates of methacrylic acid esters. Polymerized acrylonitrile, or polyacrylonitrile, is known under the term, Orlon.

The polyadducts are the third and newest group of plastics. Polyaddition permits the greatest variety of combinations. This can lead to plastics with completely new and specific properties.

Among the plastics which retain a soft consistency, there are those with external softening and those with internal softening.

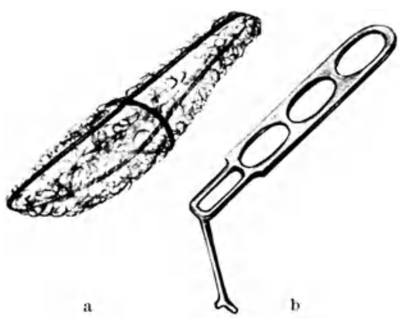
General table

Basic materials	Monomers	Polymers: Chemical term	Polymers: Trade name
		Polycondensates	
Water gas Methyl alcohol Oxygen	Phenol Formaldehyde	Phenol-formaldehyde resin	Bakelite
Phenol Hydrogen Oxygen Ammonia	Adipic acid Hexamethylene-diamine	Polycondensate of hexamethylene-diamine and adipic acid (Polyamide)	Nylon Perlon T Ultramid A
Ethylene	Ethylene glycol-terephthalate	Polyethylene glycol-terephthalate	Terylene Dacron
		Polymerisates	
Ethylene	Ethylene	Polyethylene	Polythen Polystan Lupolen Alkathene
Ethylene Benzene	Vinyl benzene	Polyvinyl benzene = Tolylstyrene	Styron Lustron Vestyron Trolitul
Acetylene Hydrochloric acid	Vinyl chloride	Polyvinyl chloride (+ "softener")	PVC (Polyvinyl chloride) Vinylite Soflex Sucoflor Vinidur Plastosyn (soft) Plastoflex Gurite Vinylate Flexiderm
Acetylene Acetic acid	Vinyl acetate	Polyvinyl acetate	Vinnapas Mowilith
Chloroform Hydrofluoric acid	Tetrafluoro-ethylene	Polytetrafluoro-ethylene	Fluon Teflon PK-plastic
Acetone Hydrocyanic acid Methyl alcohol	Methyl methacrylate	Polymethyl methacrylate	Plexiglas, Plexidur Perspex, Palapont Plexigum, Paladon Lucite, Palavit
Phenol Hydrogen Oxygen Hydroxylamine	Caprolactam	Polyamide = Polymerisate of caprolactam	Perlon L Grilon Ultramid B Supronyl Supramide = Superpoly-amide
	Acrylonitrile	Polyacrylonitrile	Orlon (USA) PAN Dralon
	Acrylonitrile Styrene	Mixed polymerisate Polystyrenes	Polystyrene
		Polyadducts	
	Diisocyanate with Diamine or Diol Triisocyanate with Triol Isocyanate, etc.	Polyurethane	Perlon

In the table on p. 177 is a summary of the most important plastics. Along with many well-known industrial plastics are the plastics which have been described as implant material.

Metals. Some metals, which were tried out as implant materials over 20 years ago, have not become popular as such. In 1925 BOGORODINSKY described implantation of silver, and ROLLIN wanted to introduce implantation of gold in the nose in 1937 (quoted from PERWITZSCHKY).

It soon became apparent that these precious metals were too heavy for nasal implants and also caused too much injury to tissue. VENABLE and STUCK trace this damage to electrolytic processes between the implanted metals and the neighboring host tissue. It has also been shown that aluminum and steel are not usable. On the other hand, after World War II nonelectric metals like tantalum and vitallium gained favor for a short time. Tantalum is a chemical element. It is a gray, hard metal. Vitallium is an alloy of cobalt, chrome, and nickel. Both metals were already used as implant material around 1940 in the other branches of surgery, particularly in neurosurgery. They were first introduced into rhinoplasty a few years later. In 1949 FOX reported seven successful tantalum implants in the nose. Reports followed by WIBLE and his colleagues, who implanted tantalum in the form of a wire mesh or seive in the nose, and by PRESSMAN who likewise implanted tantalum mesh as dorsal and columellar support (Fig. 231). Tantalum mesh is a net-like fabric made of this light metal. It is easily shaped and is supposed to adapt without irritation. In the report of PRESSMAN there is also talk of corrosion of these implants. In one of this cases an implant pierced the ala. A piece was cut off, and the rest took. On the use of vitallium in rhinoplasty, there is a report by KLEITSCH from 1952. He uses vitallium for other facial lining as well. Such facial prostheses are said to adapt without irritation. Earlier GEIG had written about replacement surgery of skull defects using vitallium plates.



Figs. 231 a and b. Metal implants. a Tantalum mesh by PRESSMAN. b Vitallium support by KLEITSCH

The nonelectric metals as well have not lived up to what was expected of them. With them the early results were good, but later results sometimes very bad. Months and years after their implantation, inflammation, ulceration and suppuration occurred either spontaneously or as a result of slight traumas. Some implants were rejected and led to damage of the surrounding tissue.

Characteristics of alloplastic material. Alloplastics have advantages and disadvantages. Artificial implant material can be worked, shaped, and sterilized easily. Its cost is minimal, and it is tolerated relatively well in tissue. The advantages of artificial implant material are also its shortened time of handling and the fact that the patient is saved from a second surgical wound for obtaining the material. The disadvantages of alloplastic material are primarily disturbances in the blood supply and the temperature of the skin covering the implant by separating the tissue layers. Alloplastic implants are encapsuled as a foreign body by the surrounding tissue and continue to act like foreign bodies because of that.

With the appearance of plastics and metals in plastic surgery, animal experiments with them were started at the same time to study the tissue reaction.

Inflammations, which can occur years after implantation, are probably based on corrosion processes.

Allergic reactions have been observed, especially in metallic implants. PERGER and MCLAUGHLIN have verified this with V2-A-steel as well as with tantalum (PERGER and MCLAUGHLIN, quoted from GREVEN).

More serious are the tumor formations after implantation of alloplastic materials observed in animal experiments by OPPENHEIMER and colleagues, DRUCKREY and SCHMÄHL, HACHMANN, NOTHDURFT, POLEMANN and BEHRING. OPPENHEIMER and his colleagues report formation of fibrosarcomas in rats. The tumors appeared after 1 to 2 years. With cellophane they were observed in 20 out of a total of 44 cases, with polyvinyl in 17 of 44, Silastic in 12 of 15, and with nylon in 4 of 21 cases. SCHMÄHL and REITER have verified formation of sarcomas after injection of liquid paraffin, yellow Vaseline and lanolin in rats. In this traces of higher aromatic carbohydrates were assumed to be biocatylists. On the basis of experiments with quartz and glass, DRUCKREY and SCHMÄHL suspect that the carcinogenitive effect of these substances can be traced back to their macromolecular structure. According to the experimental experience had by NOTHDURFT not the chemical structure, but the shape of the alloplastic implants are to be held responsible for the carcinogenitive effect. — Because of the importance of this problem, many experiments have been made on rats, mice, guinea pigs, dogs, etc. The reader is referred to the informative works by GÜNTERT, FOMON and colleagues, GREVEN, BARRY and USHER, and WALLACE. The whole problem is still open, and the next ten years will clarify the possibilities for use of these materials for implantation purposes.

It is our policy to use autogenous material instead of alloplastic material if possible. Of course if the implant is only a temporary measure, as for example in a growing skull, a plastic implant is preferred. In cases of this nature we have used Ivalon, Polystan and Teflon.

d) Incisions for implant insertion in saddle nose

Many methods for insertion of grafts and implants are used.

There are:

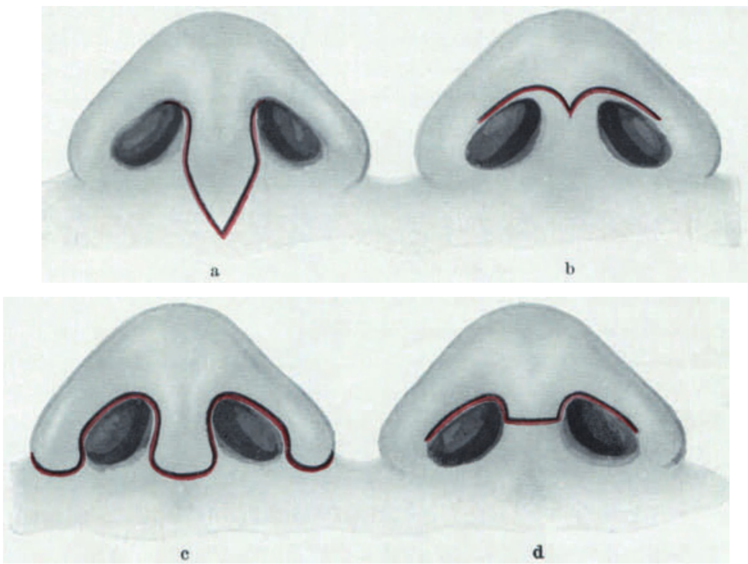
1. external incisions,
2. internal incisions in the nasal vestibule,
3. incisions in which the columella is swung upward,
4. intraoral incisions (in the oral vestibule).

Of the first, the *external incisions* (Fig. 39), some have already been abandoned, such as the longitudinal or horizontal glabella incision of LEXER, EITNER and HERLYN, the incision after SELTZER at the inner end of the eyebrow. The curved incision beneath the tip after PORTMANN and the similar incision of SCHUCHARDT are still used occasionally. Often one still finds the median columellar incision of SHEEHAN with surgeons like RÉTHI, BROWN and MCDOWELL, HOLT, DE AMICIS, B. SMITH, GERRIE, CLOUTIER and WOOLHOUSE, GELBKE, SALINGER, BARSKY, SCHUCHARDT, and MAY. Only the upper half of the columella is incised by GONZALES-ULLOA. Although this incision permits easy insertion of a single dorsal graft as well as of a two-piece or L-shaped graft, we do not consider it very advantageous, since the easily visible suture can sometimes be pierced by the pressure of the implant. Cartilage grafts are also introduced into the dorsum from the colummellar incision by means of the trocar of DUCLOS.

Of the *internal incisions in the nasal vestibule* (Fig. 40b), the lateral rim incision is well-known. It is 1—2 mm inside the vestibular rim at the lower border of the lower lateral cartilage. This is used by SELTZER and FARINA for graft insertion. CONVERSE extends this incision to the side of the columella.

Thus the columella is opened laterally in front of the medial crura. Barsky uses an intercartilaginous incision in the vestibule and extends it likewise across the columella to the septum, i.e. about at the level of the medial crura. Joseph used the intercartilaginous incision by itself for saddle nose correction. Holmes uses the transfixion incision in the membranous septum.

Incisions that make it possible to *swing the columella upward* have their antecedents in the V-Y advancement at the base of the columella. This was already described (Figs. 152 and 153). Also the older method of Kazanjian, a bow-shaped ("bird in flight") incision at the nasal tip and the border of both alae (Fig. 232b), probably gave rise to the open-tip procedure much practiced today.



Figs. 232a—d. Various incisions for correction of saddle nose. a Columellar flap of Gensoul and Lexer. b Bow-like incision behind the tip, by Kazanjian. c Incision around the columella, extension along the vestibular rim to the alar attachment and around the latter, according to Cooghlin. d Incision across the columella and extension to the alae at the vestibular rim

Swinging the columellar skin upward as a flap pedicled at the tip comes from Gensoul and Lexer (Fig. 232a). Sheehan and Gillies also have recommended it. The Réthi incision severs the columella horizontally in the anterior third and extends laterally into both nostrils at the vestibular rim (Fig. 124). It was taken over by Šercer for a so-called "decortication" of the nose. With that he meant the elevation of the nasal skin from the cartilaginous and bony structures, which is like "décollement". The incised skin is swung upward and, at the end of the operation, back down and is sutured. This kind of decortication must not be confused with the paring of a rhinophyma as by Berson (see p. 197). The incision which Cooghlin uses (Fig. 232c) for the reconstruction of flattened nasal tips in so-called "dish-faces" runs from a horizontal incision at the columellar base bilaterally into the vestibules. Along the alar border the lateral alar attachment is severed bilaterally. With this incision it is possible to push the nasal skin upward as far as the bony vault and expose the cartilaginous structure of the nasal tip. Thus, under direct vision, implants can be inserted, and additional corrections can be made on the lower lateral cartilages and on the cartilaginous septum. The cartilages can be sutured together in the desired position at their anterior angle. Rehrmann coined the term, "open method", for this approach.

For 8 years we have used an incision derived from the GENSOUL-LEXER incision for inserting angled grafts. With this not only the columellar skin is swung upward like a trunk but also the medial crura of the lower lateral cartilages and the membranous septum as far as the transfixion, i.e. as far as the anterior border of the septal cartilage (Fig. 233). With this the medial crura of the lower lateral cartilage are exposed from behind. They can be spread apart and are allowed to spring back after insertion of the angled graft, thus closing around the shorter leg of the graft. Once the trunk has been swung down again it must be sutured in place meticulously. For better viewing in the dorsum, the transfixion incision can be extended laterally on both sides to the intercartilaginous incisions. At the base of the columella the incision is either U-shaped in the natural fold at the base, or V-shaped. The advantage of this procedure is that the columellar graft is enclosed by a skin covering with good blood supply. Thus

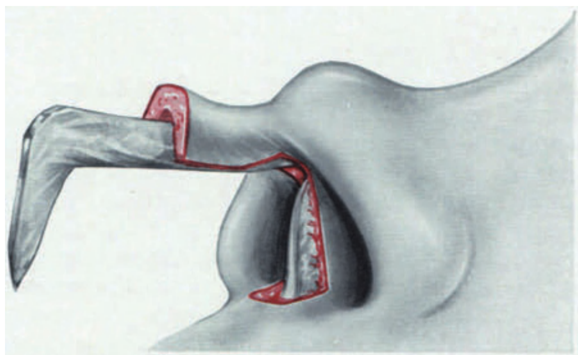


Fig. 233. Insertion of the angled graft from the rib by means of swinging the columella upward, according to R. MEYER

there is greater protection of the lower lateral cartilages, particularly in their anterior angle, and a perforation of the columella due to the graft is more likely to be avoided. The columellar graft can be pushed all the way forward just below the skin, i.e. in front of the medial crura of the lower lateral cartilages, and be fixed with mattress sutures. The mattress sutures bring the medial crura into symmetrical position again next to each other. Thus one can arbitrarily shape the profile to the desired angle in the area of the tip and columella. The sutures are placed far inward in the vestibule.

Finally there is the intraoral approach in the duplicative fringe of the mucosa in the oral vestibule. This was chosen by KRETCHMANN for septal surgery and by LINK and SCHMID for graft surgery. From a horizontal incision in the gingivolabial fold, the maxillary spine and the lower border of the piriform aperture are exposed. From here one separates the two mucous membranes of the septum, first in the direction of the nasal tip. It is best to grasp the anterior part of the septum between thumb and index finger in order to ascertain the position of the scissors or the knife. The medial crura of the lower lateral cartilages are forced apart also. When one has reached the region of the nasal tip, one elevates the skin of the dorsum from its foundation and separates the septal membranes downward as far as the vomer. One can now insert the graft into the pocket thus prepared. PEER uses this approach only for the columellar graft, if he uses a two-piece graft for the saddle nose.

We proceed transorally only if lining of the columellar base, the nasal floor, and the piriform crest is necessary, as in cases of dish face (scaphoid facies).

e) Fixation of implants

The *fixation of two grafts to each other* has, in part, been mentioned (Fig. 223) (Galtier, Gillies, Berson). One should also mention the joining of two cartilage grafts with a kind of hinge after Barsky and a similar method after Wegener. In the latter method a square end of the columella graft is inserted into the corresponding square hole of the dorsal graft. In another method Wegener joined the two grafts by means of nickelin pins and nuts embedded in the Paladone. B. Smith joins two bone grafts from the iliac crest with steel wire. Gonzales-Ulloa fixes his two acrylic implants in a similar manner with steel wire sutures (Fig. 234). The acrylic struts are polymerized by the author himself and strengthened with vitallium if necessary.

Other surgeons usually provide their implants with *multiple perforations*, particularly when the implants are of alloplastic material. This permits the host tissue to proliferate through the holes and thus give the grafts better stability (Hilding, Holt, etc.).

For the immobilization of the columellar graft *at the maxillary spine*. Many authors make a small notch at the spina with a chisel or with a Luer bone forceps. Some apply a wire suture in addition. Dingman embeds small bone cubes around the foot of the graft. However more important than the lower immobilization is the immobilization of the *dorsal graft at its upper end*. Dingman uses a chisel to remove the anterior median edge of the bony dorsum and with this extends the saddle of the dorsum upward. Above the naso-frontal suture he then makes a notch in the frontal bone in which the upper end of the graft is positioned. An additional stainless steel suture is then used to fix the bone graft to the nasal bones. This insertion at the frontal bone is intended primarily for grafts without support in the tip region. In this manner such simple, unsupported grafts are also anchored under the loosened periosteum of the nasal bones or in the synostosis of the two nasal bones and the perpendicular plate of the ethmoid by Messerklinger. To make the hole in the frontal bone Goldman has developed a special hand drill with a handle like that of a corkscrew and cutting surfaces like an auger bit. B. Smith drives a Kirschner wire through the skin and the bone graft at its upper end into the nasal process of the frontal bone to a depth of $^1/_2$ cm. He leaves it there for 3 weeks for fixation of the graft. Holmes also anchors the upper end of the graft subperiosteally. In doing this he slits open the periosteum almost up to this point of anchoring. Converse incises the periosteum in midline and places the upper end of the graft on the bone between the two separated periosteum membranes. In doing this he makes sure that the cortex of the bone graft rests on the raw nasal bone, while the cancellous bone is forward toward the skin. After elevating the periosteum Farina also uses a chisel to make a hole in the bone about 0.5 cm deep in the middle of the frontal bone just over the naso-frontal suture. This is intended for the cephalic end of the autogenous osteoperiosteal tibia graft. He states he has proved by X-ray that in this manner bony fixation has occurred.

Holmes drives the *lower end* of his bony graft between the medial crura of the lower lateral cartilages in the anterior third, i.e. between the cartilage angles. These angles are sutured together in front of this end of the graft. Converse does the same, whereby he also places a thin columellar graft perpendicular to the dorsal graft between the medial crura. We anchor the lower end of our bayonet-shaped, one-piece, dorsal graft similarly to Holmes. We pass mattress sutures through the medial crura above and below the graft. If possible we likewise anchor the upper end of the graft subperiosteally or by means of a notch in the bone. But sometimes if it is a rib cartilage graft, we pass an immobilizing mattress suture of fine steel wire or of thicker nylon around the tissue and the graft. To do this we have to make a very small hole bilaterally in the nasal bone close to the lateral suture using the finest perforating burr. The burr is introduced through a small skin incision. If the nasal pyramid is narrowed at the same time by means of osteotomies, the fixation sutures for the graft can be passed through the lateral osteotomy clefts. — The implant can also be immobilized by means of a carefully applied *plaster dressing* in such a way that displacement is practically impossible and all sutures are unnecessary.

If *fractures of the bone grafts* occur, the fractured parts can be adapted again with fine steel wire sutures or splinted with Kirschner wire. This is indicated by Gerrie and recommended by Straith for deflected noses (Fig. 194) and for nasal fractures in general, and by Brown for guidance of the cartilage graft.

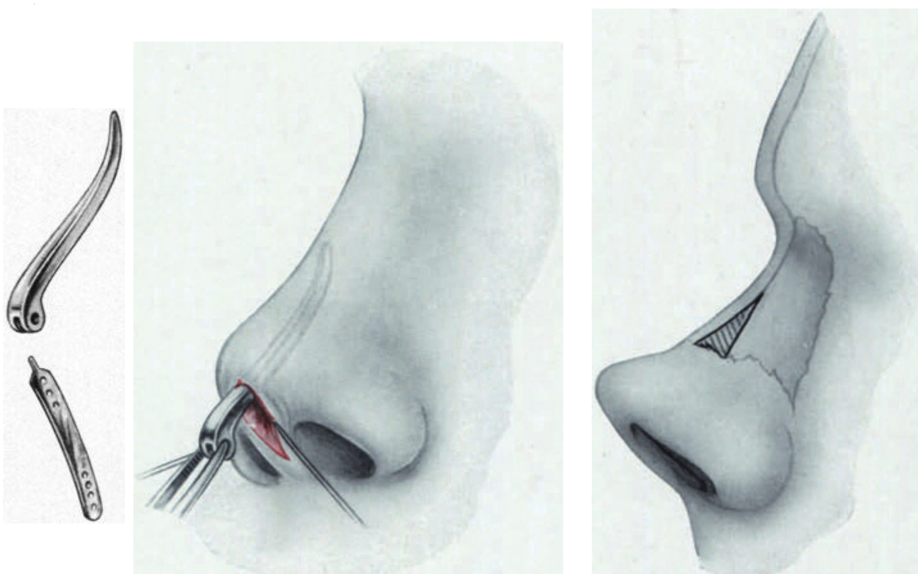


Fig. 234 b

Fig. 235

Figs. 234a and b. Insertion of an angled graft made of plastic by Gonzales-Ulloa through a medio-columellar incision. a Implant with hinge. b Separate insertion of the implants

Fig. 235. Removal of the anterior border of the nasal structure in compound saddle nose in order to better guarantee the solid placement of the implant after insertion

In *secondary curling of cartilage grafts* we expose the graft half a year or a year after the rhinoplasty by the inner approach from the vestibule bilaterally or by swinging the columella upward. We incise it along its entire length several times and arrange the parts of the graft in such a manner that a slight deflection toward the other side results.

X. Correction of compound saddle nose

Saddle nose of high degree is called compound saddle nose or microrhinia. It is caused mostly by accidents and also by lues. For this reason one also finds it termed luetic saddle nose.

"*Lorgnette nose*", is a lesser degree of saddle nose. Its correction is essentially the same as for usual saddle noses. One must emphasize here only the usually necessary removal of the lower part of the prominent, highly excavated bony nasal structure. This is done so that the graft does not ride on this bony edge and does not project at the glabella (Fig. 235). Legler emphasized this particularly. The procedure has already been mentioned above in the discussion of immobilization of grafts in the saddle nose (see p. 182) (DINGMAN).

There are also compound saddle noses of slight degree which have no pronounced saddling of the dorsum, but rather a contraction of the alae and the

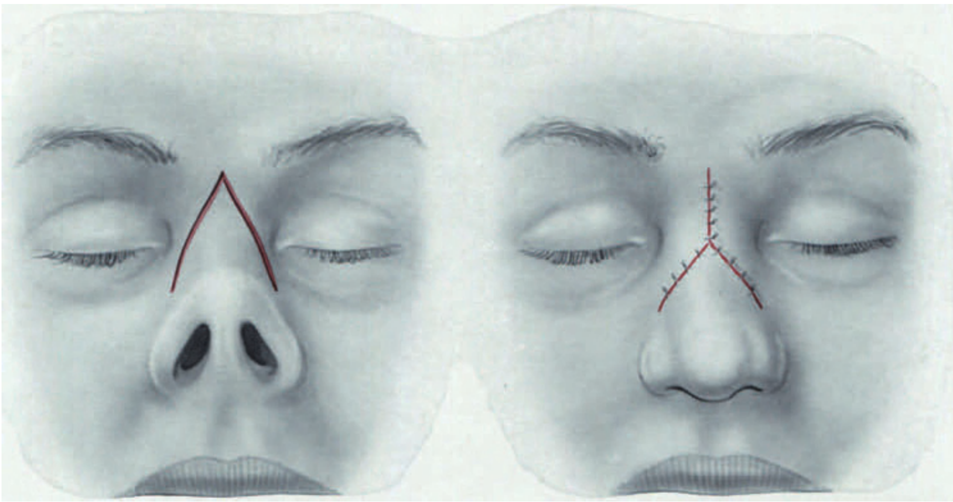
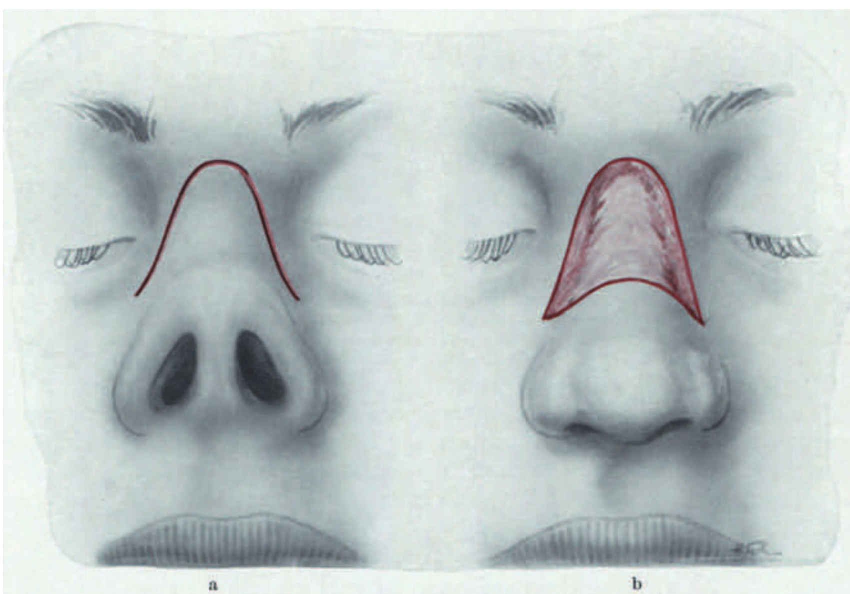


Fig. 236. Inverted V-Y advancement in compound saddle nose according to DIEFFENBACH



Figs. 237a and b. Compound saddle nose operation by GANZER. a Incision. b Inferior part of the nose brought downward to the normal position. Resulting defect is covered by means of rotation of skin from the neighboring areas, by using skin flaps from the forehead or the upper arm or by means of tubed pedicle flaps (BOLLOBAS)

columellar base. Thus the nasolabial folds are more pronounced and create a tormented facial expression. Such contractures must be eliminated by adequate separation of the scars. This necessitates additional internal lining of the gap at the nasal wall and at the nasal bone. In some circumstances it is possible to graft the epithelium by means of stent dental compound (CONVERSE).

Surgical repositioning of the lateral base of the alae fills the naso-labial fold, but this has as a result the creation or increase of hidden columella. This must then be corrected additionally by the proper manipulations (see p. 114).

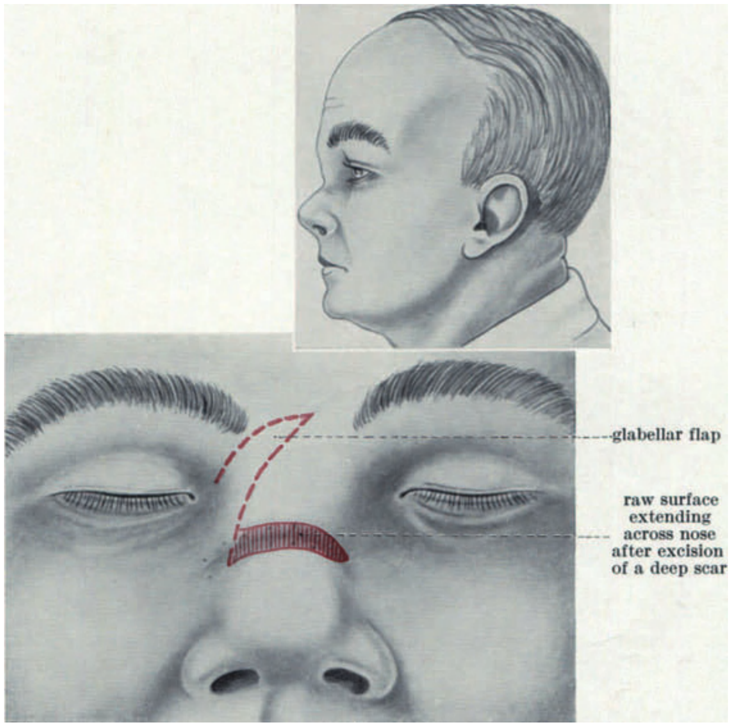


Fig. 238. Nose which appears too short. The skin over the glabella is pulled toward the nose by scars (see smaller sketch) and change the profile. Dotted red line shows glabellar flap. Red hatching shows raw surface after removal of a deep horizontal scar

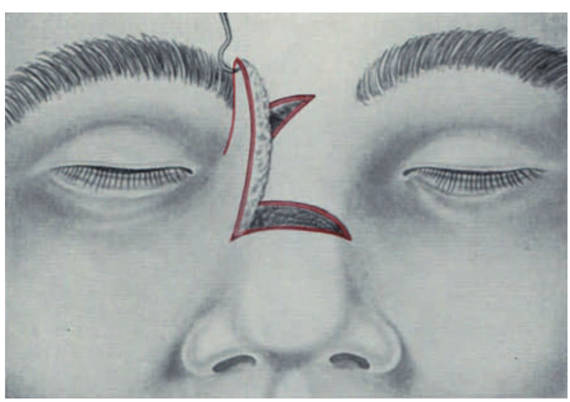


Fig. 239. The flap raised on the glabella is transferred into the deep defect bed in the nasal dorsum in order to bring the level back to normal

1. Sliding flaps and other flap utilization

In a compound saddle nose of high degree the skin of the dorsum can probably still be sufficient to form a proportioned nose. If this is the case, then even in children it is necessary to make a temporary filling with a bone graft or with plastic

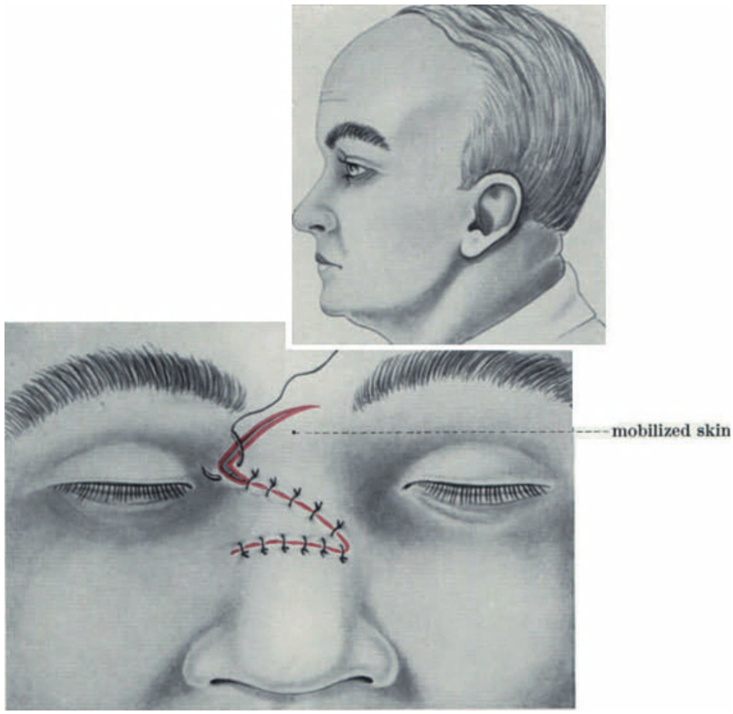


Fig. 240. The nasal dorsum is covered by the glabellar flap which is thinned by removal of subcutaneous tissue. The smaller sketch shows corrected dorsal line. The nose seems to have been lengthened in the region of the nasal root due to the correction

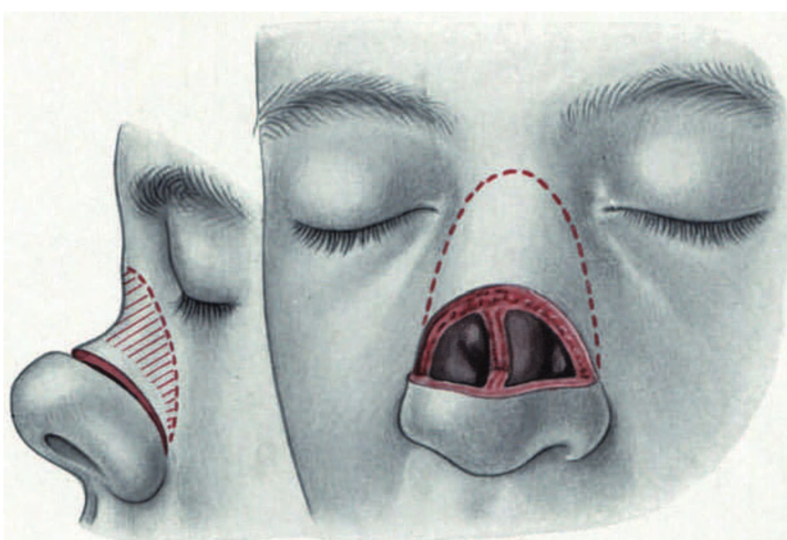


Fig. 241. Plastic replacement of the nose in a defect of the middle and upper part of the nose. The lower part of the nose which is pulled upward is separated from the upper part by means of an incision completely through the nose and is drawn downward. The inner lining of the nose is formed from the skin which covers the nasal dorsum (red hatching). (From H. J. DENECKE)

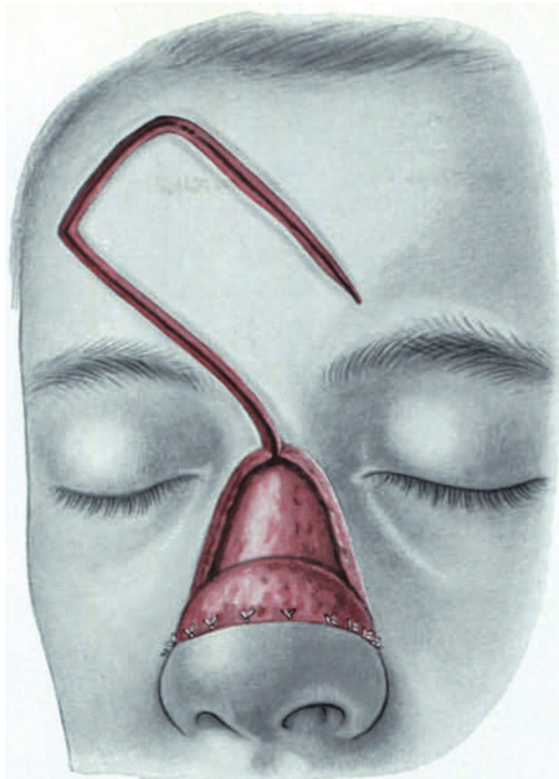
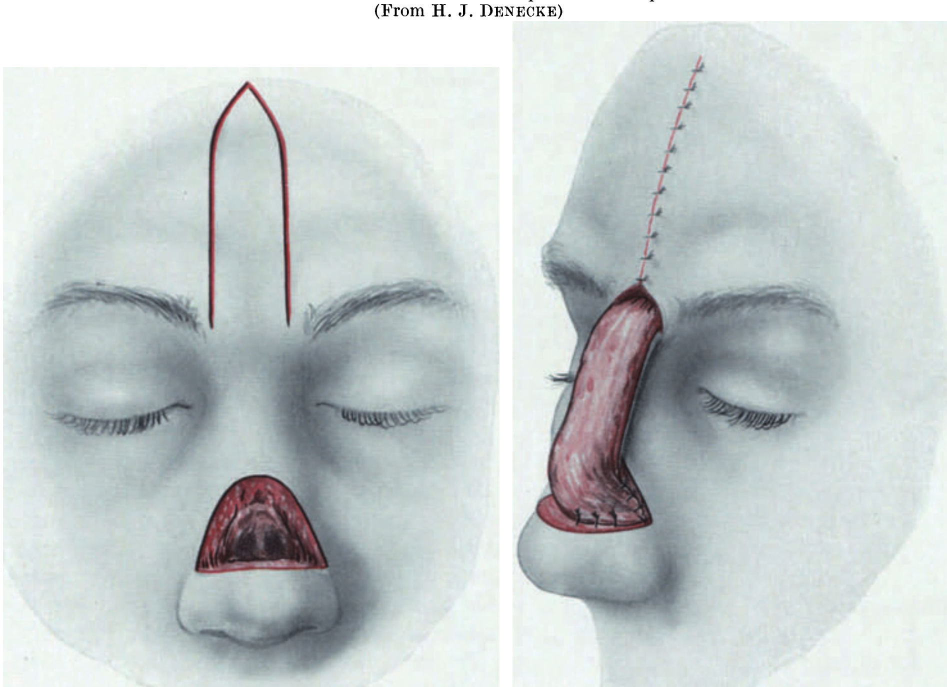
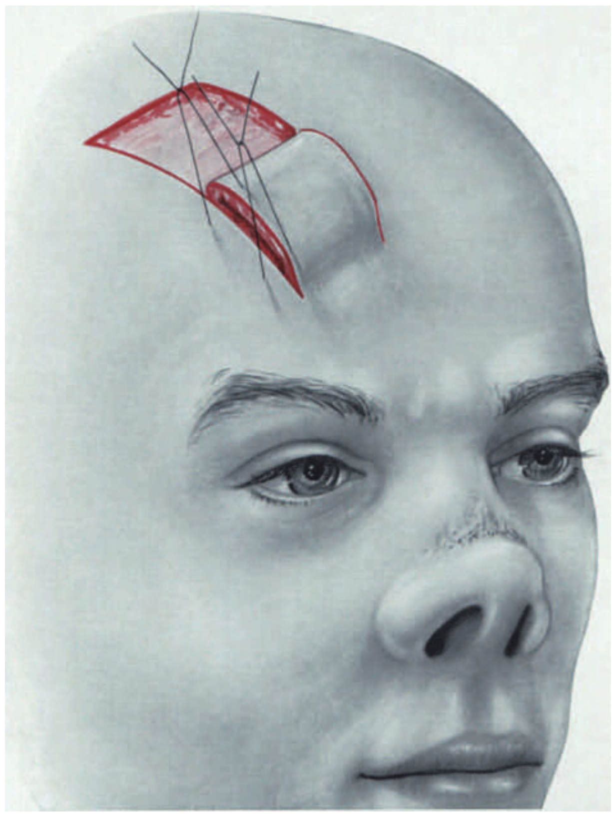


Fig. 242. Plastic replacement of the nose in a defect of the middle and upper part of the nose. The inner lining of the nose has been formed. On the forehead one forms a flap which corresponds to the defect on the nose. (From H. J. DENECKE)



Figs. 243a and b. Compound saddle nose surgery by KAZANJIAN with median forehead flap. a The lower part of the compound saddle nose is drawn downward after an incision is made through the entire nose. Formation of the flap. b Suturing the flap for inner lining. Donor site on the forehead closed. The middle part of the flap is intended for external covering of the defect. The base of the flap is to be replaced on the forehead material to stretch the skin. Subsequently one must also often implant larger grafts at intervals of a few years (Erich, Rapin, Fomon and colleagues. After Erich this can be done every three months in adults. If the compound saddle nose is so pronounced that the nostrils are situated more or less vertically (nasus recurvatus) instead of horizontally as is normal, then in the first place skin must be brought to the site. The simplest type of skin surgery is an *inverted V-Y advancement in the region of the glabella* (Fig. 236). A further possibility is the formation of an *oval flap at the glabella* as by Ganzer, which extends to the



Figs. 244a—d. Correction of compound saddle nose using a forehead flap by Réthi.
a Formation of the duplication of the distal end of the flap in a subcutaneous pocket on the forehead

forehead (Fig. 237). The pedicle of the flap is undermined below to the piriform aperture. In this the soft tissue on the dorsum spreads apart, without opening the nasal cavities. If only slight scarring is present, the nasal tip can be pulled downward; the skin flap is pulled along with it. To close the resulting defect at the nasal root and the forehead, the surrounding skin can be rotated onto it with excision of lateral Burow's triangles or be provided by means of flap procedures. Later, in half a year at the earliest, a supporting graft can be inserted in the manner described above. Only in extreme cases, in which a *pedicled flap or a tubed pedicle flap* must be used to form the nasal dorsum, can one implant the bone graft in the flap prior to this. In traumatic compound saddle noses the defect resulting from removal of the scar can also be covered with a free skin graft and later be lined with an implant or a graft (Herlyn).

If the glabellar skin is pulled downward by a scar on the dorsum, e.g. following trauma or rejection of a graft, a prominent nasal root is simulated, and the nose appears too short. The defect can be corrected by means of appropriate advancement flaps from the glabella, e.g. *transposition flaps* (Figs. 238—240). Often at the glabella as well one must still remove subcutaneous tissue or bone. This makes the dorsum of the nose appear longer. The flap taken from the glabella and the nasal root can be used to replace deeply contracted, horizontal scars in the dorsum. It has been shown that even relatively thin flaps in this region guarantee an excellent profile correction.

Fig. 244b. Formation of the entire flap with the duplicated end. The entire nose is cut through at the border of the bony and cartilaginous part. The skin lateral to the dotted lines on the flap is removed

Sometimes not only external loss of substance on the dorsum is present, but the mucosa is also inadequate for lengthening and enlarging the nose. When this is the case, then a mucosa defect in the middle part of the nose occurs after the horizontal severing of the nose and mobilization of the lower part of the nose described above. To *replace this missing mucosa* JOSEPH described a procedure which is much used today (Fig. 241). A flap is formed from the external skin covering the dorsum and is folded down into the perforating defect, so that the skin originally covering the dorsum forms the inner lining in the area of the perforating defect. The free edge of the skin flap is sutured to the upper edge of the separated nasal tip which has been repositioned downward. The resulting larger defect area on the dorsum is covered by a forehead flap (Fig. 242). The covering flap can also be pedicled from the upper arm or come from other parts of the body as a tubed pedicle flap. If the tissue of the dorsum is not suitable for the inner lining, e.g. because of radiation damage, one can take skin from the cheek bilaterally or skin from the covering flap for this. Skin from the cheek must be taken so that no ectropion at the lower lid occurs when the secondary defect is closed.

A similar procedure was worked out by KAZANJIAN (Fig. 243). He likewise repositions the lower part of the nose downward by making a horizontal incision at its upper edge through the entire thickness of the nose. Then he sutures the

Fig. 244c. Suturing the flap with the duplication inward for inner lining of the nose. The donor site on the forehead should be resurfaced temporarily with a THIERSCH graft

tip of a long forehead flap into the resulting defect for inner lining. The pedicled flap is cut in midline from the entire height of the forehead and is 2 to 3 cm wide. The forehead defect is closed by approximation of the borders. Later the base of the pedicled flap will be swung back upward and sutured after the middle part of the nose has healed. The defect area at the tip of the flap is covered by folding the middle part of the forehead flap downward. Later, after improvement of the edges of the flap, a bone graft is implanted here as well.

The KAZANJIAN procedure is more complicated than the one of JOSEPH. After the flap is sutured in place, the nourishment of the tip of the flap is much endangered by the horizontal incision. In addition the externally exposed wound surface of the forehead flap can give rise to pronounced shrinkage. This will occur especially if one has to wait longer for understandable reasons before severing the pedicle in tissue with radiation damage.

When the tip of the flap has healed and the flap has been swung down for external covering, the duplicative fold still must be corrected in a later stage. For in order to avoid a disruption of nutrition at the duplicative fold, a leveling correction is not permitted here at the same time.

In almost the same way RÉTHI also uses a forehead flap to lengthen the dorsum (Fig. 244). The skin flap is shaped like a parallelogram, the axis of which runs diagonally across the forehead. Along the upper and the lateral edges of the parallelogram the skin is cut and folded under the future base of the flap

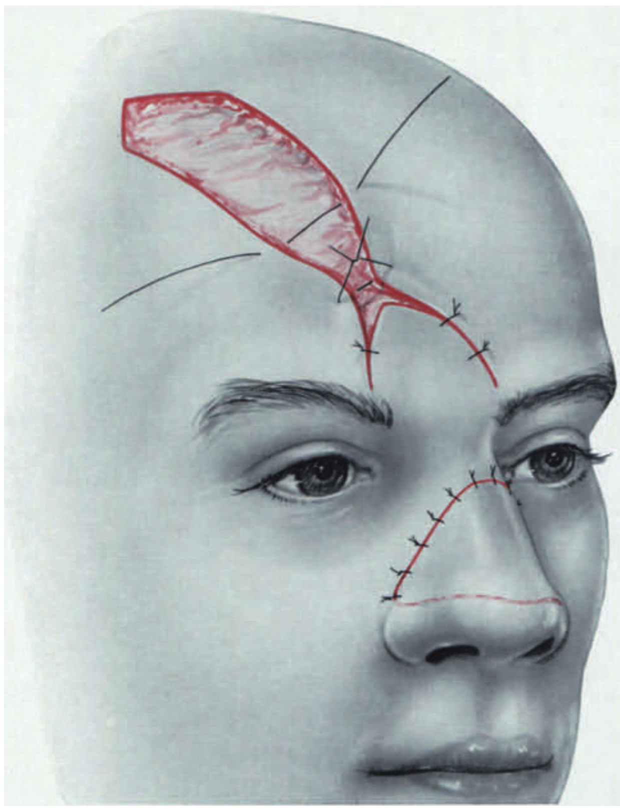
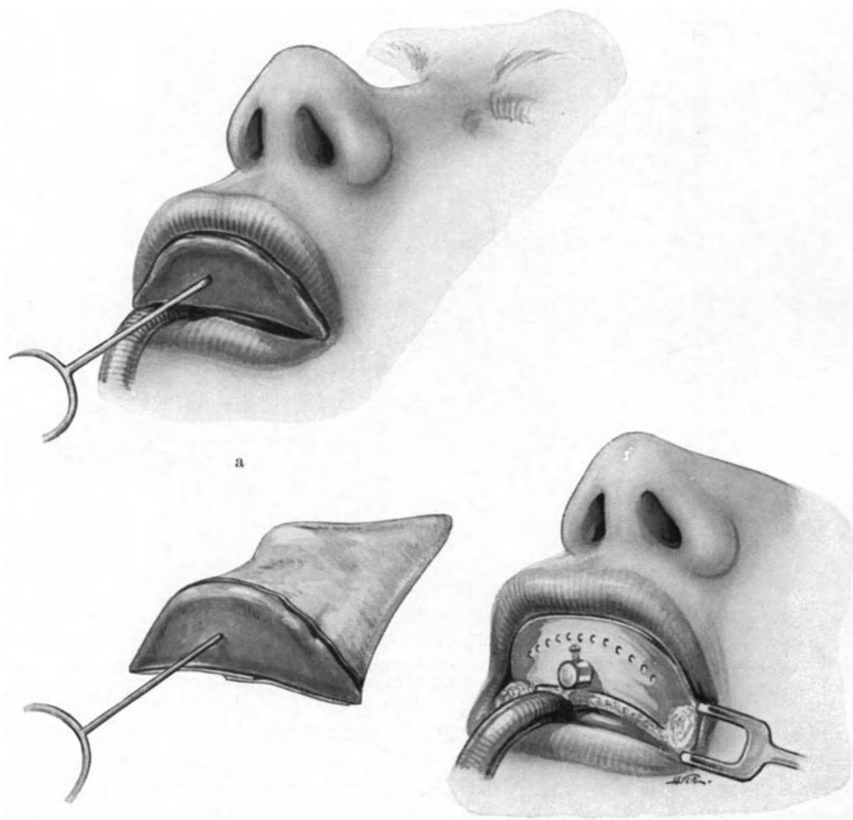


Fig. 244d. Situation after suturing the flap and replacing the pedicle on the forehead. The temporarily resurfaced donor site is closed by approximation after removal of the THIERSCH graft

and allowed to heal. This is done according to the extent of the desired lengthening of the nose. Now the incisions in the extension are proportioned long enough so that the border of the skin flap which has been turned under reaches the lower end points of the pedicle. With this one obtains a skin duplication which will form the inner and outer lining of the area necessary for lengthening the nose. Since complete organic union of the skin duplication is a prerequisite for future viability, the second phase of the operation takes place after 3 or 4 weeks at the earliest. In the second phase the pedicle is extended to the nasal root. The forehead flap is raised. Nor far from the nasal tip one cuts straight through the dorsal skin, the lateral nasal wall, and the septum. Now the lower part of the nose can be swung downward until its position corresponds to normal nasal length. The next task is to trim the distal portion of the skin which was turned under the original flap. This is done so that the cut corresponds to the border of the mucosa at the upper wound surface of the severed dorsum. The skin is cut through along the fold of the duplication. The inner skin layer of the flap rotated to the dorsum is joined with the lower mucosal border of the nose. Finally the border of the wound in the outer skin layer of the end of the flap is sutured to the skin wound behind the nasal tip. Again one waits 4 weeks. Then the pedicle is separated where it reaches the upper limit of the defect. The rest of the pedicle is replaced on the forehead. In particular cases the thick scar of the dorsum can be removed completely, since enough replacement tissue is available.

2. Endonasal prostheses and retention devices

The methods for inner lining of the nose with THIERSCH grafts are much more complicated. They are indicated in the most pronounced form of compound



Figs. 245a—c. Nasomaxillary inlay by CONVERSE with a THIERSCH graft for correction of compound saddle nose. a Insertion of the prosthesis. b Prepared prosthesis wrapped with a THIERSCH graft. c Fixation to the maxilla

saddle nose. In such compound saddle noses of high degree caused by internal shrinkage, usually the middle part of the maxilla is also partially destroyed, and so-called "*dish-face*" occurs. In 1923 GILLIES worked out the procedure of the *nasomaxillary epithelial inlay* for the treatment of such deformities. Some authors today ascribe the method to SHEEHAN as well. The term, epithelial inlay, was coined by ESSER, a Dutch physician, who was active in the Austrian army during World War I. When reconstructing the lower jaw he formed the oral vestibule by using this type of stent wrapped with a THIERSCH graft. The "nasomaxillary inlay" is an artificial retronasal device. The collapsed nasal pyramid is raised from within by means of a support. From an incision in the oral vestibule, a stent mold shaped according to a previous wax impression and covered with a THIERSCH graft, is inserted under the nasal skin (Fig. 245). After healing, the newly lined cavity must be provided with a permanent prosthesis of rubber. Today these prostheses are made of acrylic acid derivatives like Acrylith and Paladone. The nasal prosthesis is anchored to a dental plate or to the upper teeth. Many surgeons today use plastic from acrylic acid derivatives for the mold carrying the THIERSCH graft (CONVERSE). After GILLIES, KAZANJIAN and CONVERSE, the carrier made of hard rubber, stent, or acrylic plastic is removed after 2 weeks and replaced by smaller ones. After 6 weeks the permanent prosthesis is provided. BROWN and MCDOWELL even take out the mold after 4 days, trim the THIERSCH graft and replace the same mold every other day for 4 to 6 weeks.

GILLIES and SHEEHAN also use complicated *metal supports* which are likewise anchored to the upper teeth or to the upper dental plate (Fig. 246). Through an incision at the base of the nose F. SMITH opens up the nasal cavities in which a retrusion of the maxilla, i.e. a "dish-face" or scaphoid facies is present. He does this to introduce the stent for lining. The incision is made from one alar attachment to the other, and he turns the entire skin inside out over the shrunken septal cartilage in the region of the tip. He does not use a THIERSCH graft for the inner lining of the nose. Instead he uses a thicker dermatome graft, the so-called intermediate graft. After about 10 days he removes the stent but does not replace it with others. He packs the cavity for up to 6 weeks. Then he lines the skin with cartilage grafts, working from the columella, i.e. after swinging a columellar flap upward as described in the discussion of saddle nose corrections (see p. 179).

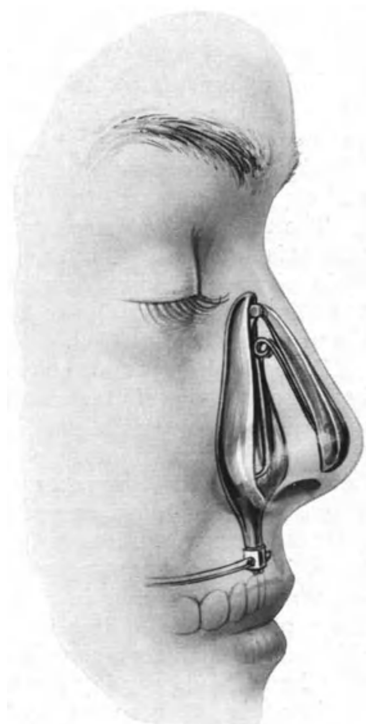


Fig. 246. Spring-loaded metal support with fixation on the maxilla for correction of compound saddle nose by GILLIES

The question of replacing the supporting metal, rubber or plastic prosthesis with *autografted cartilage or bone* has also been considered (GILLIES, SHAW, BATTLE, BROWN and MCDOWELL and others). Then it is also possible to close the large oronasal fistula. BROWN and MCDOWELL have shown this procedure with the use of rib cartilage. Probably it has the disadvantage of a certain amount of subsequent shrinkage, but crust formation and the complicated hygiene of the permanent prosthesis are eliminated. For many patients the lasting dependency upon a prosthesis might be a psychic burden, but the cosmetic successes of the treatment by GILLIES are amazing. In 1957 MCLAREN and PENNEY published seven cases treated as by GILLIES, in only one of which the prosthesis was replaced with cartilage. The result was not as good as in the others. Further publications are by McIndoe (1937), Kazanjian and Converse (1949), Bruch, Barsky (1950), Battle (1952), Jayes (1957) and Donati von Gralath (1958). Donati von Gralath described a modification for the plastic inlay. It is not anchored to the upper teeth nor to a dental prosthesis as after Gillies and Sheehan, but is supported at the lower rim of the piriform aperture. This way the intact teeth of the patient can be spared. The oronasal structure also has two lateral plates next to the nasal support which advance the soft parts forward bilaterally at the nasolabial fold.

XI. Correction of rhinophyma

Rhinophyma is a disfigurement, particularly of the lower parts of the nose. Although the etiology has not been indisputably explained, it is known the vernacular and in medical terminology under the most diverse names, such as Whisky nose, rum nose, strawberry nose, wine nose, brandy nose, potato nose, and copper nose.

The term generally recognized today, rhinophyma, comes from Hebra, who used this name in 1856 to designate the 3rd degree of acne rosacea of the nose. — Rhinophyma tissue can sometimes also be found in the region of the cheeks, the chin (mentophyma), the forehead, and the ears (otophyma). Then the proper therapy is to be extended.

Several attempts at conservative therapy have failed. People have tried hormone and vitamin treatment, X-ray treatment (Villafuerte), chemocautery with zinc chloride (Guérin), with trichloracetic acid (Tamerin) or with cryotherapy (Fishof). All of these attempts were unsuccessful. Thus the most practical treatment with lasting success today is surgical removal of the diseased tissue. The first rhinophyma operation was performed by the Wittenberg professor, Daniel Sennert. However, he did not describe his operation. On the other hand, in 1845 Dieffenbach described his cross-shaped or *elliptical excision for hypertrophy of the nose* in older people. The excision after Dieffenbach in the shape of a vertical ellipse from the dorsum and the nasal tip and a horizontal ellipse from each ala was redommended again by von Bruns (1903), later again abandoned, and only in recent years again taken up by Borges.

According to a report by Trendelenburg, Langenbeck sliced the proliferation from the cartilaginous nasal structure in 1851. In 1876 Ollier coined the term, "*decortication du nez*", for this method of slicing the skin with the knife. It was also described in 1864 by Stromeyer and in 1873 by Boncé. Along with these two fundamental methods of excision and decortication a third appeared at the turn of the century: the *extirpation of rhinophyma tissue*, which was published in 1901 by Weinlechner. By means of an inverted Y-shaped incision, he performed the subcutaneous extirpation of the rhinophyma. But later he abandoned this method in favor of decortication because of unsatisfactory scar formation. Joseph still used this method intıanasally later in early stage rhinophymas, i.e. through an incision at the vestibular rim bilaterally. In slight cases this *endonasal method of excision* is still used today by Galtier. In the excision of the rhinophyma tissue, the superficial skin layer is protected and placed on the intact cartilaginous structure after the excision. Middle-sized rhinophymas, which essentially affect the lower part of the nose, were also reduced by Joseph by means of decortication. In order to minimize the skin defect he additionally reduced the cartilaginous nasal structure by means of horizontal wedge excisions from the lower lateral cartilages and from the septal cartilage. He covered the defect with pedicled rotation flaps from the region of the glabella or from the neighboring cheek. In a group of very large rhinophymas JOSEPH also used the decortication method with the knife in local anesthesia. He covered the defect with a forehead flap. Thus decortication has won the most followers. OLLIER has replaced the knife with the thermocauter. But for some cases he has recommended the combination of knife and cautery. DELONNES, HARDY, BLOEBAUM and others advocated work with the thermocauter. JOSEPH only used it for deep decortication in extreme special cases of the third group. He did this because of OLLIER'S view that the cauterization of the superficial skin layers

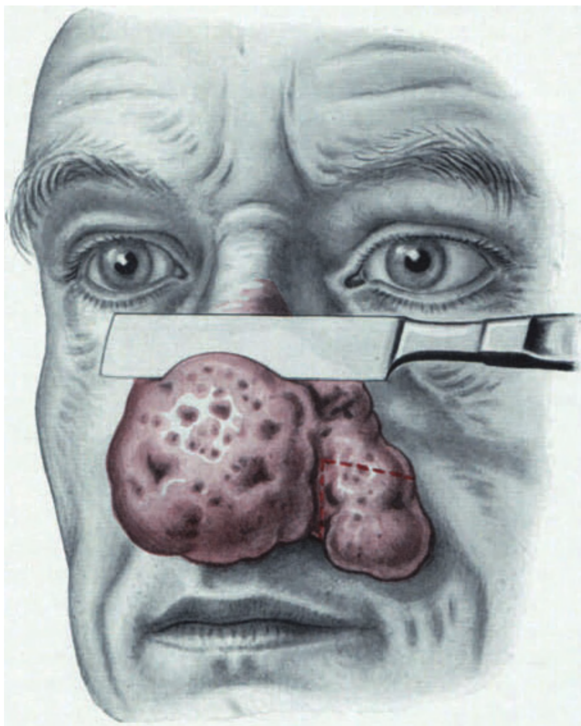


Fig. 247. Superficial decortication of a rhinophyma. The incision for removal is made parallel to the surface and shallow enough so that small epithelium islands remain on the surface of the cut. In bulbous and flap-like formations, the wedge excisions are made (dotted red line). After partial healing in this region, the remaining rhinophyma tissue is removed by means of the customary surperficial decortication. (From H. J. DENECKE)

stimulated the deeper layers to increased growth. Today the removal of proliferation by means of diathermy is still recommended by some surgeons like FARINA, ROSENBERG and FELSHER, NIEDELMAN, NYLEN and KLEINE-NATROP. MALBEC cauterizes the superficial vessels with needles and coagulates the vessels. Hemostasis by means of electrocoagulation is recommended by MARTIN and FISHOF.

Like most surgeons today, we prefer the knife to the electric cautery. The electric cautery no doubt has the advantage that unevenness apparent during the first days can immediately be eradicated again without disturbing the healing process. But there is danger of cartilage necrosis in this. We have already observed ugly scar formation due to cartilage necroses. It can also come to perforation defects in the area of the alae. These must be repaired with a composite graft (see p. 330) after being freshened.

In *decortication* the rhinophyma is sliced off in layers (Fig. 247). Because of less bleeding this is done with local anesthesia. One should be sure that follicular epithelium remains on the surface of the cut for epithelization of the wound surface. If the entire epithelium is removed, ugly scars occur if one does not cover the defect with a THIERSCH graft or a full-thickness skin graft. In very large rhinophymas the method described above is not adequate. In such cases one must additionally excise large portions of the bulbous growth from a skin incision laterally at the dorsum so that the nose is considerably reduced. Surplus skin is removed also and the remaining skin is fitted to the new nasal shape, placed on the wound surface and sutured. Since this concerns parts of the rhinophyma, after healing the thick parts of the skin are thinned in layers using a sharp knife in the customary manner during a second step. Overly large alae are reduced by appropriate excisions. If the rhinophyma has bulbous and flap-like formations along with it, these are cut off at the "neck" in such a way that the wound surface can be covered with epithelium from parts of the flap, until the remaining parts of the rhinophyma are removed with the sharp knife as shown above. Since bleeding is heavy from the rhinophyma wound, after the maneuvers are completed one places a pledget soaked with epinephrine on the wound. One applies a pressure pad and fixes it with a nasal dressing.

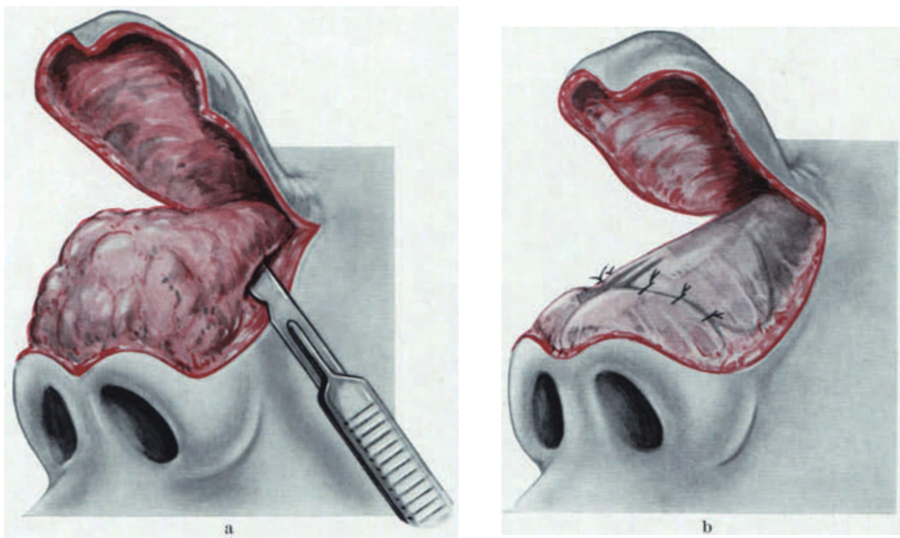
If the rhinophyma skin affliction also encroaches on the cheek from the lateral nasal wall, the skin can also be cut away here correspondingly. The curved double-edged knife of JOSEPH is suitable for work in the angle between the nasal wall and the skin of the cheek, because it fits best in this area of the concavity when the skin is stretched.

If deep decortication with complete removal of the epithelium must be made, it is recommended to cover the wound with a THIERSCH graft, with a full-thickness skin graft, or with a transposition flap from the forehead or from the arm. But then one must be certain that all rhinophyma epithelium has been removed.

During surgery one must take care that the lower and upper lateral cartilages are neither injured nor resected. This can lead to deformities. In addition, thinning at the periphery should not be overdone. Otherwise necroses occur at the alar rims. Also in the area of the columella the rhinophyma can be removed while protecting the medial crura of the lower lateral cartilages by stretching the columella. The operation is technically easier when slicing from the alae if one inserts a finger into the nostril, to stretch the ala. Contrary to many authors like DE KLEINE and others, we are of the opinion that in deep decortication the lower lateral cartilages should not be stripped of their perichondrium and of a thin layer of connective tissue. This prevents a necrosis and ugly retraction of the surface. NYLEN, MAY, BROWN and MCDOWELL also point out this danger. But in deep decortication all epithelium islands should be removed. In superficial decortication in slight cases, a satisfactorily attractive skin covering forms again by itself. With deep decortication as well, some authors leave the extensive defect to spontaneous granulation and skin covering. Others cover the granulating area with a THIERSCH graft on the 8th day. Contrary to BARSKY and NYLEN we consider it better to cover the defect with a THIERSCH graft immediately after the decortication. According to the case, we use a very thin split-thickness skin graft of epidermis and papillary stratum or a medium thickness graft of epidermis and a half cutis layer. Both are obtained with the electro-dermatome. SHEEHAN, BROWN and MCDOWELL, GALTIER and MAY have used split-thickness skin grafts for covering. In cases of deep decortication, in which we have made no covering with a skin graft after the recommendation of BARSKY and NYLEN, the defect closed with a fine layer of scar epithelium without glands, which tended to be ulcerated. In our experience the cosmetic result is better with the free skin graft. In many cases we have observed the appearance of small pustules in the grafted skin months after the operation. — Some authors (MAY, DEBIDOUX and DE VILLIERS) also use full-thickness skin grafts, so-called WOLFE-KRAUSE flaps of epidermis and cutis, to cover defects. If possible one should try to do the superficial decortication without grafting, since the cosmetic results with this method are best, in which the epithelization occurs from the crypts left behind.

Among the adherents of decortication with scalpel, amputation knife or razor are SHEEHAN, BROWN, McDOWELL, BERSON, SELTZER, WOLFE, MAY, REES, DE VILLIERS, LOWENTHAL, WEHR, LENZ, MALBEC, MARINO, FISHOF, NETO, CINELLI, SCOTT, MACOMBER, PITANGUY, and others.

A further procedure for treatment of rhinophyma is the use of high-speed, rotating grinding wheels and fraises by SCHREUS. We have tried it only in



a b

Figs. 248a and b. Subcutaneous extirpation. a Extirpation of a rhinophyma by means of subcutaneous excision of the rhinophyma tissue (BERSON). b Situation after excision of the rhinophyma tissue and shortening the nose with protection of the upper and lower lateral cartilages. The skin flap which has been swung upward is replaced after the raw area has been treated (according to BERSON)

very slight cases. KLEINE-NATROP and BEISENHERZ report good results with the high-speed fraise. Here, too, one must make sure that the cartilage is not injured and that epithelium islands remain for later skin covering if one does not intend to use THIERSCH grafts or split-thickness skin grafts. Heat caused by the fraise could mean danger of a later cartilage necrosis.

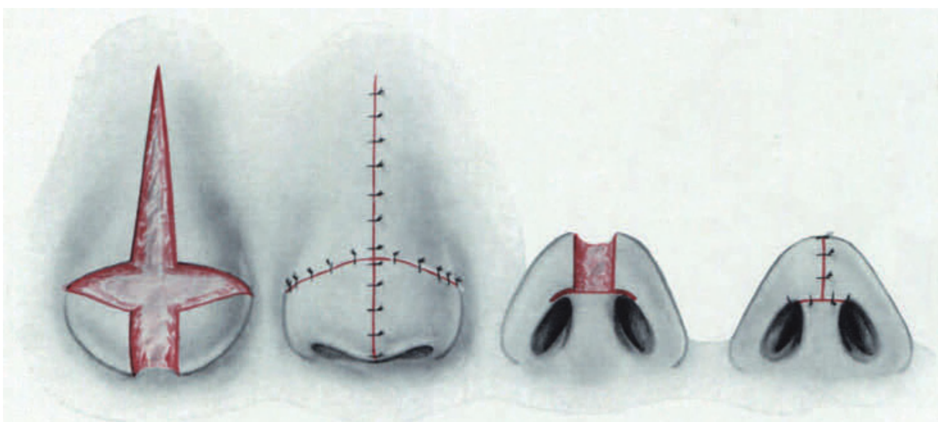
Intensive coagulation for hemostasis can lead to ugly scar formation which can affect the cosmetic result. Therefore during the operation it is necessary to cover the operative field for a few minutes with compresses soaked in saline solution and epinephrine. During the operation it is also recommended to compress the A. angularis which runs upward at the side of the nose as a branch of the A. facialis.

The *subcutaneous extirpation method* of WEINLECHNER is still practised today in a modified version by BERSON. From a curved incision bilaterally along the alar rim and over the anterior part of the columella, he undermines the superficial rhinophyma skin, swings it upward and excises the rhinophyma tissue down to the cartilage. Then he trims the skin which has been swung out of the way, replaces and sutures it (Fig. 248). Because of the unevenness of the skin surface in rhinophyma, we do not consider this procedure very favorable. It is suitable only in rhinophyma of slight degree.

In our cases we have not yet seen an indication for closure of the defect with a skin flap from the glabella, forehead, or cheek, as described by JOSEPH, MAY and GALTIER.

Nor were our cases suitable for the flap covering after SANVENERO-ROSSELLI. In this method a bilaterally pedicled bridge flap is formed and pushed downward. The donor site is closed with a V-Y advancement.

In rhinophyma there is usually ptosis of the lower lateral cartilages, i.e. drooping of their anterior angles. Correction of this ugly deformity along with removal of the rhinophyma masses seems likewise important. Certainly DIEFFENBACH was able to relieve this problem, at least partially, with his cross-shaped excision (Fig. 249). DE KLEINE makes a resection on the cephalic border of the

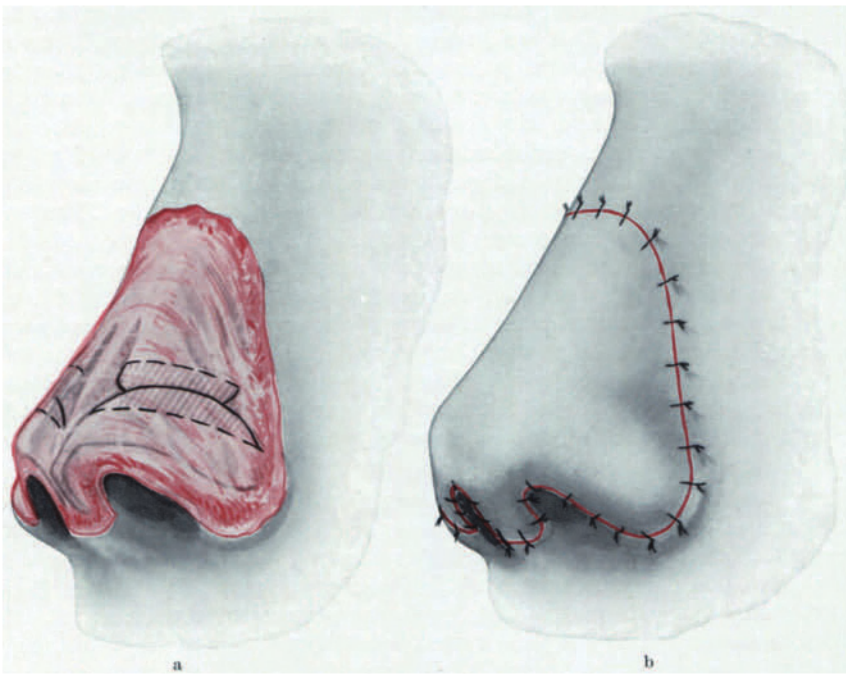


a b c d

Figs. 249a—d. a Elimination of rhinophyma by means of cross-shaped excision and subcutaneous removal of the rhinophyma tissue (DIEFFENBACH). b Treatment of the defect region. c Situation in a viewed from below. d Situation in b viewed from below

lower lateral cartilage and on the caudal border of the upper lateral cartilage and sutures the cartilage borders together with fine nylon. By approximating the edges of the skin he covers the defect over the nasal tip. Of course this can be done only in superficial decortication. In extensive, deep decortication such a method of covering can naturally not be considered. Thus because the defect must heal by itself or be covered with a graft, it is not advisable to leave the cartilaginous structure open, i.e. to trim and suture it directly from the outside. Therefore we *model the lower and upper lateral cartilages* from within through the intercartilaginous incision. In doing this we are most careful that the perichondrium and connective tissue mantle over these cartilages is left intact during decortication and is not pierced from within. Thus two operation areas are formed which do not communicate with each other. By means of the eversion method, one can resect the upper border of the lower lateral cartilages and the lower border of the upper lateral cartilages and if necessary suture the cartilage borders together. With application of a fixation dressing, sutures are superfluous because the cartilage borders lie next to each other (Fig. 250a). The intercartilaginous incisions should run into the transfixion incision. The nasal tip is raised by means of resection of the anterior border of the septal cartilage and application of mattress sutures at the transfixion incision. In some circumstances grafting of a strut of septal cartilage as a columellar support, in the usual manner, is indicated. This support of the columella in rhinophyma was also mentioned by FISHOF, but not in connection with a modelling of the cartilage. Sometimes we even combine a rhinophyma operation with total reduction of the nasal structure, i.e. removal of bone on the dorsum and the median repositioning of the nasal bones.

Having removed the rhinophyma masses and raised the nasal tip, we now cover the defect, which has become smaller, with a very thin or middle thickness



Figs. 250a and b. Plastic treatment of rhinophyma nose after deep decortication. a Excision of the cephalic border of the lower cartilage and of the caudal border of the upper lateral cartilage through the intercartilaginous incision. The raw external and the endonasal surfaces should not come into contact with each other (R. MEYER). The cartilage to be excised is shown by the hatching. b Covering the external defect by means of an intermediate thickness dermatome graft

dermatome skin graft. This is sutured carefully at the edges with nylon (Fig. 250b). We pack the nasal vestibules with petrolatum gauze and cover the skin graft with ointment-gauze.

On the first day we apply neither saline compresses, nor Gelfoam covering as recommended by FISHOF, nor do we paint with tannic acid as suggested by FERRIS SMITH.

After 5 to 10 days the dressing is loosened carefully and removed. The nose is left open to the air dry, with or without a skin graft.

We give hydrocortisone postoperatively as GRUPPER does. Authors like MALBEC, MARTIN, GRATTAN and HUNT mention X-ray radiation as postoperative treatment, sometimes even before the final epithelization, in order to stabilize the success of the operation. We do not consider this necessary, since there is scarcely any tendency toward recurrence anyway.

XII. Treatment of nasal injuries

Generally speaking one distinguishes between recent and old nasal injuries. Both can affect only the soft structures of the nose, only the bony and cartilaginous nasal structure, or both.

1. Recent injuries of soft nasal structures

In recent nasal injuries there are varying findings according to the extent and cause of the injury due to laceration, tearing, or crushing. *Lacerations* of the soft structures are treated according to the general principles for treatment of facial wounds. The wounds are freshened and sutured carefully with fine silk, or fine nylon, which after our experience is better. Subcutaneous catgut sutures are necessary only in rare cases, e.g. when the underlying upper or lower lateral cartilage is also injured and displacement of the cartilage is apparent at the point of laceration. Then perichondrium sutures are made, best of all with atraumatic catgut. This way disfiguring scars and corrective plastic surgery, which might later become necessary, are avoided or at least minimized. Treatment of a lacerated or split nose is very rewarding. With careful procedure hardly visible scars occur here. Almost completely severed pieces of the nose should not be entirely separated from the nose, even if they are still joined by a narrow strip of skin. With proper treatment healing of the severed part is almost always successful. This fact was already well known by Felix Würtz. In 1612 he wrote in his "Practica der Wundarzney": "For such wounds heal up nicely and easily however little they be attached . . . But if a nose or ear were quite cold when one would touch it but still hung on strongly, one should not startle but attach it — then grows a fine nose."

The suture is to be applied in such a way that no blood clots remain between the stump and the severed part of the nose and so that no blood can gather in the wound. If it is the tip of the nose, as it usually is, then one places a few sutures somewhat deeper. One stops the bleeding as completely as possible by means of compression before suturing. In the area where an attachment remained, the sutures should not be allowed to exert a horizontal pull which would disrupt circulation. It is better not to pull the sutures too tight here so as not to cut off circulation in the nourishing attachment. Trendelenburg already recommended this in 1886 in his treatise, "Verletzungen und chirurgische Krankheiten des Gesichtes" ("Injuries and surgically treated diseases of the face").

Even in former times people attempted the reattachment of *completely severed pieces of the nose.* Trendelenburg reported that, Lanfrancus, Guy de Chauliac, Hieronymus von Brunswick discussed this, but considered readaptation impossible because of theoretical reasons. At the beginning of the 18th century, whoever published an observation on readaptation usually reaped scorn and ridicule. Several observations were withheld out of timidity in the face of public opinion. As Trendelenburg reports, several slanderous articles were written against Garengeot when he reported a case of reattachment of a soldier's nose (1724). Gradually theory has caught up with practical experience. Today no one considers the readaptation of a severed piece of the nasal tip to be extraordinary. One should not be hasty with the reattachment of the severed piece. According to available experience, it is less a matter of attaching the severed piece while it is still warm, than of stopping the bleeding as completely as possible at the stump before reattachment. Dieffenbach even advised waiting until all bleeding has stopped and the wound surface of the stump has entered the "stadium lymphaticum". After suturing the severed part of the nose, a loose dressing with a plaster cap for fixation should be applied.

Recent septum hematomas should be removed immediately by means of incision or aspiration. The two nasal cavities should be packed firmly with Vaseline gauze and the packing left a few days. It should be renewed if necessary. If required, one must incise or aspirate the hematoma. A prophylactic antibiotic should prevent formation of an abscess from the hematoma. If an abscess is already present, it must be removed in the same manner and be treated with large doses of antibiotics. No necrosis of the septal cartilage should occur, since autolysis of the septal cartilage on the nasal dorsum could have the feared saddle nose as a result. In some cases in which a beginning saddle of the dorsum becomes noticeable we have tried to counteract the development of a full saddle nose in the middle part of the dorsum by reimplanting a strip of septal cartilage or by filling the depression with a plastic implant. This procedure is considered one month after the autolysis of the septal cartilage, at the earliest when no irritation to the nose is present. It is best to wait a few months.

2. Old injuries of soft nasal structures

Old injuries of the soft nasal structures are treated according to the principles of scar excision. If they are thin *scars*, they can be corrected by excision. In larger scars with tissue contraction, one must use more complicated methods with flap rotation and advancement. This is described in the following chapter on plastic coverage of defects. In the excision of horizontal scars on the dorsum, lining of the suture area with a subcutaneous tissue flap is recommended. This flap can be rotated from the neighboring area. With this, later contraction of the secondary scar is avoided. It is especially advisable if an already short nose will be shortened even more by the horizontal scar excision (see p. 188).

If patients first come some time after the trauma because of the deformities resulting from it, then one often has to deal with secondary treatment of nasal fractures in addition to disfiguring scars. After 6 weeks the fractures have healed and repositioning of the nose with the method described below is no longer possible. One can then make the maneuvers for correction of deflected nose (see p. 134), of wide nose (see p. 67) and of saddle nose (see p. 141), as described in the respective chapters. Old poorly healed fractures must be refractured, i.e. newly osteotomized. Only then can the bones be brought into the desired position and immobilized there. In a later revision sometimes osteitic foci or sequelae which are in the fracture area can be activated. Since they can cause pain, swelling conditions of long duration, and possibly fistulas, they must definitely be removed if they are discovered.

3. Fractures of bony and cartilaginous nasal vault

There are more fractures of the nasal bones than of all other facial bones. One differentiates between the closed uncomplicated fractures without soft structure injury and combined, complicated open fractures. With the impact of a blunt object, the skin covering of the nose remains closed. Through this one palpates the abnormal mobility and the crepitation of the broken nasal structure. A fall, push or blow against the nasal tip can cause isolated fractures and luxations of the septum. The effect of force on the dorsum may lead to its fracture and displacement into the nasal cavities and thus to the formation of the saddle nose already mentioned. In severe traumas the bones in the neighboring areas may be fractured as well. Then fractures of the middle third of the face occur. There are 6 types: 1. the simple zygomatic bone fractures, 2. zygomatic fractures including the infraorbital border and the anterior wall of the maxillary sinus, 3. horizontal fractures of the maxilla or Lefort I, 4. pyramidal fractures of the

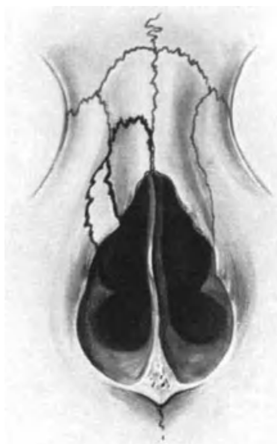


Fig. 251. Unilateral depression fracture

Fig. 252. Fracture through the entire nasal bone with dislocation. Bone torn away at the nasomaxillary suture

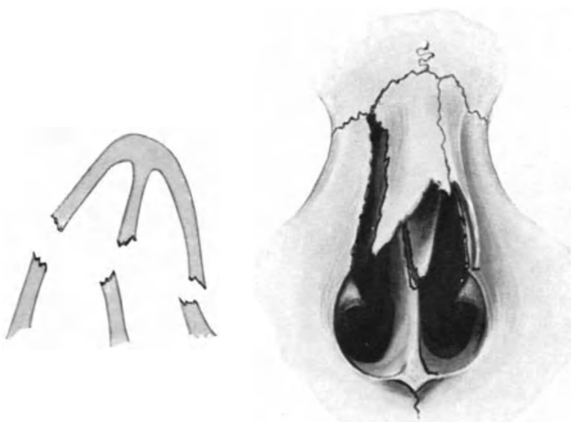
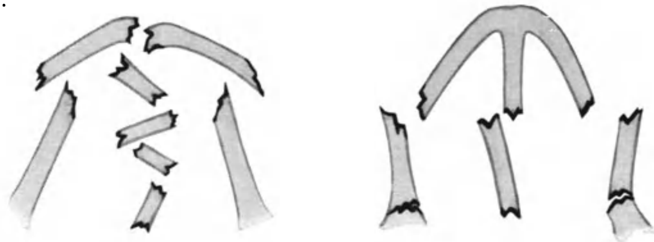


Fig. 253. Fracture of the nasal bone and the perpendicular plate of the ethmoid with dislocation toward one side

maxilla or Lefort II, 5. craniofacial fractures or Lefort III, and 6. the combinations of the above. There are six forms of actual nasal fractures, which do not include the fracture of the neighboring bones: 1. unilateral depression fracture (Fig. 251), 2. tearing away of bone at the naso-maxillary suture (Fig. 252), 3. Fracture of the nasal bones with dislocation toward one side (Fig. 253), 4. Fracture in the region of the naso-maxillary suture and the septum due to crushing of the nasal pyramid like an open book (Fig. 254b), 5. comminuted fracture (Figs. 254a and 255), 6. fracture of septum only (Fig. 256). Typical septal fractures are the fractures mentioned in the anatomy of the nose by Chevallet and Jarjavay. That of Chevallet runs more or less vertically and divides the septum into a firm posterior part and a mobile and displaced anterior part. The fracture of Jarjavay refers only to a rupture of the septal cartilage at its diagonal union with the vomer. — Only two kinds of deformity appear externally after nasal fracture: lateral dislocation of the nose and depression of the dorsum.



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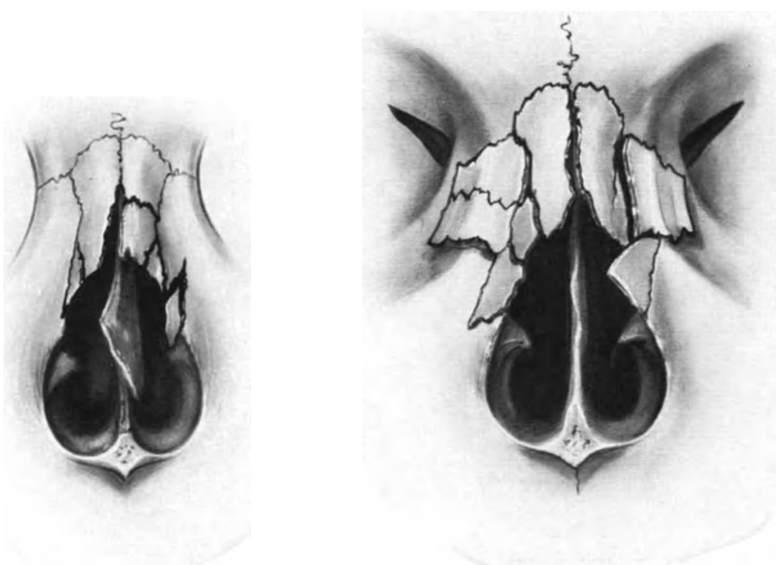
Figs. 254a and b. Types of fracture of the nasal pyramid. a Shattering. b Depression of the nasal pyramid like an open book



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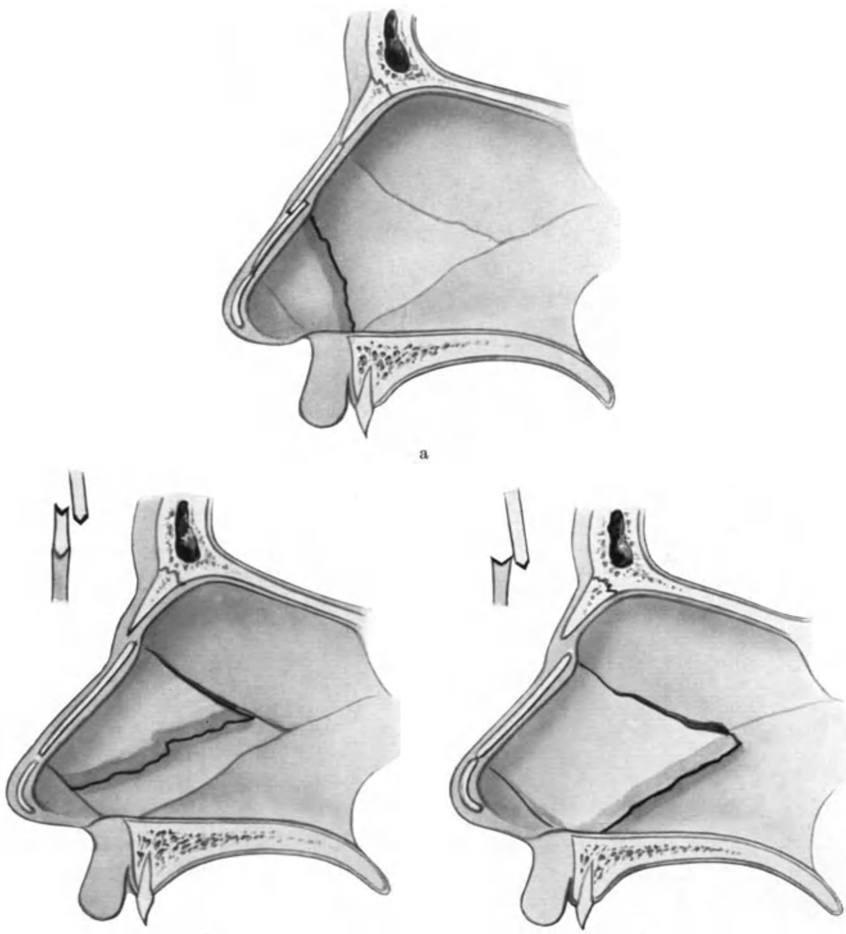
Figs. 255a and b. Comminuted fracture of the nasal structure

One should also mention the subperiosteal fracture which primarily occurs in children. This is usually a separation of the naso-maxillary suture, which can cause an external depression in the bony nasal skeleton.

Very many nasal fractures are not diagnosed. In about two-thirds of all nasal deformities in the adult a previous trauma must be assumed. The patient usually knows nothing about this because it probably happened during early childhood. In every facial trauma one should look for nasal fractures. Anterior rhinoscopy alone does not always rule out a fracture. If the mucosa remained intact and the septum is not injured, hardly any pathological findings are to be made rhinoscopically.

In simple, i.e. closed fractures, one sometimes palpates a fissure or dent, finds crepitation, or sees effusions at the point subjected to the blow. A sure sign of a nasal fracture soon after the accident is the lid hematoma. In addition there is almost regularly a more or less profuse epistaxis. In compound (i.e. open)



a b c

Figs. 256a—c. Fractures of the septum. a Vertical cartilage fracture according to CHEVALLET. b Horizontal cartilage fracture with dislocation (see small sketch as well). c Septal cartilage torn away at the vomerine border, according to JARJAVAY (see small sketch as well)

fractures there are often smaller or larger chips of bone. These project outward through the external laceration or into the nasal cavities after these have been cleansed of blood clots.

Most rhinoplastic surgeons feel that *X-ray examination* is very important for diagnosis. It is also important in older fractures. According to BECKER (USA) and BROWN it may also yield no clue. Among 100 definite cases of nasal bone fracture examined, BECKER had a negative X-ray result in 47. According to FOMON as well the X-ray picture is said to be of diagnostic value in only 50% of the cases. GOSSEREZ particularly points out the inadequacy of customary

X-ray pictures (simple profile, separate side view with the aid of dental films, anterior view). Often they are not completely satisfactory for diagnostic clarification. On the other hand, Gosserez recommends a picture with the *central ray from the nasal root to the base*. This was described by Waters as early as 1914 as being a suitable view for exploration of the maxillary sinus.

This view is said to be particularly illuminating for the recognition of fractures in the nasal substructure, whose injury is usually neglected. It often happens that even with a strong blow from the side, the dorsum remains intact, but the nose is rotated toward the side opposite the blow, or that the substructure is pressed inward due to a blow from directly in front. In the latter case the nose is pushed inward like a cork into the neck of a bottle. Metzenbaum was the first to describe this phenomenon. In French literature it is called "télescopage" (telescoping fracture). It is classified as one of the pyramidal fractures of the maxilla or Lefort II. In these the maxilla, together with the dental arch and the nose, is pushed dorsally between the two zygomatico-malar blocks. The term, pyramidal fractures, comes from McIndoe.

Most often *full profile* views are made. In these the plate is supported at the canthus. The full face view is the one suitable for recognition of septal fractures. An axial view similar to that by Waters was suggested by Caperosa and Zavatzky. The incident ray comes from above onto an occlusal film which is held by the patient between under the palate between the teeth. Ginestet and colleagues and Bienias also mention this technique. Bienias advises X-rays in 3 positions: a.p., lateral and fronto-submental views.

In children a reliable X-ray examination is difficult because usually the nasal fracture is still in the cartilaginous or only partially ossified area of the nose and maxilla.

A fracture along the sutures of the individual bones is generally less common due to the elasticity. More often one finds small cracks, separations at the rim of the aperture, depression fractures or transverse fractures. A sharp, blunt blow at the nasal root is particularly dangerous. This can cause a fracture of the lamina cribrosa, tearing of the meninges, cerebrospinal fluid drainage, and subsequently lead to meningitis.

With regard to the *proper moment for treatment*, this should principally be done as soon after the accident as possible. Immediate repositioning must be made if the bony structure of the nose is depressed or pushed to the side. Immediate repositioning is also required if a dislocation of the fragments, which later could lead to a deformity, is hidden in swelling in the side view and can be discovered only by X-ray. The sooner the dislocated fragments are repositioned, the less danger there is of a posttraumatic deformation of the nasal skeleton. Becker (USA) considers repositioning during the first hours following the accident to be decisive. He is of the opinion that repositioning of the fragments in adults is still possible within one week (see Becker in the textbook by Frühwald). According to Malbec and Quaife early repositioning should be done within 2 weeks after the trauma (Malbec and Quaife, quoted from Montserrat-Viladiu). Peyrus considers the first 48 hours the proper time for repositioning. He first lets the shock, pain and bleeding subside.

If larger hematomas are present or if the patient comes for treatment several days after the injury, one can also make the repositioning after swelling has subsided. The nasal contours can then be repositioned better. Rubinstein and Gosserez generally wait a few days until edema and swelling have subsided. In open fractures McKenzie first treats the external wound and waits a few days before repositioning the fracture.

In our opinion repositioning should generally be done no later than 8 days after the accident. But even after 4 weeks it can still be done. If one waits longer than that, the bone must be refractured. Spontaneous consolidation occurs much sooner in children than in adults.

Bourdial and Pollet usually wait until after the start of callus formation before surgery. Thus they let the hematoma and swelling completely subside and then destroy the initial callus. They do this by separating the bones again along the fracture line using a chisel, in order to bring them into the desired position.

Aloin also proceeds in a similar manner in recent nasal fractures. He waits 2—3 weeks before repositioning. By that time edema and hematomas have subsided, the injuries to the nasal mucosa have healed, and the repositioning takes place at the same moment when nature itself sets about healing the fracture. Aubry and Giraud are also of the same opinion. They consider the period between the 2nd and 8th days the poorest time for surgery and operate after 2 to 3 weeks, sometimes even after 6 and 8 weeks. Mounier-Kuhn (quoted from Aloin) points out that because of social indications it is often necessary to treat recent, especially slight nasal fractures even after 24—48 hours. As a rule this is possible with antibiotic protection even without danger of complications. — A nasal fracture should never be repositioned and fixed with packing as long as cerebrospinal fluid leaks from a fracture in the cribriform plate.

The X-ray picture may show a fracture, but the external examination may reveal no lateral dislocation, no widening, and no depression of the nose, and the internal examination no abnormal narrowing of the nasal cavities. Then one can proceed conservatively with ice packs and light massage to reduce swelling.

If one decides upon surgery, then one must first decide upon the type of anesthesia. If possible, topical anesthesia with additional local anesthesia should suffice in adults. In many cases a short general anesthesia will be necessary. Children will need general anesthesia. In sensitive adults as well, general anesthesia is best either with intubation or with a Negus or Davis-Meyer mouthgag. This way aspiration of blood will certainly be avoided. A short intravenous narcosis with Pentothal, Evipan, etc. or with Trylene is, in our opinion, not indicated. Light ether anesthesia may be used for closed reduction. Most authors prefer local anesthesia. Among them are Fomon, Brown and McDowell, Ferris Smith, Converse, Kazanjian, Schuchardt, McKenzie, Bourdial and Pollet. Jordan, Aagesen, Bruck and Hussarek, Gosserez and others add Hyaluronidase to the local anesthetic (see p. 33). In addition Gosserez administers a gangioplegic combination of Largactil, Dolosal and Dipharcol. We also do the repositioning in local anesthesia with the lytic cocktail (Largactil, Phenergan and Dolantin, see p. 29) as premedication. Aloin, Peyrus and others consider intubation narcosis the choice from the first.

Two methods are possible for the *repositioning of simple fractures:* 1. closed, and 2. open reduction, i.e. surgical exposure of the fractured nasal vault with positioning of the dislocated particles under direct vision. Both methods have advantages and disadvantages. The older method, closed reduction, has the advantage that no special instruments are required. On the other hand it is less precise and permits neither an accurate anatomic fracture diagnosis nor certainty with regard to precise repositioning. Like Fomon and his colleagues and Jordan, we are of the opinion that the indication for this method is limited to simple fractures of the bony nasal structures. We prefer open treatment in the more complicated types of nasal bone fractures, especially in cases where the adjacent bones and the cartilaginous support are also involved. Since with this method an exact repositioning of the fragments is possible, the danger of post-traumatic deformities and later malfunction is reduced considerably.

Preparation for the operation is like that of the usual rhinoplasty, and one cleans blood and crusts from the nasal cavities. Endonasal submucous hematomas are lanced with puncturing incisions and aspirated. In external injuries the usual debridement is necessary. The primary suture is passed deeply so that no subcutaneous cavities occur. If the closure of larger defects can not be done by simple mobilization of the surrounding skin, remaining defects should immediately be treated with pedicled flaps or free full-thickness grafts. If the wounds are infected, they are left open after careful debridement and closed 2 to 3 days

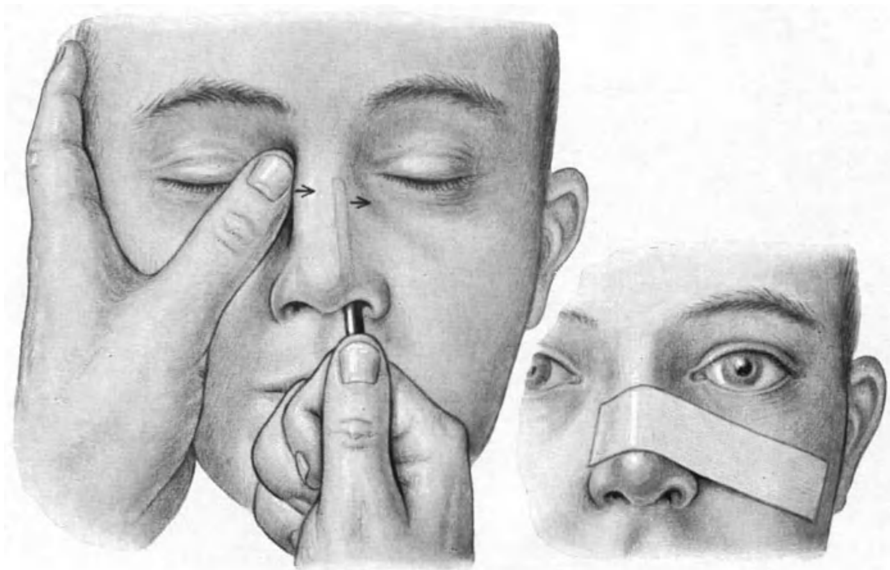


Fig. 257. Reduction of a recent nasal bone fracture using the closed method. The fractured nasal structure is realigned with an elevator and is pressed into midline with the thumb. The fracture is immobilized with an adhesive tape dressing. (From H. J. DENECKE)

later with a delayed primary suture, so long as they are clean. In case of infection, which lasts more than 40 hours from the time of injury, a secondary suture is proposed.

The closed method is used by many authors exclusively, but by us only in slight cases. The depressed parts of the nose are raised and brought into a normal position with the aid of plain forceps or elevators, small or large nasal forceps guarded with rubber tubing or with gauze (petrolatum gauze). There are also special forceps for this maneuver. In the last century JURASZ used a forceps which is modeled after the ADAM forceps. A similar instrument, which we use, is the forceps by WALSHAM (Fig. 79a). The French use the forceps of CLAUDE MARTIN, and the Americans mainly use the one of KELLY. These forceps are also guarded with rubber or gauze. With one of these instruments one lifts the depressed nasal structure from within back to its old position. At the same time one presses the fractured nasal bones into the proper position from the outside and ascertains the resulting shape of the bony nose by means of palpation.

In case of severely depressed nasal bones with fracture of the adjacent bones as well, as in the pyramidal fracture of MCINDOE, the entire nasal structure must be pulled forward by means of leverage. This prying motion is known as the classical maneuver of GILLIES and KILNER (Fig. 259).

For narrowing the widened nasal root the WALSHAM or ASH forceps can likewise be used. It grasps the entire bony nasal structure. For this one can also use a bone-biting forceps, which likewise grasps the entire bony nasal root.

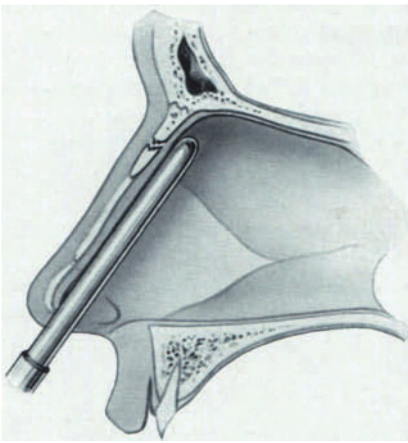


Fig. 258. Reduction of a recent nasal bone fracture using the closed method, viewed from the interior of the nose

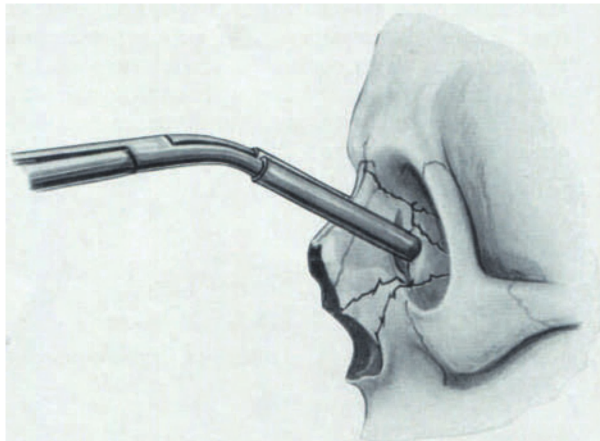


Fig. 259. Reduction of fracture of the pyramid by means of prying motion with the rubber-guarded forceps. Method of GILLIES and KILNER

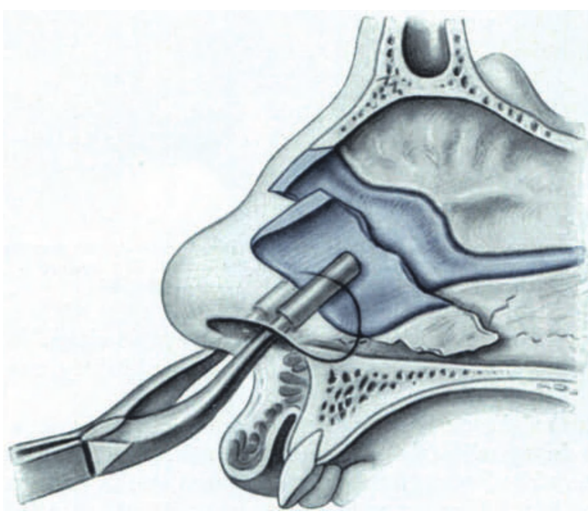


Fig. 260. Realignment of the nasal septum. The fragments of the septum which are dislocated into the nasal cavity are grasped with a forceps and replaced in the original position. The arms of the forceps are guarded with rubber. (From H. J. DENECKE)

The fractured septum is brought into proper position just like the nasal pyramid with the WALSHAM or ASH forceps. The bowed branches prevent a pinching of the alae when straightening the nasal bones and the septum in repositioning.

Open reduction begins with the typical rhinoplastic exposure of the nasal structure by means of bilateral intercartilaginous incision (see p. 40) and possibly with additional transfixion in the membranous part of the septum

(see p. 43). This way precise inspection of the site of fracture location is possible after one exposes the bony vault. The positioning of the fragments is likewise done with the WALSHAM or ASH forceps.

In the closed method, one guarded arm of the forceps is in the nasal cavity and the other covered arm externally on the skin above the fractured bone. But in the open method the uncovered lateral arm of the forceps is introduced through the intercartilaginous incision directly onto the bone. Thus it lies between the bone and the soft tissue. The other arm is in the nasal cavity. Guided by the eye, rotation, lifting, pressure and pull when necessary, the fragments are set into anatomically proper position. If the cartilaginous and bony structure of the septum has been pushed into the nasal cavity, it can be pulled forward again. Prying motions must be made with the WALSHAM or ASH forceps here as well, in order to bring the bone and cartilage plates into normal position (Fig. 260).

Since the fragments have the tendency to slip from the desired position during the following days, they must be fixed in some manner. This retention is very important in the correction of nasal fractures. ALOIN states that a retention is no longer necessary in his method of reduction of nasal fractures 2 to 3 weeks after the trauma when hematoma has completely subsided and intrafragmentary callus formation has begun. This opinion seems to be a bit exaggerated, but we feel that in fractures with slight dislocation, and thus also after slight repositioning, immobilization of the fragments after repositioning is not necessary.

4. Immobilization of corrected nasal fracture

Many aids have been described for immobilization of nasal fractures after repositioning. TRENDELENBURG already occupied himself with this problem. To keep the septum in its new position he placed two properly shaped steel plates into the nose, one on either side of the septum for 2 to 3 days. The plates were joined with a hinge and could be approximated by means of a screw. Later he used ivory wedges for this purpose. Since he was afraid of placing foreign bodies in the upper parts of the nasal cavities, he supported the bony nose after the operation by means of external truss-like devices. Later pelottes were constructed which could be fastened to the maxilla or to the forehead. They are still used today in some places. We generally apply a *plaster cast* (Fig. 261) or a nasal shaper of stent or Plexidon, a plastic which hardens (see p. 443). Such a splint of plaster or another material which hardens should extend from the glabella to the nasal tip and laterally to the infraorbital arches. Otherwise in more extensive fractures there is usually danger that the shattered nasal bone will be pressed so far apart by the packing of the nasal cavity that a wide nose results. If the nose has only deviated laterally one can hold it in the proper position by applying an ordinary *adhesive tape dressing* (Fig. 257). Generally speaking, in such cases one must over-correct the deflected nose during the immobilization. The nasal dressing is left for 8 to 10 days, or better, 15. The nasal cavities are packed. If necessary and if possible, the packing can be placed only in the upper part of the nasal cavity keeping the lower part open, or a rubber tube can be placed in the lower part to aid nasal breathing. The packing is removed after 2 to 5 days. SCHUCHARDT advises against routine packing. He packs only when repositioning and immobilization of the fragments can not be achieved in any other way or when profuse nasal bleeding forces it. In his opinion nasal packing should, in general, remain in place no longer than 24 hours so that infections and secretion blockage are prevented. We feel that packing is not harmful even if it must be tight and remain in place for a few days, when antibiotics are given prophylactically.

In addition to Vaseline packing, paraffin gauze, petrolatum gauze, one can use iodoform gauze, or gauze impregnated with antibiotic ointment, like aureomycin gauze.

Instead of being made of stent, plaster or plastic, the nasal splint can also be made of metals like copper (Ferris Smith), lead (McKenzie), tin, aluminum (Sanvenero-Rosselli, Brown and McDowell) or of tin combined with stent (Converse). These splint dressings are held in place with strips of adhesive tape or with a bandage across the forehead and the cheeks.

Many authors still use the nasal brace or nasal splint of Joseph (Fig. 262) and of Safian for immobilization of the fractured nose. According to our

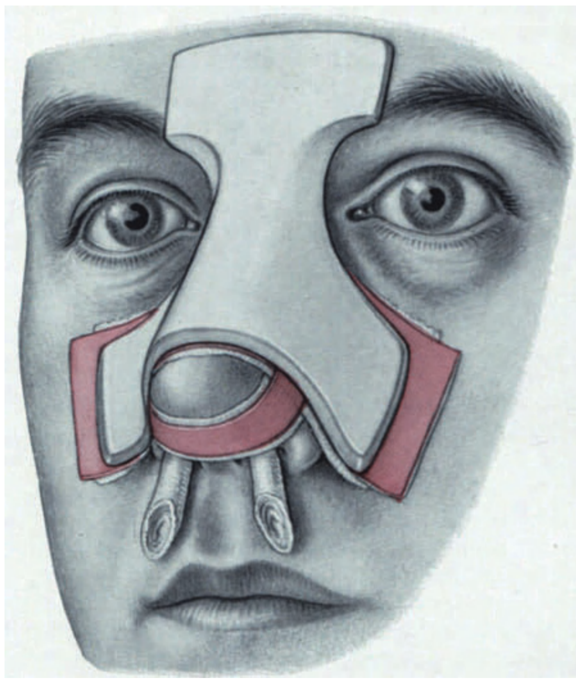


Fig. 261. Immobilization of the realigned fragments by means of a plaster cast. In surgery on the soft portions of the nose an adhesive tape dressing passed around the nasal tip helps to keep the cartilaginous parts in the desired position. (From H. J. Denecke)

experience this immobilization is not stable enough and is uncomfortable for the patient.

For more pronounced lateral deviations in which stronger over-correction is necessary *pelotte splints* have been made constructed which are anchored to forehead bands. A simple procedure of this kind for immobilization of deflected nose by Gorlia is described on p. 137. Pelottes (pressure pads) attached to a forehead band are described by Joseph, Aufricht, Risdon, Kazanjian etc. as well. This forehead band immobilization does not seem particularly favorable, because sufficient traction at the forehead can only be obtained by pulling the forehead band very tight. But a very tight forehead band often leads to unbearable headaches. Neck straps were also tried for securing the fixation dressing in nasal fractures as well as in correction of wide nose. But they are likewise unreliable and in addition affect the nodding and turning motion of the head. The nasal splint with anchorage on the maxilla as by Lindemann and Huguet

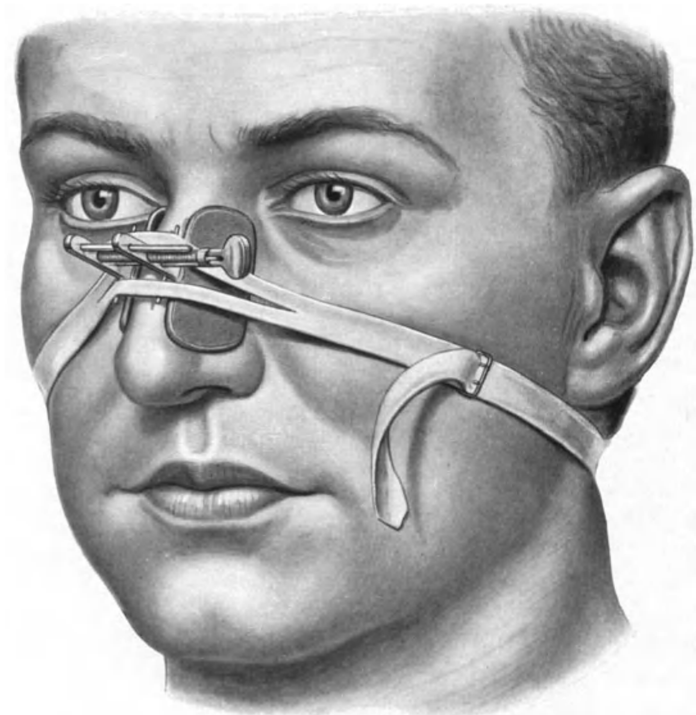


Fig. 262. Immobilization of the fragments by means of the JOSEPH nasal brace. (From KLEINSCHMIDT)

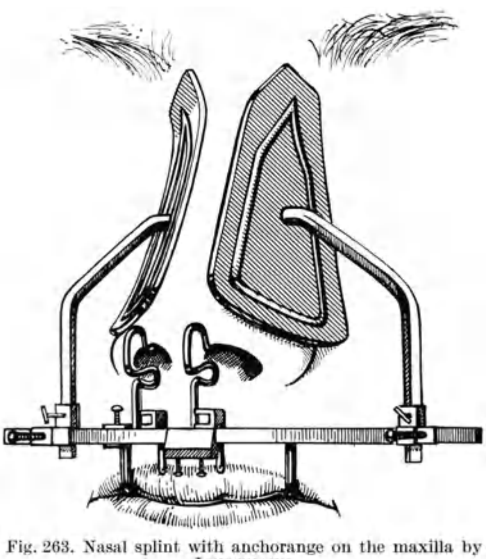


Fig. 263. Nasal splint with anchorange on the maxilla by LINDEMANN

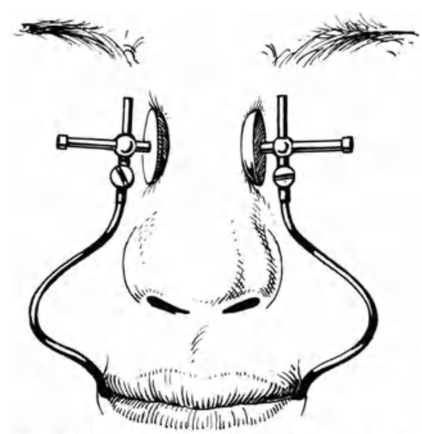


Fig. 264. Nasal splint with anchorage on the maxilla by HUGUET

(Figs. 263 and 264) also seem to be too complicated. Better is the wire or cast splint dressing at the maxilla with detachable support wires as by SCHUCHARDT. Immobilization in this manner is complete, since the device is attached to the skeleton. Such a splint dressing remains in place until postoperative treatment

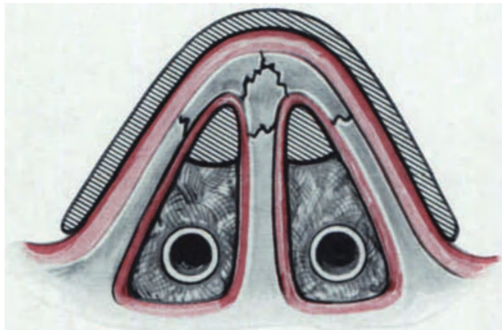


Fig. 265. Internal pressure pads used to treat nasal fracture. In addition the nasal cavities are packed and provided with rubber tubes to facilitate nasal breathing. External immobilization by means of plaster or stent (MALINIAC)

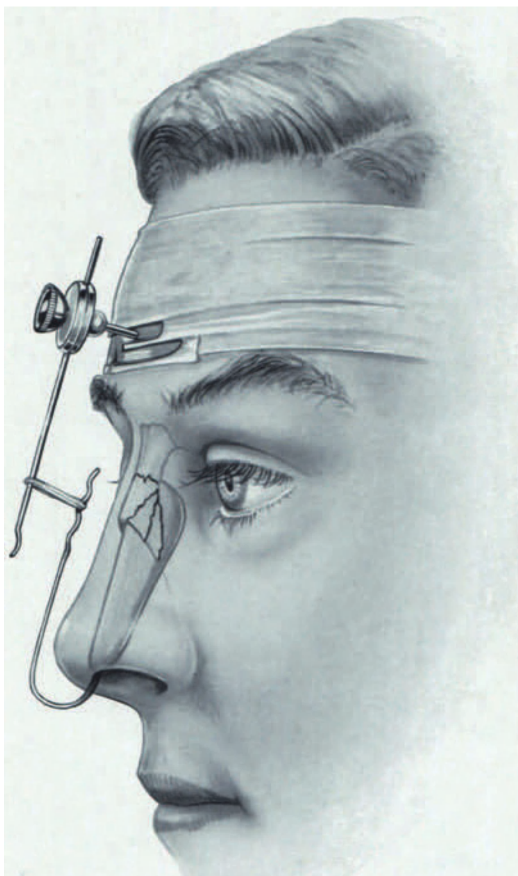


Fig. 266. Internal pressure pad with external spring support according to KAZANJIAN

is ended. Only the pressure pads and their wires can be moved and permit appropriate application of pressure. A similar construction was described by OLDFIELD. He too anchors the pressure pads to the upper teeth. An improvement of these unstable splints was found by KÖRBER and SCHNURBUSCH in a palatal plate to which appropriate pelotte wires are fastened. The plate is made of Plexiglas or Paladone and is fastened to the teeth of the upper jaw with four simple clips.

In particularly difficult cases of depressed, comminuted fractures, one sometimes does not succeed in immobilizing the repositioned nasal structures with packing and external dressing. In these cases *internal pelottes* (pressure pads) fastened to forehead bands or to maxillary splints have proved useful (Fig. 265). Such pelotte dressings have been described by JOSEPH, BRUHN, WATSON-WILLIAMS, CARTER, WATKINS, RISDON, KAZANJIAN, MALINIAC, GONZALES-ULLOA,

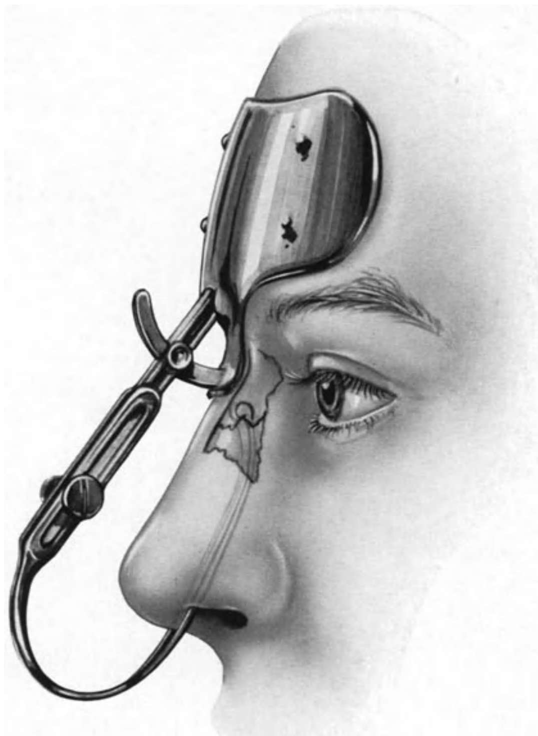
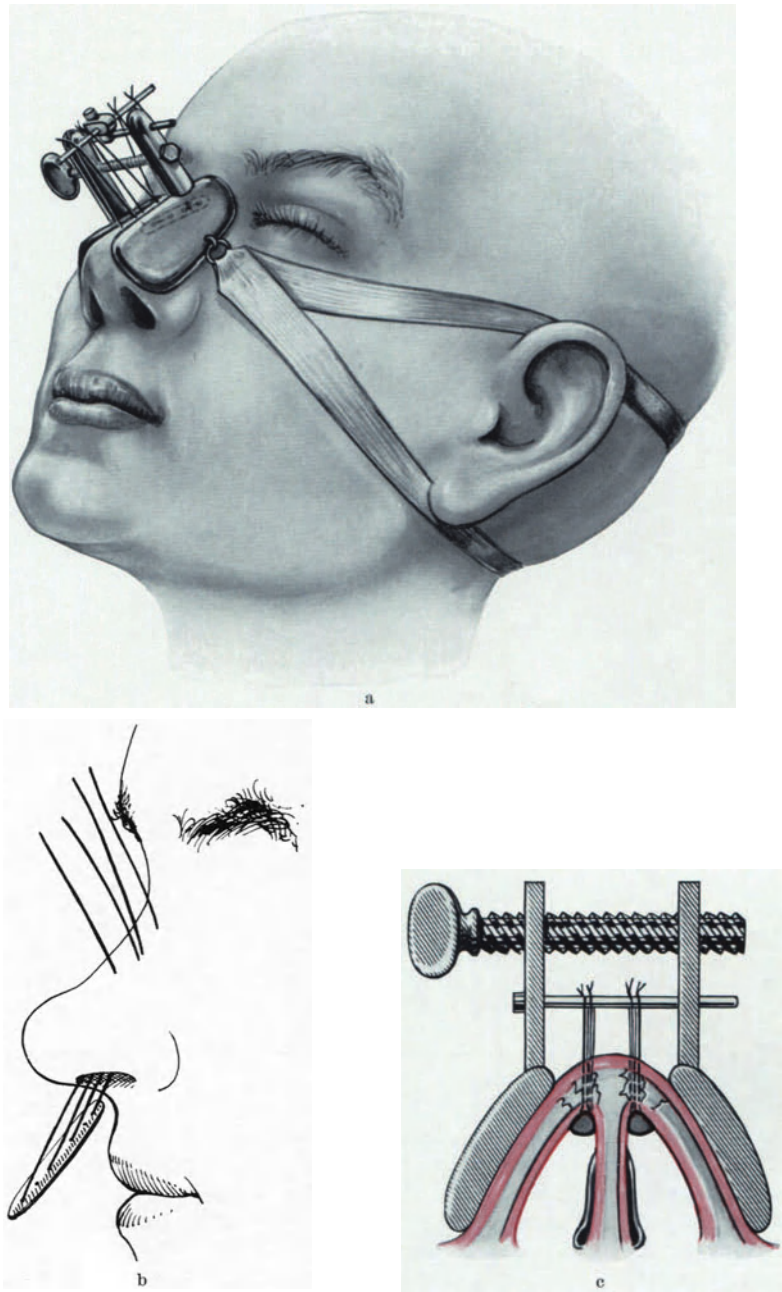


Fig. 267. Internal pressure pad with adjustable forehead anchorage by GONZELES-ULLOA

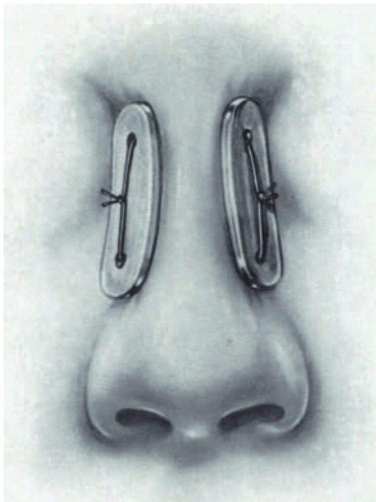
SCHUCHARDT, STRAITH and DE KLEINE (Figs. 265—268). The intranasal pelotte (pressure pad) of KAZANJIAN is of stent. It is attached to a U-shaped metal wire, which in turn is attached by an elastic band to another metal wire anchored to a forehead band. This elastic tension is exerted forward on the nasal bones (Fig. 266). The internal support after MALINIAC is combined with the external brace by means of transcutaneous suspension (Fig. 268).

In recent years we have abandoned these complicated devices and immobilize the shattered and repositioned nasal structure by means of the *through-and-through wire suture with metal plates* as by BROWN and McDOWELL (Fig. 269). Instead of wire we use heavy 2/0 nylon and line the metal plates with petrolatum gauze. The through-and-through sutures are made with a straight or only very slightly curved large needle. The suture is passed through the skin, the lateral line of fracture in the frontal process of the maxilla, then through the septum, through the fracture line on the other side and out through the skin. The sutures



Figs. 268a—c. Fixation method by MALINIAC. a Fixation of the realigned nose by means of internal and external pressure pads. Inner pressure pad indicated by dotted line. b Introduction of the pressure pad by means of transcutaneous bridle sutures which are used to fix the pressure pads in place. c Internal and external pressure pads in cross-section

are placed about 2 cm apart. BABLIK and GOSSEREZ have also had good results with this through-and-through fixation method. McCOY immobilizes with a figure-eight wire loop. He passes it through holes drilled in the frontal process of the maxilla and through holes farther back in the lacrimal bone made with a trocar (Fig. 270).



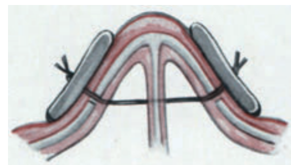


Fig. 269. Through-and-through wire fixation with metal plates by BROWN and McDOWELL. Small sketch shows cross-section in the region of immobilization

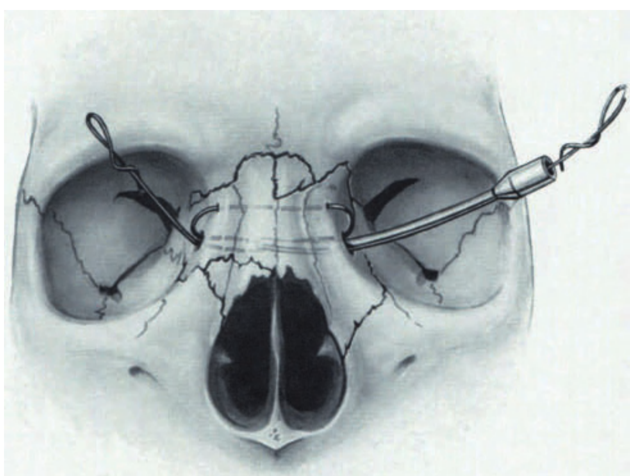


Fig. 270. Immobilization using a figure-eight loop of wire for realignment of the nose according to McCOY. Holes are drilled in the frontal process of the maxilla and in the lachrymal bone bilaterally. The trocar is placed in the holes to facilitate passing the wire

Mattress sutures at the root or base of the nose were also described by OLDFIELD, STRAITH and TANIEWSKI. We leave such through-and-through fixation sutures for 1 to 2 weeks, according to the seriousness of the fracture, hematoma, and edema or danger of possible decubitus, but most often it is left for 12 days.

A modern immobilization of the dorsum and septum already mentioned in the discussion of deflected noses is the support of the columella and the anterior border of the septum, each with a KIRSCHNER wire as by STRAITH, Jr. and his colleagues (Fig. 194). One KIRSCHNER wire is inserted upward paramedially along the cartilage on one side between the mucosa and cartilage and is stuck into the frontal bone. The second KIRSCHNER wire, which is not shown in the illustration of the method for deflected nose, is inserted into the maxillary spine. This second wire serves as a support for the fractures. After 4 weeks the wires are removed, but they can also remain in place longer. In a comminuted fracture of the nasal bones, under some circumstances bone fragments must be approximated by means of osteosyntheses as by HILGER using steel sutures.

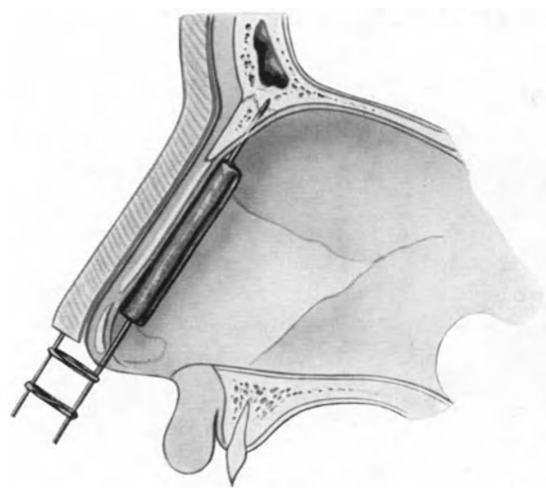


Fig. 271. Fixation of the nasal dorsum and the septum by means of KIRSCHNER wires, according to DUFOURMENTEL and MOULY (STRAITH, Jr.). A KIRSCHNER wire guarded with rubber is inserted endonasally into the frontal bone. A second KIRSCHNER wire is fastened in plaster on the nasal dorsum and is used to support the endonasal wire

The fixation method of DUFOURMENTEL and MOULY (Fig. 271) is the modified method of STRAITH, Jr. In this a KIRSCHNER wire is likewise inserted into the frontal bone under the roof of the dorsum along either side of the septum. This internal wire is guarded with rubber and is fixed by means of elastic bands to two external KIRSCHNER wires which are joined externally in a strip of plaster which lies on the nose. — In France still another fixation is used by AUBRY and PALFER.

Isolated septum fractures are easy to reset in the early stage. But often one or more nylon mattress sutures are necessary to immobilize the fractured cartilage plates after repositioning. Sometimes fixation plates are necessary, e.g. of polyethylene film (HILGER), as discussed in corrections of septum and deflected nose. Sometimes one must even use a submucous septum resection.

If the *maxillary sinus is involved in the fracture* and its anterior wall depressed, then the intra-antral repositioning of the fractured bones should be done immediately if possible.

Leakage of cerebrospinal fluid due to shattering of the cribriform plate is one of the most serious complications of nasal fracture. High doses of antibiotics, resting of the skull in a certain position and strict prohibition of nose-blowing are the most important therapeutic measures. The best position for resting the skull is to have the patient prone with his chin supporting the head. This way the weight of the frontal lobe presses against the fistula. Usually the fistulas close spontaneously within one week. Otherwise plastic closure of the dural tear is necessary.

5. Plastic closure of dural fistulas in the region of nose and paranasal sinuses

In connection with recent and old injuries, cerebrospinal fistulas must be mentioned here, since, in order to eliminate danger of fatality due to them, they must be closed in one stage together with the rhinoplasty. Rhinorrhea

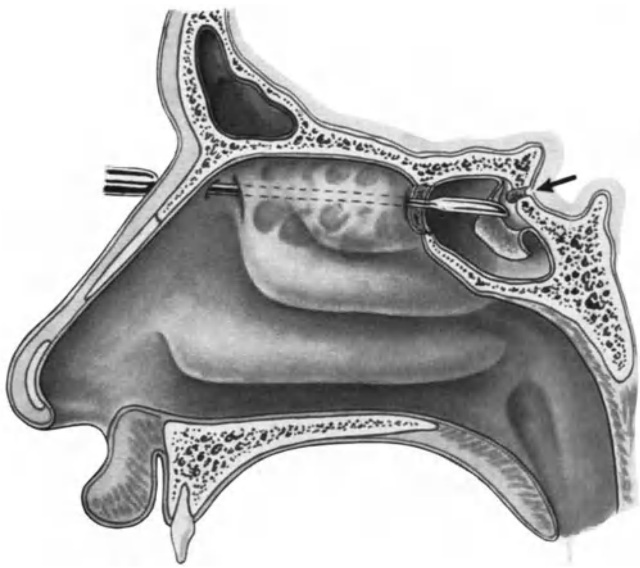


Fig. 272. Closure of a cerebrospinal fluid fistula (arrow) in the region of the sphenoid sinus and the pituitary gland. A large area around the opening of the fistula is freed of mucosa

after accidents and surgery demands an approach in treatment which will leave the least deformity possible. Neurosurgeons and rhinologists as well have been successfully active in this area. Rhinologic experience is to be listed here briefly, so far as it are based on standard methods of nasal surgery and plastic surgery. — *Diagnosis* of the fistulas can be simple if X-ray pictures give definite information concerning the location of the fractures and if the affected side is determined. On the other hand diagnosis is difficult if no clues are available. The most varied diagnostic procedures have already been devised in this area. The method of collecting stained cerebral fluid in the nasal packing or in the Belloc tampon has proved to be good in our experience. During removal of the packing, the dye shows the localization of the fistula: First topical anesthesia of the nose is applied with colorless anesthetic. A Belloc tampon is placed in the nasopharynx, and the rest of the nose is packed with gauze. Now methyl violet or indigo red (Hörbst, Denecke and others) is injected through a lumbar puncture needle. When introducing the dye one must make sure that after injection of a very small amount, e.g. after 0.1 cm^3, one draws spinal fluid into the syringe to thin the dye and then reinjects it a little at a time. By this maneuver a diluted dye reaches the ventricles in a relatively short time. After a few hours it is to be found in the packing. Careful removal of the packing and precise observation of the colored spots give a clue to the position of the dural tear. The removal of the BELLOC tampon from the epipharynx must be done so that one can exactly locate the colored part of the tampon in the epipharynx.

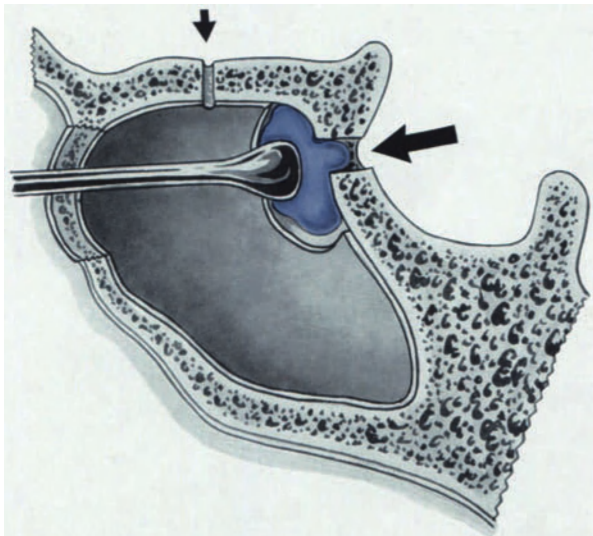


Fig. 273. Fibrospoon (blue) is pressed into and onto this fistula. To assure firmness of the material which covers the fistula, packing is introduced through the ethmoid bone

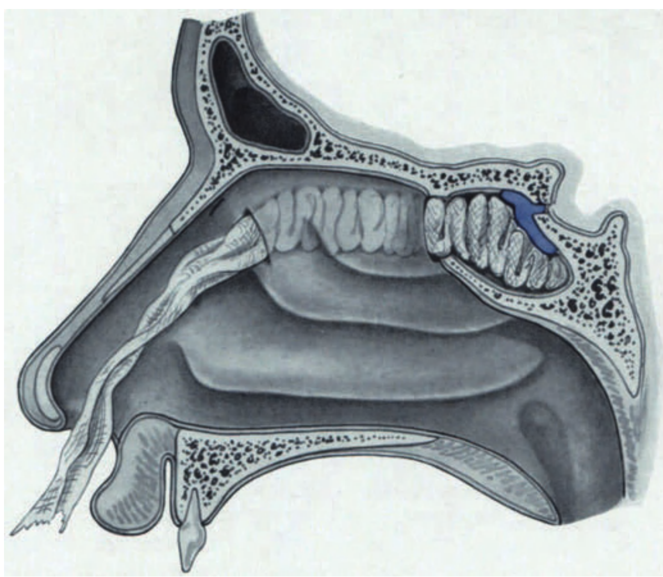


Fig. 274. Firm packing is introduced through the ethmoid for pressure against the fistula covering

In recent injuries the interior of the nose can be exposed by open soft tissue wounds. In escape of cerebrospinal fluid the dural defect can be located from here. According to the degree of destruction of the nose, septum and base of the skull, appropriate steps are to be taken for treatment of the fistula region. It should be pointed out here that in cerebral fluid fistulas *in the region of the anterior* *cranial fossa*, large mucosa flaps can be rotated from the septum to the defective spot and held in place with fairly loose packing. Other methods of treatment are the use of galea-periosteum flaps, free muscle grafts, fascia lata strips, dermal grafts, as well as the use of Fibrospoon layers. *In the region of the sphenoid sinus* and the pituitary gland, closure of cerebrospinal fluid fistulas using neuro-surgical methods can present difficulties, and an approach from the nose is more advantageous. After locating such fistulas, one removes the mucosa surrounding the rim of the fistula to a distance of 1 to 2 cm. This denuded area is then covered with Fibrospoon layers. Packing which holds this covering in place should be left 14 days (Figs. 272—274). The transethmoidal method can be chosen as an approach to the fistula. In cleaning out the ethmoid appropriate cells can be left on the floor of this to serve as an abutment for the very firm packing.

As O. Hirsch does, Hage proceeds transseptally from the Réthi columellar incision (Fig. 124) to pituitary and sphenoid fistulas. After removing the mucosa he closes off the dural defect with fascia lata packing. — The cosmetic result is good in both methods.

D. V. Krüger has approached these fistulas in the posterior third of the anterior cranial fossa with neuro-surgical methods. After appropriate removal of bone fragments, the defect is closed with muscle and fascial grafts.

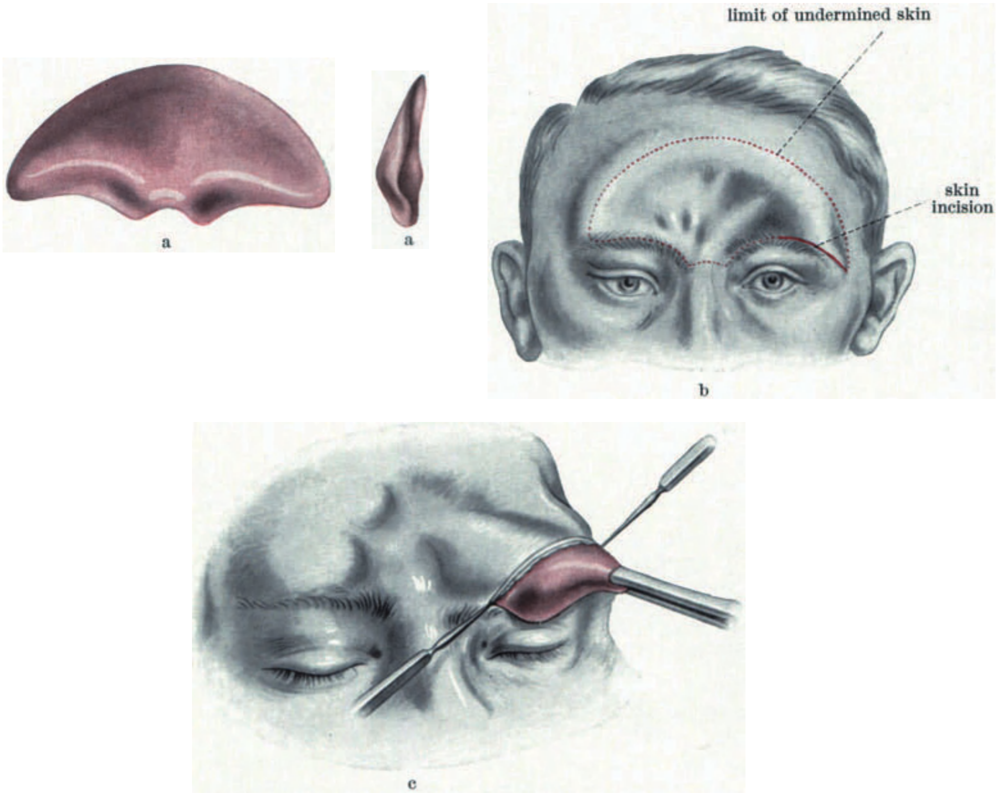
Because in all corrective surgery due to nasal injury complications like rhinorrhea, meningitis, etc. can occur, it is advantageous to know appropriate treatment of dural fistulas. One must study the usual problems of sinus surgery as they are presented in the standard surgical texts.

XIII. Plastic operations in the glabellar and frontal sinus region

While *obliteration after* Riedel in small frontal sinuses causes no considerable deformity, the collapse of the forehead in medium and large sinuses in the region of the nasal root can have a particularly unfavorable cosmetic effect. Often the patient asks the surgeon to eliminate the defect on the nose and forehead.

Since the nasal root is very often affected by injury or surgery, one should consider correction in the same stage. The required implant is to be made accordingly. The part which fills out the nasal root (Figs. 275—277) should correspond in shape to the rest of the nose. The dorsal line and the glabellar junction must harmonize. The correction should be made when the sinus disease has been completely eliminated surgically and the scars are healed without reaction. First a plaster impression of the nose and forehead is made. A plastic plate which fills the depression of the nasal root and forehead is made according to this (see p. 220).

It is best to insert the plate under the skin from an incision above the lateral part of the eyebrow (Figs. 275, 277, 278). Naturally the implant can also be inserted from a coronal incision which runs along the hairline from one temple to the other. Through the incision the skin is separated from the periosteum with a small septum knife in the region of the depressed part. But before this one must make sure whether the bony posterior wall of the frontal sinus was removed during the first operation and the dura exposed. If this is the case in a small area, then one proceeds especially carefully with the separation of the skin in this region. If the posterior wall is completely removed, which is possible especially after war injuries with dural tears, then it is better to do without the plastic inlay. If the patient insists on having his forehead raised, a tubed pedicle flap can be used for this. It must be prepared accordingly. Later a plastic inlay can be inserted into this flap. — After raising the skin in the depressed area of



Figs. 275a—c. Raising depressed forehead following the forehead operation of RIEDEL. a Paladone plate shaped like the forehead defect. b Solid red line shows the skin incision; dotted red line shows the area of skin to be undermined. c Insertion of the plate. (From H. J. DENECKE)

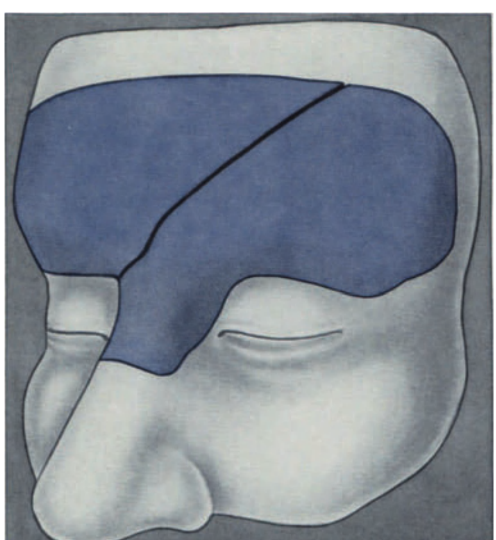


Fig. 276. A model with a fitted plastic plate for the nasal root, glabella, and forehead. Black line shows saw cut to divide the plate

the nose and forehead, one inserts the inlay into the pre-formed pocket holding the inlay with a surgical forceps (Fig. 275). It is advisable to press out the blood which has collected in the pocket before inserting the inlay. In unilateral small and medium frontal sinuses, the insertion is not difficult. When forming the pocket in these cases one must not break through the interfrontal septum which

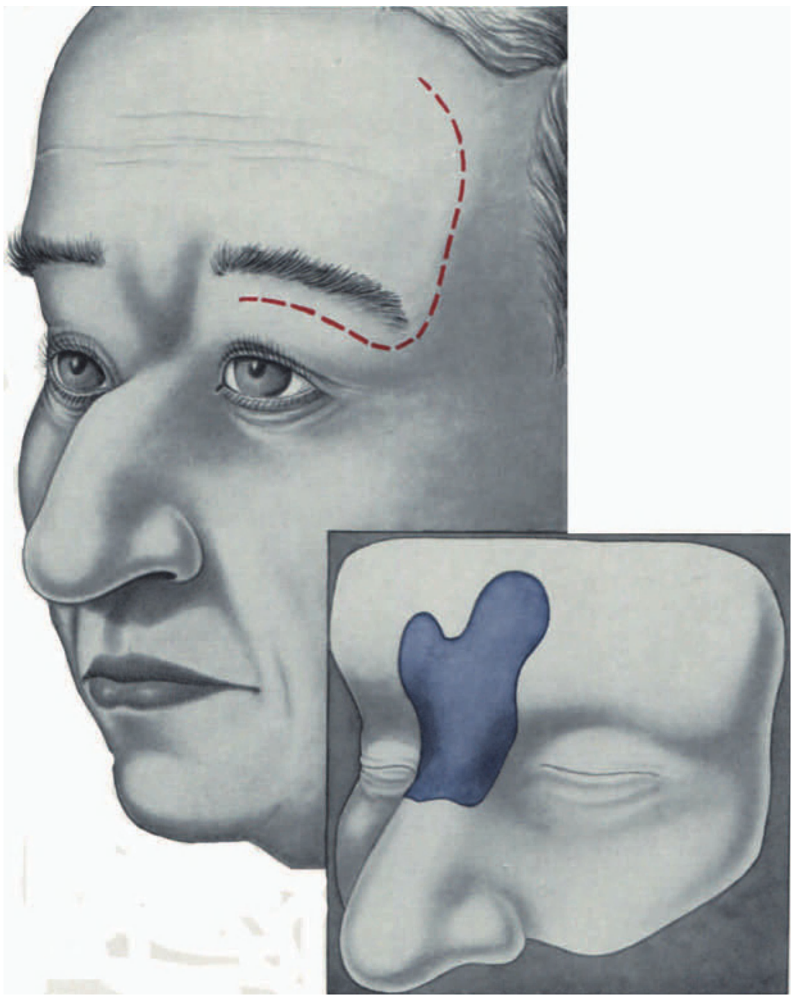


Fig. 277. Dotted red line shows approach for forming the pocket to receive the implant. Small sketch shows a model with a rather small implant for raising the nasal root

separates the sinuses, i.e. the contralateral frontal sinus must not be connected with the pocket. This complication causes failure of adaptation of the plastic implant or inflammatory reactions of the operative site over the years. With large implants, as are necessary for correction *after a bilateral* RIEDEL *operation*, one may be forced to extend the skin incision laterally. If that should be avoided for cosmetic reasons, then one must saw the plate apart and insert the pieces singly. Then the pieces are brought together so that they have the effect of an intact implant. If necessary the two pieces of plastic must be attached to each other with nails. To prevent a hematoma and thus an obstruction to the adaptation of the implants, a *compression dressing* is placed around the forehead after

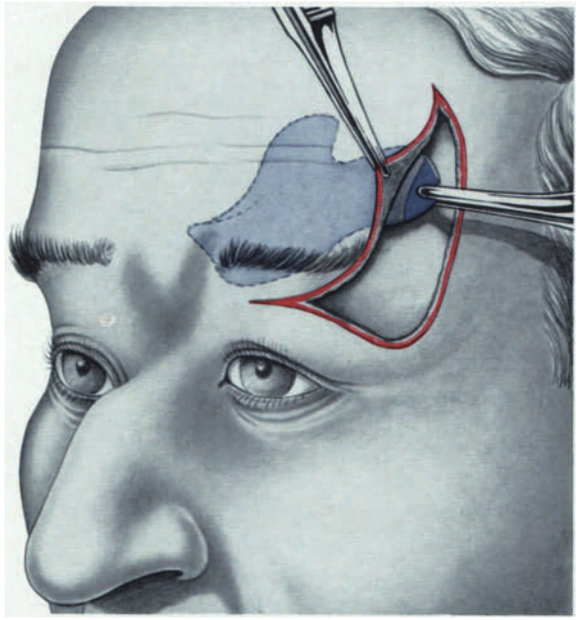


Fig. 278. Inserting the implant

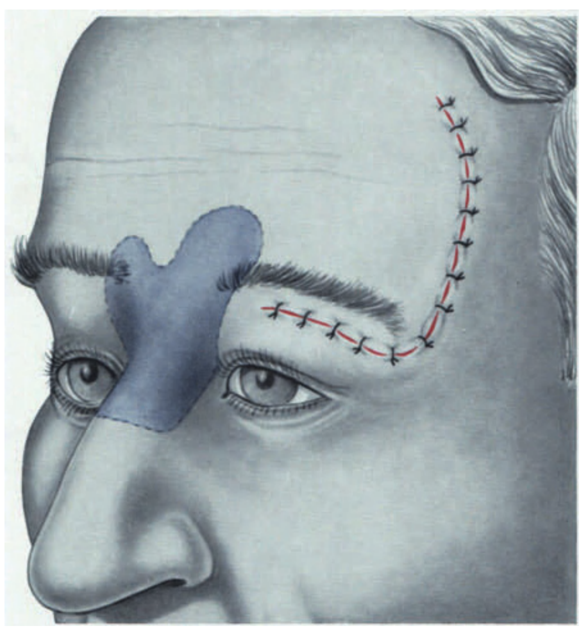


Fig. 279. Situation after insertion of the implant

suturing. With antibiotic protection the implants usually cause no reaction. If to an effusion or a strong reaction, occurs, then the skin incision is split slightly and drainage provided. The wound will heal a few days later under antibiotic protection. For a good cosmetic result it is absolutely necessary to fit the implant exactly in area and thickness. In the pocket formed according to the defect a displacement of the implant is hardly possible with a firmly immobilizing dressing. Individual authors, SCHOBEL, BAUER, LAUBER and others, have described *fixation methods* to assure the desired position of the plastic implant. In the scale pattern procedure after SCHOBEL, first a model is made of Autocryl. In shape and size this covers the edges of the bone defect. Then holes are drilled in the model at the points where the later permanent protoplast (a methyl methacrylate) prosthesis will have projections. After exposing the bone defect, the model is inserted. Holes are then drilled in the bone at the corresponding places in which the projections of the permanent prosthesis will be anchored. Other prostheses only have holes drilled so that connective tissue can fill them and effect fixation after adaptation. In the USA screws made of tantalum and other materials are used for fastening in bone. A reaction to the implant can always occur and cause effusions and thus enlarge the pocket. This makes it possible to displace the implant a few millimeters without careful treatment or dressing afterward. Various methods of immobilization are justifiable and are to be recommended. After successful adaptation tissue reactions are very rare, because in the region of the glabella and nasal root the implant and its surroundings are almost completely at rest. As observed, the plastic implants are borne for decades in these areas without reaction.

There have been only few cases (BAUER, DENECKE and others) in which *removal of the implant* was necessary because of reactive swelling around the plastic. Conditions resulting from the accident or the former operation, ostitis or osteomyelitis, can then be the cause for the disruption of adaptation. Ostitic or osteomyelitic foci must be removed. After an appropriate period, if all reactions have subsided, a reimplantation can be made. — *Correction with autogenous tissue* like cartilage and bone often does not give such good cosmetic results in this region, even if the surface can be shaped easily by grinding and sanding. In addition it is possible that the grafts can shrink. Relatively large pieces must also be available, since material is lost during preparation. — While the use of bone and cartilage grafts for correction of the forehead is still to be recommended, grafting of fat is to be rejected because of the considerable postoperative absorption of this material.

Smaller *depressions at the nasal root* can be corrected through a lateral incision by means of corresponding implants. An overly prominent nasal root can be removed with a bow saw or a chisel (Figs. 83a and b). In addition one must round off the nasal surface with a rasp. *Bony prominence in the region of the frontal sinuses*, as in leontiasis ossea, can be flattened through a bilateral incision at the edge of the eyebrow by means of subperiosteal inward fracture with the chisel (KRAUS). The arc-like incision running behind the hairline from one temple to the other is suitable for such removals as it is for lining in cases of depressed superciliary arches following the RIEDEL operation or accidents (UNTERBERGER, AUBRY and others).

XIV. Correction of harelip nose

The correction of harelip nose in unilateral as well as in bilateral clefts presents rather difficult problems. Here, too, it is important for the surgeon to be acquainted with as many as possible of the methods practiced to date. He should also have the ability to adapt them to the conditions of the case at hand or, if necessary, to improvize modifications of them.

In bilateral harelip nose a second correction is practically always necessary, in particular for lengthening the columella. In unilateral harelip nose it is sometimes possible to correct the nose to such a considerable degree already in the primary repair, that later hardly anything must be altered.

1. Correction of unilateral harelip nose

Primary repair. In surgical treatment of unilateral harelip nose in infants one condition is particularly to be taken into consideration with regard to the nose: The nasal floor must not be built up too high. Without going into every detail of harelip nose surgery, it should be mentioned briefly that the closure of the cleft in the region of the nose, i.e. the *formation of the nasal floor*, is obtained by suturing the septal mucosa to the mucosa of the lateral nasal wall. This can be done in various ways according to the method of the cleft surgery. The names of the best known methods are listed here; they will be described in greater detail in the chapter on cleft lip and palate (Vol. II): AXHAUSEN, VEAU, WASSMUND, PICHLER, TRAUNER, CAMPBELL, STELLMACH-SCHRUDDE and JOHANNSON.

To us it seems essential that the new nasal floor is at the same level as the normal floor. It should be located too low rather than too high. It is much easer to raise it than lower it in a later correction. The greatest difficulty in all secondary repair of clefts is encountered in creating normal spatial relationships in the nose where they are inadequate after the primary repair, and where the success of a postoperative plastic correction is jeopardized by the almost regularly present chronic rhinitis. Again and again we have the experience that stenoses of the nasal vestibules occur due to cicatricious contraction. Thus in constructing the nasal floor one should be most careful that the mucosa flaps used for the nasal floor are cut adequately large.

The methods of PICHLER, CAMPBELL and WASSMUND have the disadvantage that too high a nasal floor results, even with good surgical technique. Therefore, from the rhinologic standpoint, it is better not to use them. Thus one must choose primary methods by which the nasal cavity is not narrowed more than necessary in the lower part of the cleft side even if it must be done with the danger of later insufficiency of the nasal floor. SUBTENLY and BRODIE determined by means of tomographs that at a time when active growth is to be observed in all parts of the head, the distance between the lateral nasal walls remains the same or even becomes less. The narrowing is sometimes so pronounced that the inferior turbinate touches the septum. In most cases of plastic repair of harelips, the nasal passage is narrowed and the patient is thereby condemned to oral breathing with all injurious consequences.

In 1955 GÖTZ described a procedure for the construction of the nasal floor in case of cleft lip with cleft palate. This procedure particularly deals with the spatial relationships of the nose. The nasal cavity is approximately as wide as normal. The displacement of the nasal floor toward the nose is prevented by attaching the mucosa to the palate using deep interrupted sutures. By this means the nose assumes its physiological function even in earliest childhood.

There is a certain danger that the nose will be narrowed too much from below in the creation of the nasal floor using the double mucosa plasty and bone grafting in the jaw defect (JOHANNSON, STELLMACH, SCHUCHARDT, SCHMID). Therefore one must make sure that the bone graft does not lie too far toward the nose.

On the other hand we definitely reject the practice of leaving out closure of the jaw in the primary repair as is still done by some surgeons. A fistula remaining in the jaw leads to continual irritative symptoms in the nose, even if the shape of the fistula is split by lip tension.

With observance of these rhinologically important facts during the primary repair, many commonly found afflictions of the upper air passages, such as rhinitis, pharyngitis, inflammation of the eustachian and bronchitis, can at least be essentially reduced, if not always eliminated.

Oblique columella should be straightened in the primary repair, if possible. This is not always possible to a satisfying degree. Reduced asymmetry after the primary repair does not present any difficulty for the secondary repair. Straightening the cartilaginous septum can be done later.

The *ala* of the cleft side must be rotated inward in the primary repair. In addition the nostril must have the proper width. In the primary repair the proper inward rotation of the alar attachment is obtained by rotating a small skin flap after Trauner from the lateral stump of the lip to the base of the columella. The inward rotation can be increased by means of mattress sutures at the base of the nose. D. Browne ties wire suture over metal plugs for immobilization of the new alar position. We rotate the alar attachment inward after mobilizing it with a blunt scissors from an incision in the lateral stump of the lip. Undermining is extended laterally from the alar attachment into the cheek and medially in the ala as far as the nasal tip.

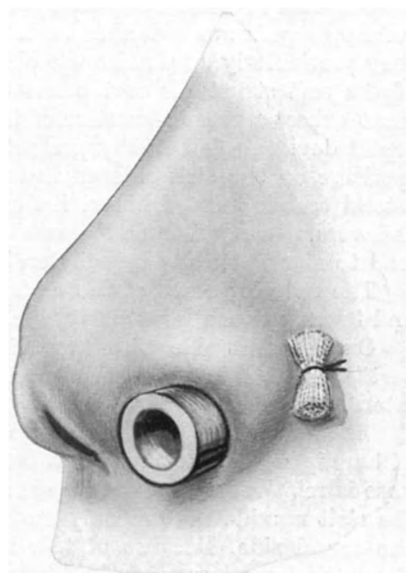


Fig. 280. Insertion of a rubber tube into the nostril on the side with the defect and fixation by means of a mattress suture (Callister)

If necessary we not only mobilize the external skin but also the vestibular skin above the lower lateral cartilage. We immobilize the new curvature of the ala after positioning the alar attachment by means of one or two through-and-through mattress sutures as by Brown. The mattress sutures are tied over small rolls of petrolatum gauze. Sometimes we insert an appropriately large rubber tube into the nostril of the cleft side and tie it with mattress sutures to the ala and the membranous septum after a suggestion by Callister (Fig. 280).

At the end of the primary repair the alar attachment still may be higher on the cleft side than on the sound side in spite of good lip surgery technique after Le Mesurier or after still newer methods like those of Tennison, Marcks, Skoog or Millard. In this case, the alar attachment can be positioned more toward the lip by means of small, lateral Z-plasties.

In the primary repair, Gelbke goes farther in the correction of the nose than other cleft surgeons. He combines closure of the complete unilateral cleft as by Le Mesurier with his own procedure for tip correction. A V-Y advancement is made at the nasal tip and columella. The two folds of skin resulting laterally at the ends of the V are eliminated by excision of a Burow triangle on either side. The medial crura of the lower lateral cartilages are sutured together at their most anterior part. A wire mattress suture with stabilizer bilaterally at the alar attachment is passed under the nasal floor to narrow the base of the nose, as by D. BROWNE. Small mattress sutures as by BROWN immobilize the ala in its new position.

We feel that the cartilage arches are to be placed at the same height by means of incisions in the cartilage. Therefore we refuse to make such radical corrections in infants. Like IMMENKAMP, TRAUNER and WIRTH we certainly do not agree with making external skin incisions around the nasal tip as in the procedure of GELBKE. External scars must definitely be avoided here. Thus we would accept a certain small asymmetry of the nasal tip and delay its correction until the patient is older.

Secondary repair. The *pathological anatomy* of unilateral harelip nose *following primary repair* was described in detail by HUFFMAN and LIERLE in 1949. In this they particularly emphasize the obliquity of the columella and the displacement of the soft structures of the nasal tip toward the normal side. This displacement causes a pseudo-luxation of the septal cartilage. In many cases, however, septal deviation is actually present. In addition, flattening of the lower lateral cartilage on the cleft side or an atrophy of the cartilage is characteristic. The lateral crus is located lower, i.e. more caudally, than on the sound side. Using cadavers, STENSTRÖM and OBERG have studied the tension conditions which lead to alar flattening in unilateral harelip nose.

The anterior dome of the nostril is not as far forward as on the sound side and forms a much less acute angle. On the cleft side the columella is shortened.

On the cleft side with the thin, sometimes atrophically thin lower lateral cartilage, the skin of the nasal vestibule is fused much more closely to the lower lateral cartilage.

TRAUNER and WIRTH have also pointed out a further characteristic anomaly of harelip nose: measured from back to front, the lateral mucosal lining of the nose is relatively short on the cleft side. This occurs because the lateral part of the cleft maxilla lies not only farther laterally but also farther dorsally than on the sound side. Because of this the lateral nasal mucosa is pulled rearward. Thus the lateral crus of the lower lateral cartilage is not under the tension of the horizontal spreading of the ala, but is subjected to additional tension and additional pull dorsally. This tension takes effect at about the middle of the alar border and flattens or bends it.

The cartilaginous septum practically always is deviated toward the normal side, more at the nasal floor than at the dorsum (pseudo-luxation, Fig. 281). Thus the base of the columella also is pulled toward the sound side. The bony nasal vault usually is in midline. Only occasionally do bony and cartilaginous deflected noses occur together. In such cases as well, the deviation of the septum is more pronounced at the base than at the dorsum.

The lower nasal passage and the vestibule which were narrowed by the primary repair should be enlarged as soon as possible in the child. Sometimes in the child it is necessary to disregard cosmetic ideals to obtain a functional improvement. Thus, for example, the *enlargement of the nasal vestibule* must sometimes be obtained by rotating a flap onto the floor of the vestibule from the skin area lateral to the alar attachment (Figs. 143 and 144). Here one must rather over-correct. There is a further effective method for correction of such unilateral stenoses in children by enlarging the nasal vestibule: one separates the lateral alar attachment, elevates the skin on the vestibular floor and on the membranous septum, and forms a carpet-like flap from this skin once it has been severed at the anterior dome of the nostril. This flap can slide laterally with the severed alar attachment and is sutured in such a way that its medial edge lies at the base of the septum. The new defect on the septum is covered with a free full-thickness retroauricular skin graft. The skin graft is immobilized best with mattress sutures which are passed through the septum. The ala as well is held in its new position by means of mattress sutures. If because of this, asymmetry of the nasal vestibule occurs again, this can be eliminated now during the secondary repair by means of excisions in the vestibular floor.

Such small excisions at the vestibular entrance for *equalizing the nostrils* were the first postoperative corrections which were used in harelip noses.

The rhombus or wedge-shaped excision of SHEEHAN (see Fig. 139) is still much used today. It has been replaced somewhat by the technique of AUFRICHT and HERLYN (see Fig. 142). In the latter a wedge of skin is excised on the floor of the nostril. One cuts around the alar attachment so that the length of this cut corresponds to the base of the pyramid-shaped wedge which was removed

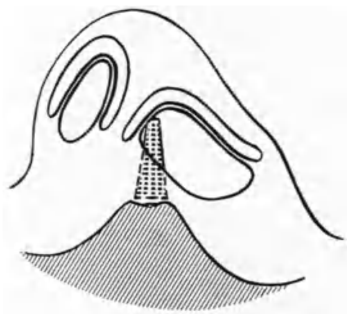


Fig. 281

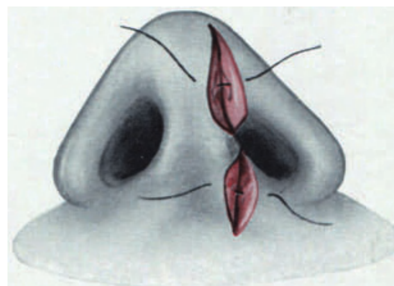


Fig. 282

Fig. 281. Pathological anatomy in harelip nose. Pseudo-luxation of the septal cartilage due to displacement of the soft structures toward the sound side. Flattening of the lower lateral cartilage on the affected side. (According to HUFFMAN and LIERLE)

Fig. 282. Excision in unilateral harelip nose according to HERMANN MEYER (obsolete)

at the nostril. While suturing the ala, one places it medially and shortens it somewhat. This shortening becomes more pronounced the more one places the excision toward the alar attachment.

Sometimes one wants to obtain a more pronounced medial displacement of the alar attachment. One can do this better with a small flap of skin, i.e. with a Z-plasty. This way a triangular flap is transposed from the floor of the nostril to the lateral side of the alar attachment. We have had no good experience with this technique. Vibrissae can afterward grow in the nasolabial sulcus; their roots must then be removed.

The rhomboid excision at the anterior dome of the ala on the cleft side by HERMANN MEYER (Fig. 282) or by LEXER are obsolete. Also outmoded are the half-moon shaped excision of AXHAUSEN and lifting the ala, which is lower on the cleft side, by means of a wedge-shaped or half-moon shaped excision on the external surface of the ala as described by JOSEPH (Fig. 283). Medial alar resection (Fig. 284), i.e. narrowing and raising the medial part of the ala, also comes from JOSEPH. In 1949 YOUNG took it up again in combination with rotation of half of the columella of SHEEHAN as described below. It has only recently been put into use again by CRIKELAIR.

BROWN and MCDOWELL reposition the alar attachment which lies too far laterally on the side corrected poorly in the primary repair. They do this simply with excision of cicatricious tissue along the upper lip and in the vestibule between two parallel hockey-stick-shaped incisions.

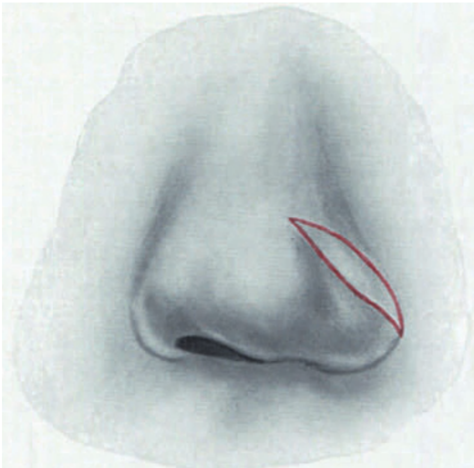


Fig. 283. Excision from the upper rim of the ala in unilateral harelip nose according to JOSEPH (obsolete)

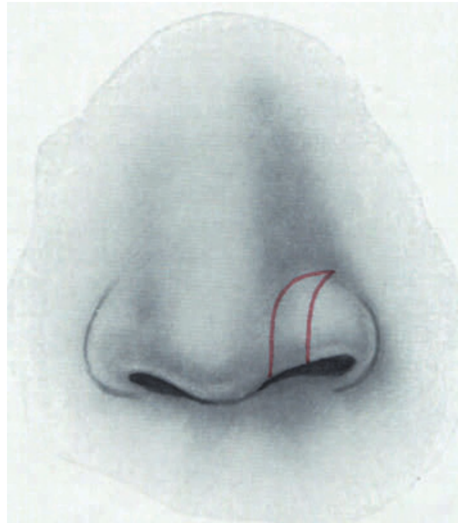


Fig. 284. Medial alar resection by JOSEPH in unilateral harelip nose

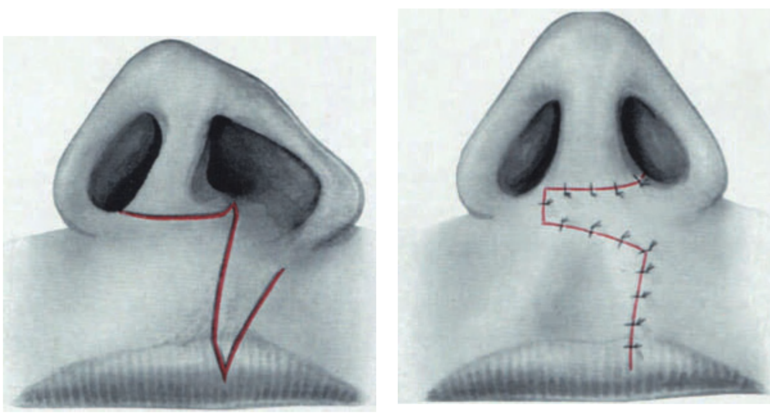


Fig. 285. Correction of unilateral harelip nose by TRAUNER using rotation of a vertical flap from the upper lip onto the columella

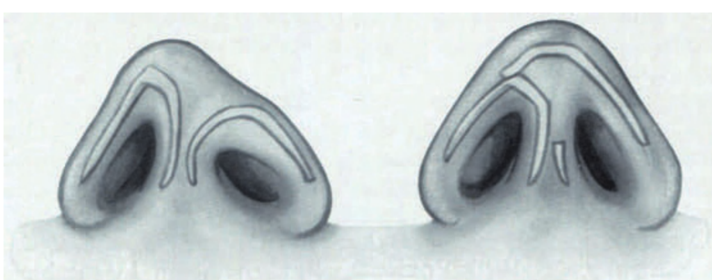
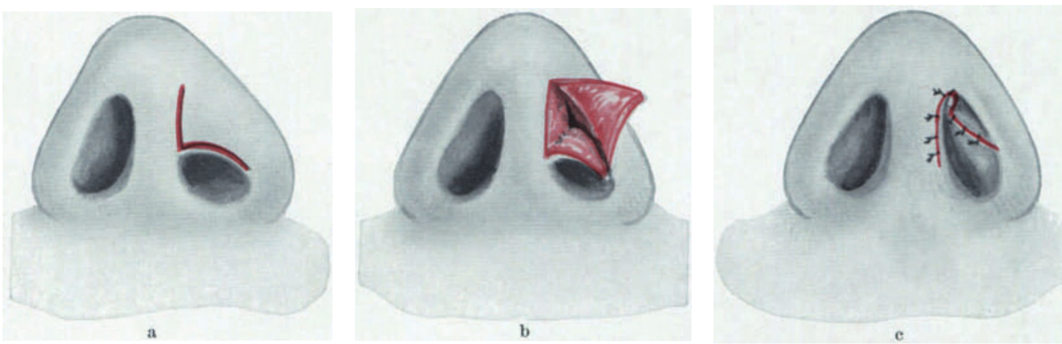


Fig. 286. Correction of unilateral harelip nose by BYARS. The medial crus of the lower lateral cartilage on the affected side is severed and the entire arch is supported on the contralateral side

Inadequate inward rotation of the alar attachment with abnormal width of the vestibular floor on the cleft side can give the nostril a more horizontal-oval shape. This can be corrected by means of a flap exchange as by TRAUNER, a

Z-plasty, at the nostril, as in the primary repair (Fig. 285). A vertical flap with its pedicle above is rotated to the base of the columella. The flap is cut immediately adjacent to the lip scar. Sometimes this manipulation is sufficient to raise the sunken nostril so that it and the sound side are symmetrical. It can also be sufficient to reposition the alar attachment medially and bring the longer axis of the nostril into an almost normal position.



Figs. 287a—c. Correction of unilateral harelip nose by STRAITH, Sr. a Cutting the lateral flap which is to be swung to the inner surface of the ala. b Formation of a flap from the wall of the stenosis for covering the defect on the membranous septum. c Suturing the flaps

Fig. 288. Correction of unilateral harelip nose by BARSKY. The cephalic half of the lateral crus of the lower lateral cartilage on the affected side is drawn upward to the dorsum and is fixed there by means of a mattress suture

BYARS' method of alar construction is more complicated. He severs the flattened lower lateral cartilage of the cleft side in the medial crus. He then draws the larger, lateral part up over the angle of the lower lateral cartilage of the normal side and sutures it to this angle. He combines this repositioning of cartilage with a V-Y advancement on the columella (Fig. 286).

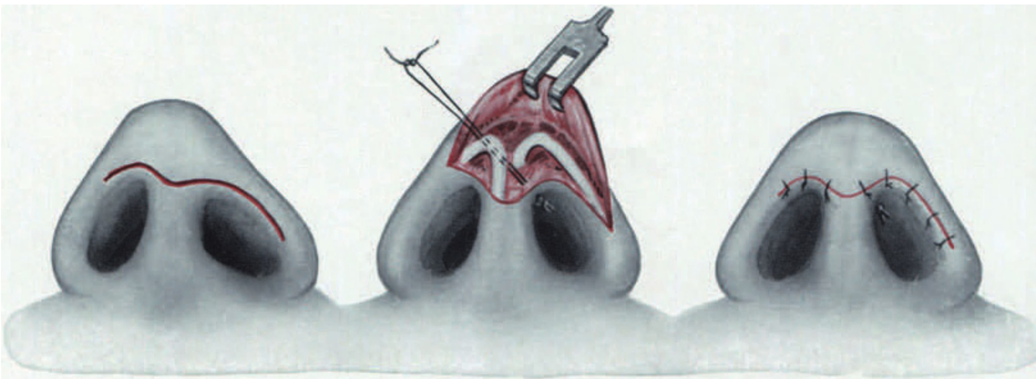
HUMBY proceeds similarly. He mobilizes the medial $^2/_3$ of the lateral crus of the normal lower lateral cartilage and swings it at the dome over onto the other side of the nose, so that it lies on top of the flattened lateral crus of the cleft side.

WALTER uses only the upper border of the normal lateral crus and sutures it free onto the flat cartilage arch of the opposite side.

The small correction of AXHAUSEN appears inadequate today and can be used only in the slightest cases of asymmetry of the nasal tip. This consists of a half-moon-shaped skin excision at the anterior dome of the nostril on the cleft side.

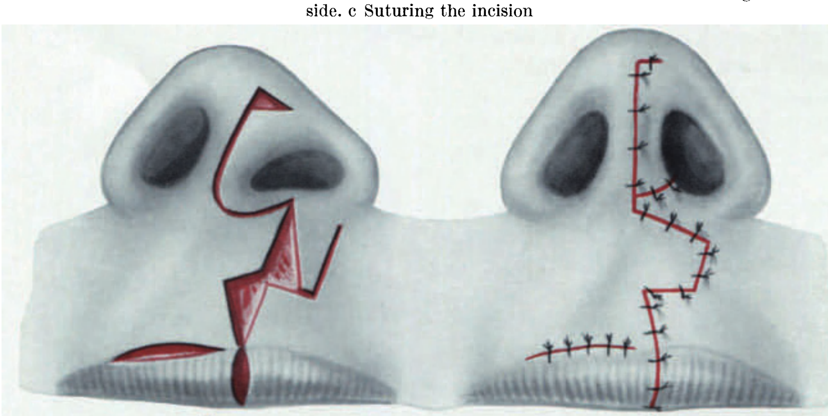
In 1946 STRAITH described a Z-plasty in two levels to make the dome on the cleft side similar to that of the other side. He rotates a small triangular skin flap with its pedicle at the alar rim into the vestibule and then a second one from the vestibular vault onto the columella. We too sometimes use this method in combination with others. It has proved useful in other rhinoplasties as well, in which the nostril is to be enlarged toward the tip and in stenoses of the nostrils (Fig. 287).

For better modelling of the nasal tip and the ala on the cleft side, Barsky pulls the upper half of the lateral crus of the lower lateral cartilage into midline,



a b c

Figs. 289 a—c. Correction of unilateral harelip nose by Erich. a Incision. b Exposure of the lower lateral cartilages; severing the medial crus on the affected side and repositioning the cartilage arch at the level of the contralateral one; mattress suture from the dome of the affected nostril to the arch of the lower lateral cartilage on the normal side. c Suturing the incision



a b

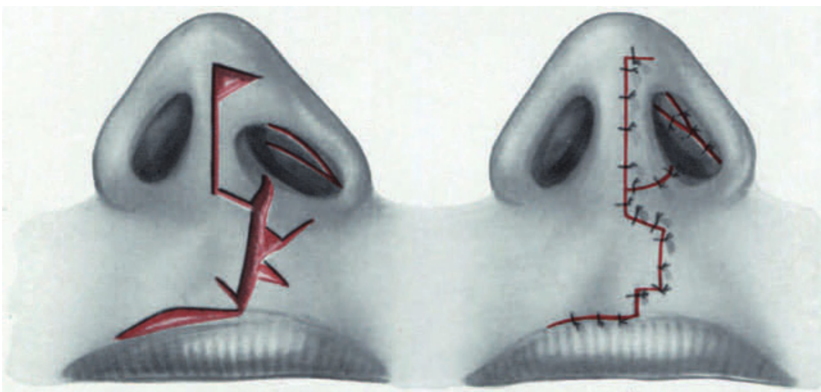
Figs. 290 a and b. Correction of unilateral harelip nose using combination of the methods of Sheehan, Trauner, Trusler-Glanz. a Incision with excision of scars. b Situation after forward rotation of the half of the columella on the affected side (Sheehan), transposition of a flap from the upper lip to the columellar base (Trauner) and removal of scars on the upper lip (Trusler-Glanz)

i.e. to the dorsum, and attaches it there to the upper lateral cartilage or to the skin (Fig. 288). This technique is described after the method of Kazanjian in bilateral use for correction of slight saddle nose (see p. 144).

Erich swings the skin of the tip forward from a bow-shaped incision on the nasal tip and thereby exposes the anterior angles of the lower lateral cartilages (Fig. 289). Then he excises some tissue on the cleft side in order to narrow the widened dome, as Axhausen does. He now severs the medial crus of the lower lateral cartilage on the cleft side and sutures the two cartilaginous angles together at the same height. Then he swings the lip of skin at the tip back into place and sutures it. In addition he shortens the ala at its attachment by means of comma-shaped excisions as by Weir (Fig. 137).

GINESTET and MERVILLE use a similar yoke-shaped incision ("en joug à boeufs") with a horizontal incision at the columella after RÉTHI. They use it for more extensive exposure of the lower lateral cartilages and for the same procedure at the nasal tip.

The rotation of half of the columella after SHEEHAN (Figs. 290—292) is a very usable method. It can be best combined with the scar excision on the upper lip. We choose the incision of TRUSLER-GLANZ as the most suitable for scar excision on the upper lip (Fig. 290). It can be combined very well with the rotation



a b

Fig. 291. Correction of unilateral harelip nose by SHEEHAN, TRAUNER, LE MESURIER. V-Y advancement on the inner surface of the affected ala

of a vertical lip flap into horizontal position as by TRAUNER. Often one must cut completely through the upper lip and suture it together again after removal of the scar, especially if the upper lip is thin in the region of the scar or if fistulas into the oral vestibule exist on the floor of the nose. In fine lip scars with contraction of the rim of the lip we combine the rotation of half of the columella by means of the lip plasty of LE MESURIER and the rotation of the flap as by TRAUNER (Fig. 291).

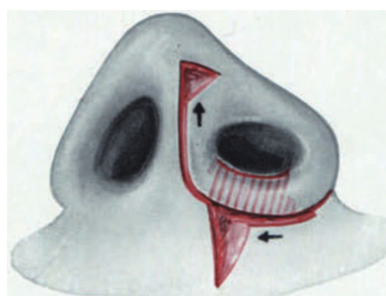
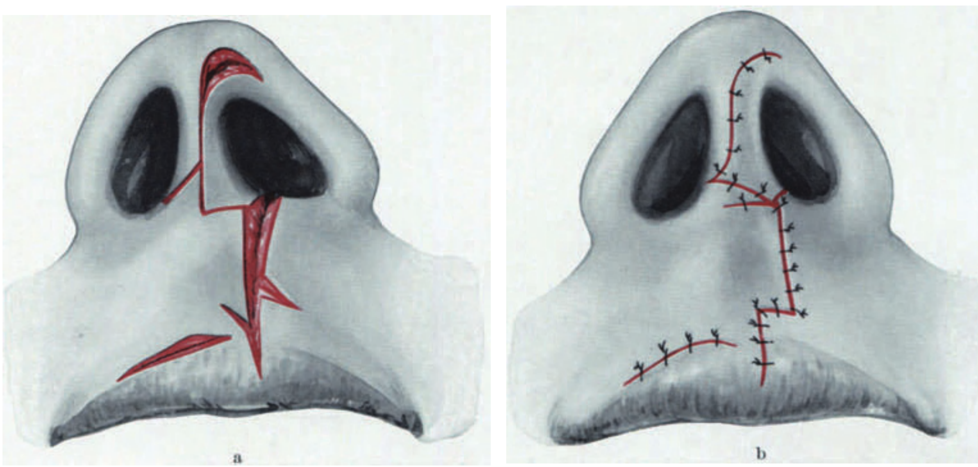


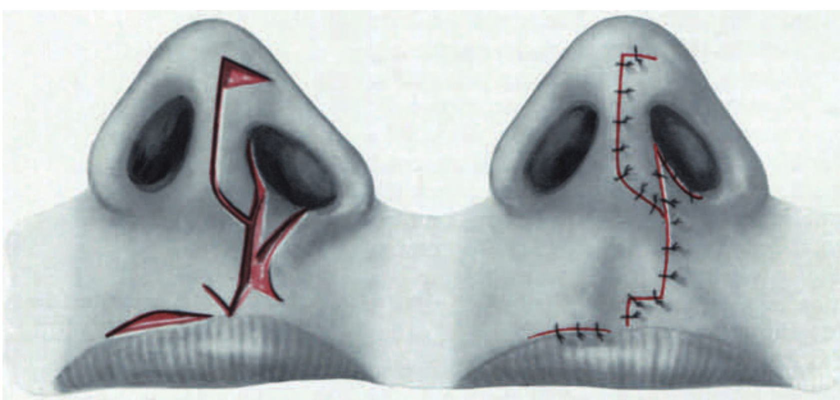
Fig. 292. Correction of unilateral harelip nose by SHEEHAN by means of rotation (arrow). Nasal floor at the entrance is also corrected

In 1961 we published a modification (R. MEYER) which has the advantage that it simultaneously straightens the oblique columella which usually leans toward the normal side. A sickle-shaped skin excision is made in front of the anterior dome of the nostril on the cleft side. This incision joins the mediocolumellar incision, so that half of the columella can be rotated forward. At the base of the columella a small skin flap is cut on the normal side and is turned toward the basal end of the rotated half of the columella. By means of the Z-plasty, the base of the columella is drawn toward the sound side, thus straightening the entire columella. The median splitting of the columella also makes it possible to trim the medial crura of the lower lateral cartilages symmetrically and, if necessary, to immobilize them by suturing them together at the same height with catgut (Fig. 293).

A further combination of the SHEEHAN method at the nostril and the LE MESURIER technique at the upper lip is used by us. It is a variation in which the additional skin flap is not transposed horizontally as by TRAUNER but is brought into the nasal vestibule to the side of the columella (Fig. 294). The rotation of one half of the columella after SHEEHAN has been modified by YOUNG in that the median incision is extended over and beyond the alar rim to the outer surface of the ala (Fig. 295). To this incision MOREL-FATIO adds another triangular skin excision with its apex pointing downward. This strengthens the rotation of the half of the columella and the alar rim in the region of the anterior dome.



Figs. 293a and b. Correction of unilateral harelip nose by rotation of one half of the columella and a Z-plasty at the columellar base (R. MEYER) in combination with the secondary lip surgery of LE MESURIER. a Incision and excisions. b Condition after suturing

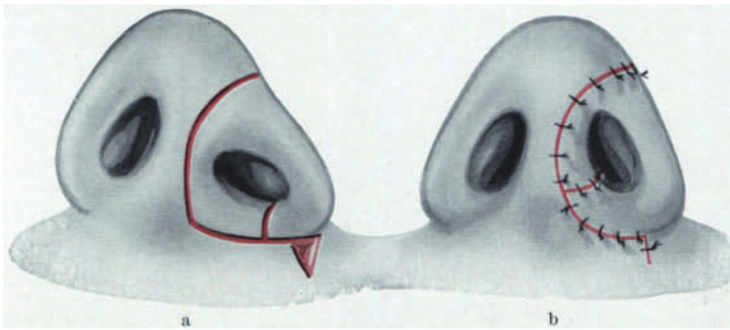


Figs. 294a and b. Correction of unilateral harelip nose using combination of methods by SHEEHAN and LE MESURIER with flap rotation onto the columella (R. MEYER). a Incisions and excisions. b Situation after suturing

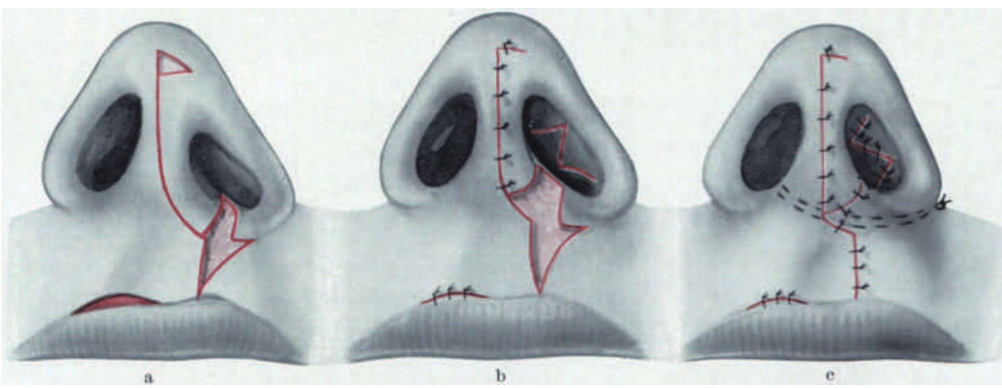
Further modifications of the method of SHEEHAN have been described by BARSKY, SCHJELDERUP (Fig. 296) and GILLIES (Fig. 297). In all of these procedures an inward rotation and medial repositioning of the lateral alar attachment takes place without the necessity of an additional flap as by TRAUNER. The anterior angle of the lower lateral cartilage of the cleft side is thereby raised anteriorly and sutured to the other cartilage at the same height.

The method of GILLIES is characterized by a flap exchange on the vestibular floor. The flaps are rounded so that one can call it more an S-plasty than a Z-plasty (Fig. 297). The GILLIES maneuver can also be combined with the flap technique of TRAUNER and the correction of the upper lip by LE MESURIER (Fig. 298).

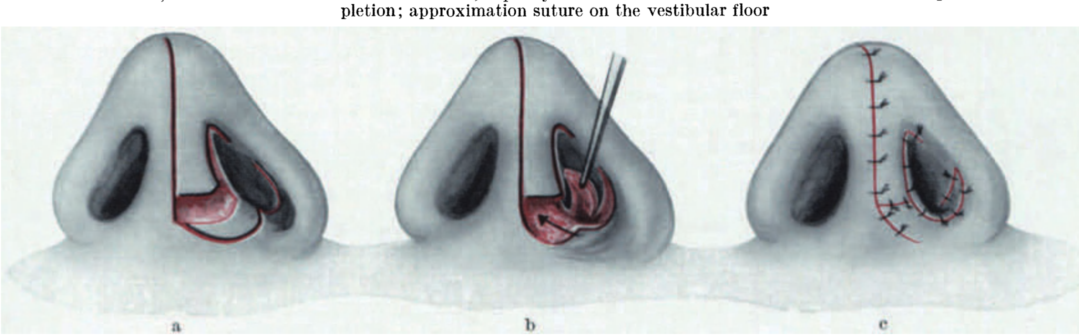
In 1955, at the same time and independently of each other, DE KLEINE and HERFERT showed that in certain cases of harelip nose correction the removal of



Figs. 295a and b. Correction of unilateral harelip nose by means of rotation of the ala according to YOUNG. a Incision around the ala and excision of a BUROW triangle at the base of the alar attachment. b Suturing the rotated ala together with the half of the columella and the vestibular floor



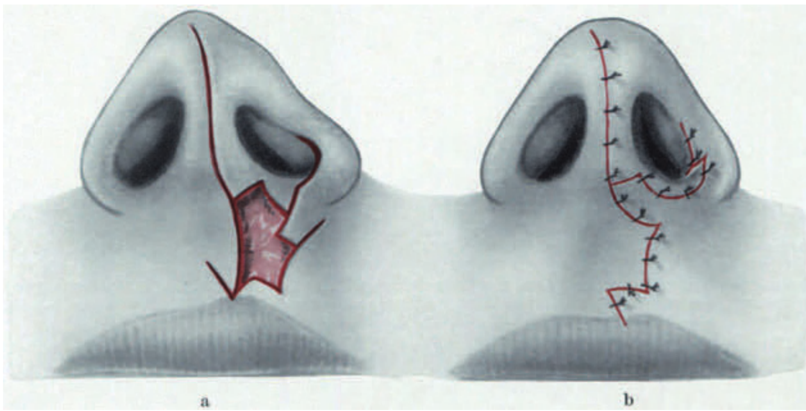
Figs. 296a—c. Correction of unilateral harelip nose by SCHJELDERUP. a Incision and excisions on the nasal tip, the upper lip and the nasal floor on the affected side, as well as on the contralateral vermilion border. b Partially sutured; half of the columella rotated forward, Z-plasty on the vestibular side of the ala. c Situation upon completion; approximation suture on the vestibular floor



Figs. 297a—c. Correction of unilateral harelip nose by GILLIES. a Incision. b Rotation of the ala medially in the direction of the arrow; flap transposition on the nasal floor. c Situation upon completion

the caudal border of the lower lateral cartilage is indicated in its lateral as well as in the medial crus (Fig. 299). We have also tried this in some cases. The lower lateral cartilage of the cleft side is exposed from an internal incision along the vestibular rim. Its caudal border is resected and its anterior angle brought forward to the level of the contralateral one. Since the columella sustains a loss of its stability due to this maneuver, it is best to strengthen it with a cartilage graft from the septum.

In *very pronounced asymmetries* of the lower third of the nose these rotation methods at the rim of the nostril on the cleft side are inadequate. It is more a matter of exposing the cartilaginous structure as much as possible, trimming it



Figs. 298a and b. Combination of the method of GILLIES with the flap procedure by TRAUNER and the flap technique of LE MESURIER

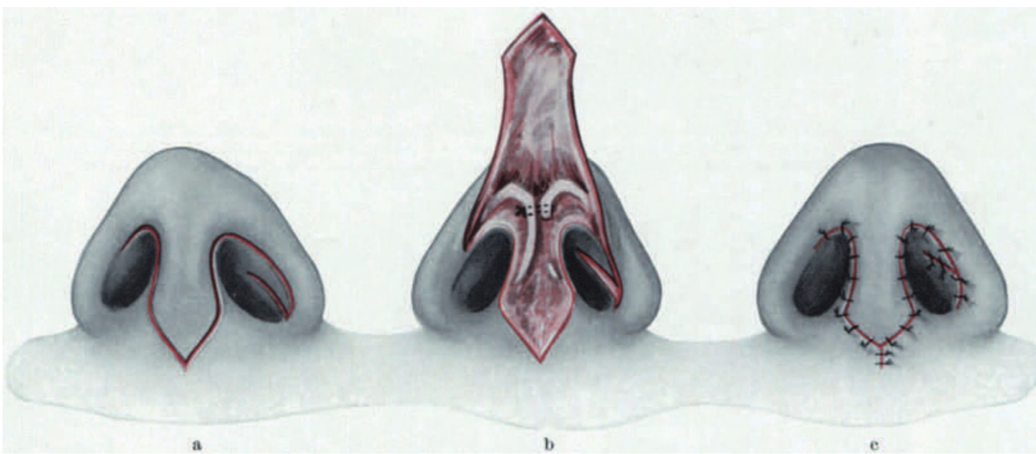
Fig. 299. Correction of unilateral harelip nose by HERFERT and DE KLEINE. Resection of the caudal border of the lower lateral cartilage from a corresponding curved incision on the vestibular rim

and fixing it in a symmetrical position. For this the procedure of POTTER (Fig. 300) is suitable. In this method one cuts around the columellar skin to form a cranial pedicle and swings it upward. By this means the medial crura of the lower lateral cartilage are exposed for modelling. From the inside one makes a V-shaped incision around the lateral crus of the lower lateral cartilage on the cleft side together with the vestibular skin. This V-shaped flap is sutured in again as a Y (V-Y advancement). This leads to an enlargement of the vestibular vault. The angle of the cartilage is severed in the medial crus and then repositioned forward to the height of the contralateral angle and attached to it. The columellar skin is swung downward after modelling the cartilaginous angles. By means of a V-Y advancement at the junction of the columella and the philtrum it is advanced farther forward and sutured. Thus two V-Y advancements are made to raise the alar vault and the tip.

The lower lateral cartilage is similarly exposed for modelling by RAGNELL, ŠERCER (decortication method), REHRMANN (open method), MCINDOE and REES (complete dissection of the lip-nose complex) and PITANGUY. PITANGUY extends the lateral incision on the vestibular rim to the alarfacial junction and thus separates the entire ala laterally.

In our modification of these methods, we (R. MEYER) also include the membranous septum and the enclosed medial crura of the lower lateral cartilage in the columellar flap which is to be swung upward. This is described as the method for opening the nose to insert a graft in saddle nose (see Fig. 233). The transverse incision at the base of the columella runs bilaterally upward and posteriorly as far as the edge of the septal cartilage. It runs along this into the anterior dome of the vestibule, where it merges with the intercartilaginous incision at the limen nasi. From this incision one makes a V-shaped incision around the lateral crus of the lower lateral cartilage on the inner vestibular side, as mentioned above. This way the cartilaginous structure is approached from behind and can be more easily exposed, modelled and brought into symmetry with the opposite lower lateral cartilage. When the cartilage angles have been brought to the same height, the trunk-like part of the nose is swung down and sutured in an over-corrected position with diagonally placed mattress sutures.

Like McIndoe and Rees we split the upper lip completely, if necessary, in the cicatricious region during the same operation. The lip is sutured again when

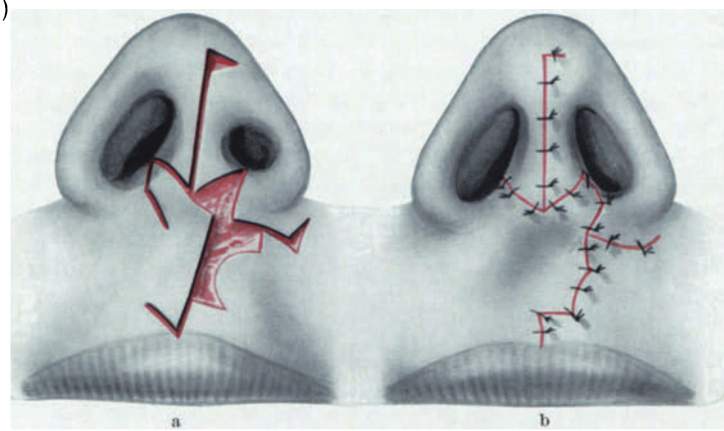


Figs. 300a—c. Correction of unilateral harelip nose by Potter. a Cutting the philtrum-columella flap as well as a V-flap on the inner surface of the affected ala for a V-Y advancement. b Exposure of the lower lateral cartilages; severing the medial crus on the affected side and fixation of the cartilage arch at the level of the contralateral one. c Suturing the flap for the V-Y advancement on the base of the columella and on the inner side of the ala

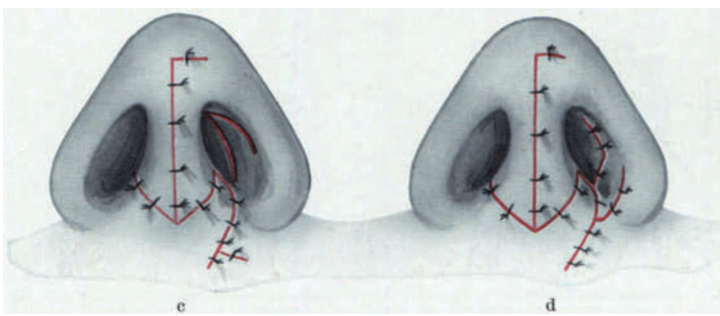
the nose is reconstructed. In this we use the well-known "pre-suturing" of the mucosa in the oral vestibule used in cleft surgery by Axhausen for obtaining filling material for the lip and nasal floor.

The correction of a *high degree of stenosis of the nostril* in adults due to poor primary repair presents a difficult problem. In these cases there is a practically permanent chronic rhinitis. It is therefore very difficult to get skin to heal in the inflamed cicatricious funnel. The missing skin must be replaced with either a rotated skin flap or a free graft. If the normal nostril is very wide, it is sometimes possible to transpose a flap from the vestibular floor on that side (Figs. 301a—d) to the stenotic nasal vestibule and to suture it in combination with other techniques, like the one here after Schjelderup (Fig. 296) or Barsky. Otherwise the very cicatricious nostril must be enlarged after adequate scar excision. One can enlarge it using a free graft from the retroauricular region (Fig. 302). The chronic rhinitis can then be before a constricture of the nostril occurs due to inflammatory cicatricious contraction of the walls. The grafted skin heals completely under relatively healthy conditions and permits the nasal vestibule and the nasal cavity to remain open. Dufourmentel, Sr., also reported on free skin grafts in the nasal vestibule.

In addition the nasal vestibule can be enlarged and deepened along its floor by means of a flap transposition from the cheek lateral to the alarfacial junction (Fig. 303)



Figs. 301a and b. Correction of unilateral harelip nose with stenosis of the nostril on the affected side, according to R. MEYER. To enlarge the circumference of the stenotic nostril, a flap is swung from the floor of the sound vestibule. Correction of scars on the upper lip by LE MESURIER. a Incision. b Situation after suturing



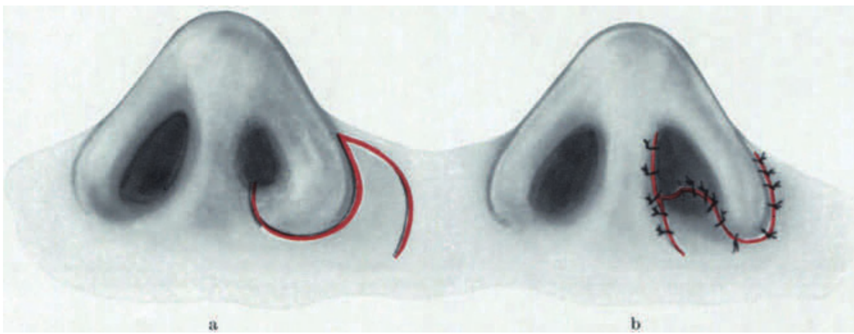
Figs. 301c and d. c Additional formation of a transposition flap from the inner surface of the ala to widen the nasal floor. d Transposition flap sutured

Figs. 302a and b. Full-thickness skin graft used to correct stenosis of high degree in the nostril on the affected side in unilateral harelip nose. a Skin flap in the anterior part for lateral inner lining on the alar rim; flap in the basal part for lining the vestibular floor. b Flap on the alar rim sutured; free skin graft sutured (R. MEYER)

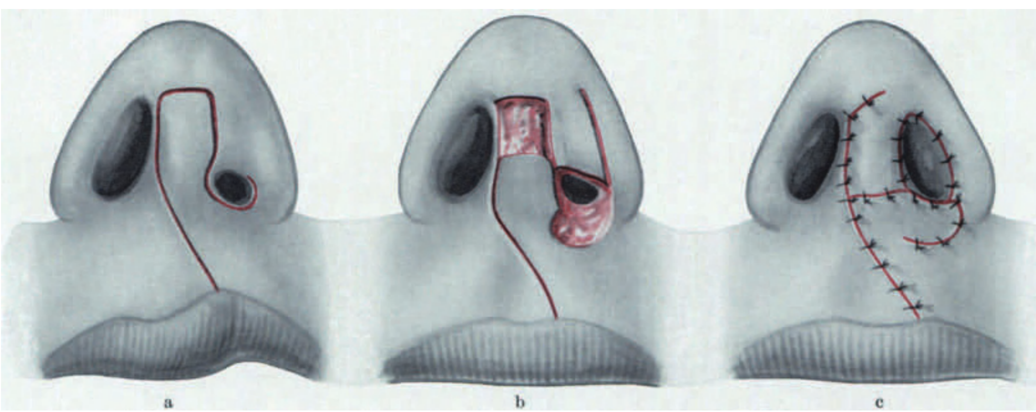
From MOERS comes an original but very complicated method for correcting unilateral harelip noses with pronounced unilateral stenosis in the nasal vestibule (Fig. 304). A skin flap is swung from the wide columella to the vestibular floor. At the same time a second transposition flap is swung from the alar rim of the stenotic side onto the defect on the columella. We have not yet tried this technique.

Of the many methods with which further smaller deformities can be repaired a few are to be mentioned.

Folds in the lateral wall often exist on the cleft side. One eliminates these by means of either a V-Y advancement as by Brown and McDowell or a Z-plasty as by Trauner and Wirth (Fig. 305). More pronounced unevenness or *improper*



Figs. 303a and b. Transposition flap from the skin of the cheek lateral to the alar attachment transferred to the vestibular floor for enlarging and deepening the vestibule. a Incision. b Flap sutured in. Operation for enlargement as in Fig. 302

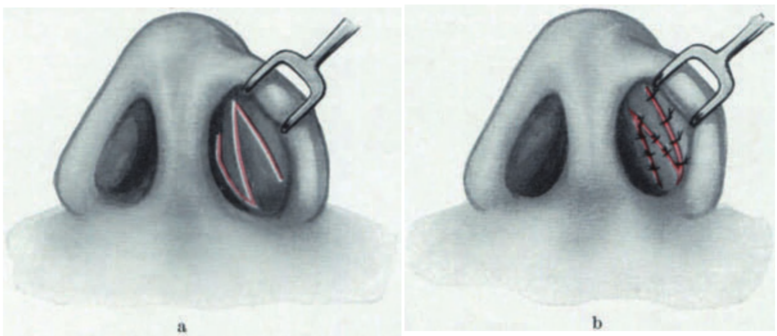


Figs. 304a—c. Correction of unilateral harelip nose with high degree of nostril stenosis, by Moers. a Formation of the columellar flap. b Columellar flap pulled downward along the scar; a skin flap is cut from the ala. c Rotation of the skin flap from the ala to the columella and of the columellar flap to the nasal floor; flaps are sutured

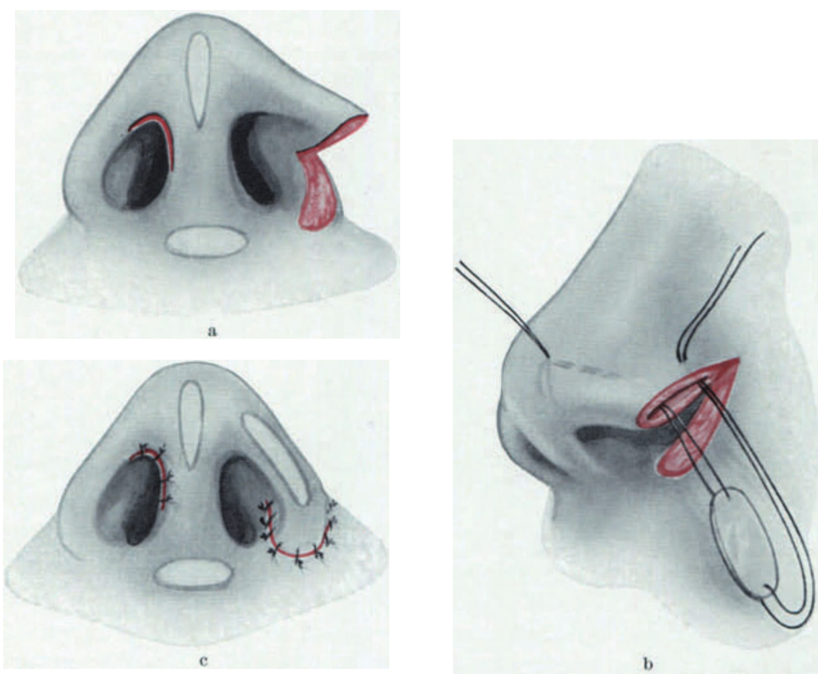
bending of the ala can be eliminated by means of scoring on the lower lateral cartilage after luxation, as in shaping the nasal tip (see p. 90). We make the scoring parallel, while Pap crosshatches the cartilage. To do this he draws it out of the vestibule together with the vestibular skin like a pedicled flap. If the thin and *soft ala* of the cleft side needs a support, we implant a graft from the auricle or the septum, as Klicpera, Dufourmentel, Sr., Trauner and Fomon do. This is done through a vestibular rim incision, through the intercartilaginous incision, or as Fomon does using complete severing of the ala at its lateral attachment and splitting its wall (Fig. 306). Fomon immobilizes the implanted piece of cartilage with through-and-through mattress sutures.

Aubry and Levignac implant a thin piece of woven nylon cut in the shape of the lower lateral cartilage. They call this material "crinoplaque". They place it over the lateral crus of the cleft side and between the medial crura in the columella.

SCHMID provides the flattened ala with the desired curvature by means of a composite auricular graft. He sutures the free graft on the inner surface of the



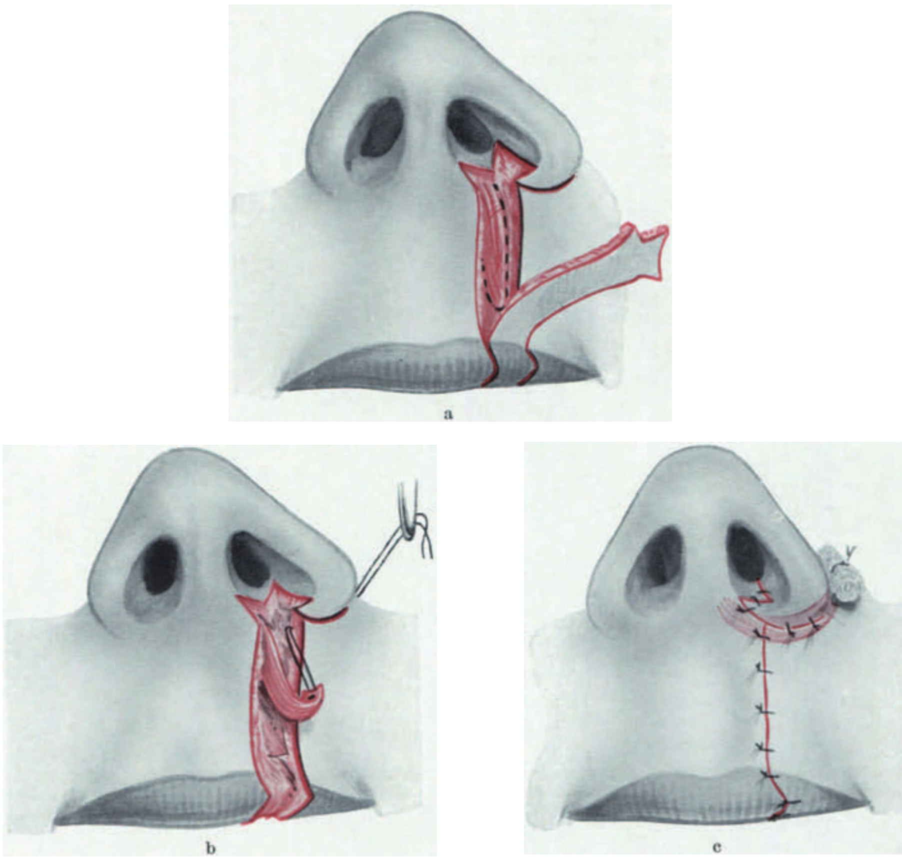
Figs. 305a and b. Correction of narrowing folds in the vestibule by means of a Z-plasty on the inner surface of the ala. a Incision of the cartilage. b Suturing the vestibular skin-cartilage flaps (TRAUNER and WIRTH)



Figs. 306a—c. Correction of unilateral harelip nose by FOMON. a Lining the tip and the columellar base with cartilage grafts inserted through an incision on the vestibular rim of the sound side; severing the lateral alar attachment. b Insertion of the cartilage graft from the auricle or from the septum into the split ala through the lateral incision. c Situation after completion

ala after prior formation of the necessary host bed. He supports the sunken ala from within by means of the appropriately curved auricular cartilage. This is similar to the method described for correcting alar collapse with external covering (see p. 106).

To *support the columella* which has been straightened and made symmetrical, we graft a piece of cartilage from either the cartilaginous septum, as OMBRÉDANNE, DUFOURMENTEL, Sr. and FOMON do, or from the rib, as HERFERT, TRAUNER and SCHUCHARDT do. This is inserted either between or in front of the medial crura. 2/0 or 3/0 nylon mattress sutures or transfixion sutures are applied at the columella and in the membranous septum. Other surgeons, like HERFERT and TRAUNER, use steel wire. The sutures which join the cartilage arches are with catgut or chronic catgut, or with nylon or thin wire if they are tied in the nasal



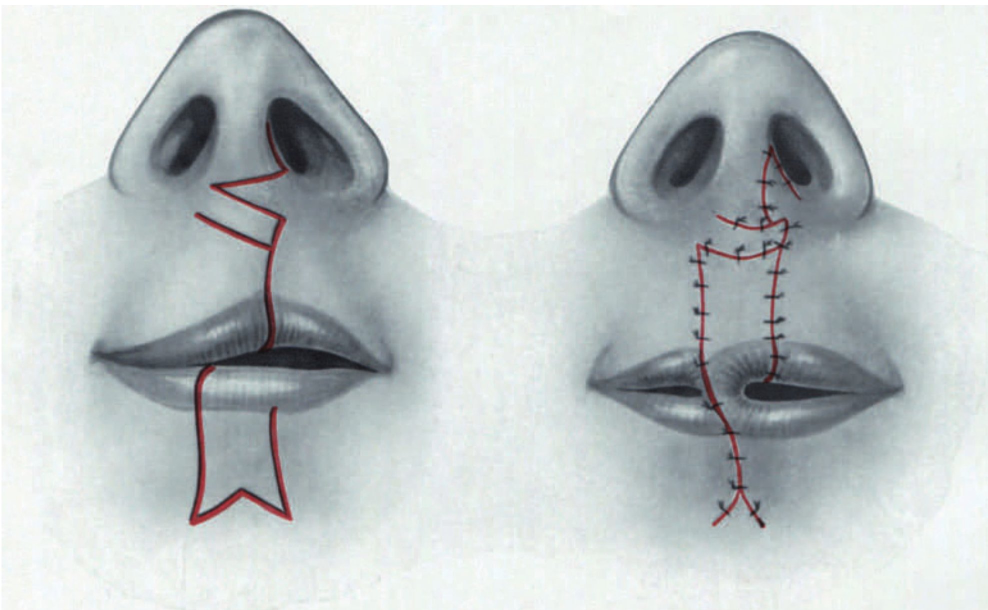
Figs. 307a—c. Correction of unilateral harelip nose by RAGNELL. a Excision of the scars on upper lip and vestibular floor; dotted line shows a muscle-connective tissue flap to be cut in the wound. b Mobilization of the muscle-connective tissue flap; a bridle suture is used to swing this flap to a position underneath the alar attachment in order to raise the latter. c Suturing the lip and the nasal floor; the bridle suture of the muscle-connective tissue flap is tied around a roll of gauze laterally in the sulcus

vestibule. We sometimes apply single mattress sutures on the upper border of the lower lateral cartilage laterally as far as the alarfacial junction. These are arranged in a curve and are tied over gauze rolls as MCINDOE does.

The *base of the columella*, the alar attachment, or the entire nasal floor of the cleft side *is raised*. Bone from the iliac crest is used, as CONVERSE, KAPLAN, GINESTET and others do, cartilage, like DUFOURMENTEL, WASSMUND, KLICPERA and others, or dermis-fat grafts, like WALTER. The lining is done from the opened nasal floor.

Septal deviations are treated as mentioned above. The most common methods are the submucous resection (see p. 118) and the reimplantation of cartilage plates (see p. 130). In addition there is the swinging door method after METZENBAUM and SELTZER (see p. 125) and the median repositioning of the displaced septal base in its anterior third by means of horizontal severing as by BECKER (see p. 129) with possible covering of a mucosal defect using a THIERSCH graft.

Rotation of a muscle flap under the nasolabial sulcus and its fixation with a mattress suture as by RAGNELL (Fig. 307) is a very good method of *filling the alar attachment*. We have often used this kind of tissue transposition with very good success. It is especially good in the frequent cases in which there is a hump due to a bulging muscle in the lateral part of the upper lip right next to the cleft scar, a condition which must be corrected anyway.



a b

Figs. 308a and b. Correction of harelip nose when substance is lacking in the central part of the upper lip. An Abbé-Estlander operation is used to provide material; this operation can be combined with the flap transpositions for correction of the nose

Sometimes much material is lacking in the upper lip. The *upper lip* is thin and retruded, or much cicatricious tissue must be excised in the philtrum. In these cases correction of the defect is made with an ABBÉ-ESTLANDER flap from the lower lip (Fig. 308). This lip plasty will be discussed in detail in Vol. II.

Sometimes a *bony deflected nose* must be straightened along with these corrections. With careful technique this can even be done at between the ages of 10 and 14. In addition if *hump formation* on the dorsum is combined with a harelip nose, the hump should also be corrected at the same age. A saddle nose is less common in unilateral harelip noses than in bilateral ones. The saddle nose should only be corrected after puberty.

Correction of dish-face (scaphoid facies) can be combined with surgery of unilateral harelip nose, even in one stage. Only the ABBÉ-ESTLANDER lip plasty should not be done in the same stage as lining the nasal floor with cartilage or bone. On the other hand the lip transposition flap can be used together with the flap exchange as by TRAUNER in one stage with good results.

2. Correction of bilateral harelip nose

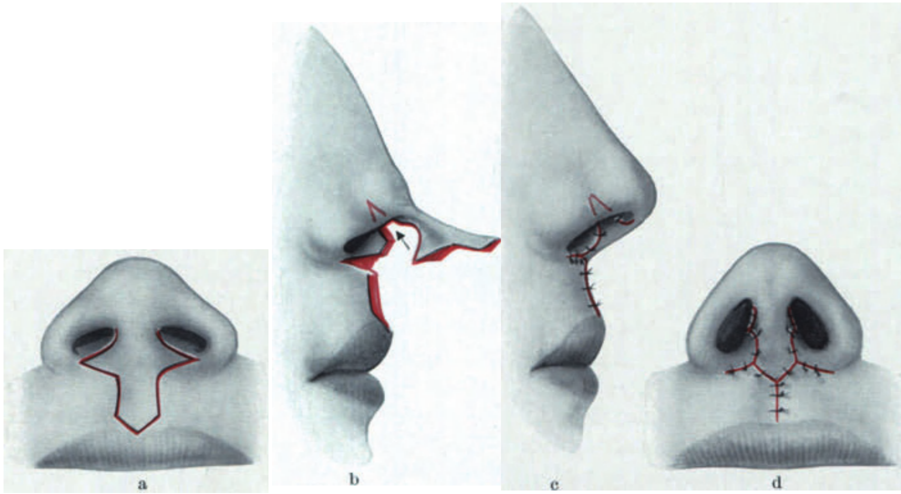
For the analysis of the *pathological anatomy* in bilateral harelip nose, as for that of unilateral harelip nose, the reader is referred to the work by HUFFMAN and LIERLE.

In the primary repair lengthening of the columella is not possible. As a result the other anomalies of the nasal shape remain for the time being, for they are essentially dependent on this clinging of the nasal tip to the upper lip. The nasal tip can not develop forward, thus causing the lower lateral cartilages to continue to grow in the wrong position. The tip remains flattened. Laterally the two alae are spread apart wide. The angles of the lower lateral cartilages are situated farther laterally and dorsally as a sharp bend (Fig. 309). This fact was first described by LEXER. The ends of the lateral crus of the lower lateral cartilage are turned inward into the vestibule and project as a fold into the lumen. This fold has already been mentioned in unilateral harelip nose. In bilateral harelip nose it is even more pronounced. The characteristics of the change in the shape of this nose are strengthened even more by further growth if it is not corrected. TRAUNER and WIRTH aptly call this "sheep-nose". Usually one finds a symmetrical position of the bony structure. Septum deviations are much less common here than in unilateral herelip nose. On the other hand there is often hump formation along the bony and cartilaginous dorsum. Even if a hump is not actually there, one still has the impression that a hump is present because the nasal tip is depressed downward and rearward.

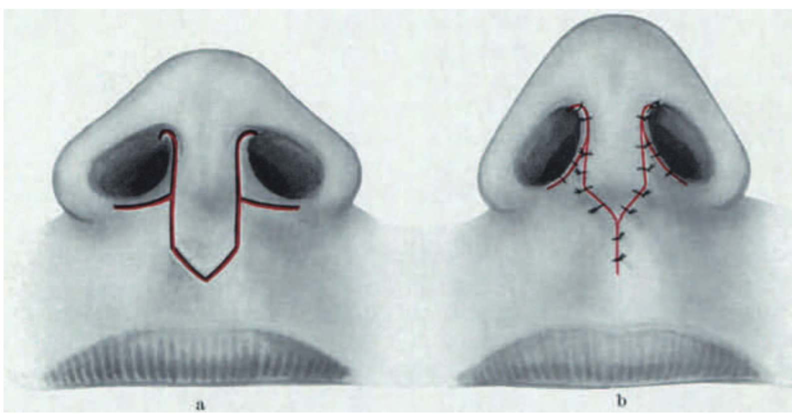
Fig. 309. Typical bilateral harelip nose with a sharp bend in both lower lateral cartilages, according to LEXER

The same principle is valid in the *primary repair* of bilateral cleft lip and palate as of the unilateral one: creation of as low a nasal floor as possible. Here one usually encounters symmetrical conditions. Therefore it is less a question of obtaining symmetry of the alae and more of obtaining a lengthening of the columella and a prominence of the nasal tip. Because of the shortness of the columella and the flattening of the support, both nostrils have a horizontally oval, flat, depressed appearance, instead of being round or vertically oval. This obstructs nasal breathing to a high degree. This functionally very poor condition must be altered as early as possible. Here, too, the success of every postoperative plastic correction is affected by the presence of chronic inflammation in the nose. — *Lengthening of the columella* is most simply obtained by means of including the philtrum skin in the columella and the advancement of this flap, which is pedicled above, toward the nasal tip. In principle it is a V-Y advancement in the middle of the upper lip. This procedure was first described by GENSOUL and later by LEXER (see p. 111). BROWN (Fig. 310) made a sensible modification which makes it particularly suitable for corrections even in small children.

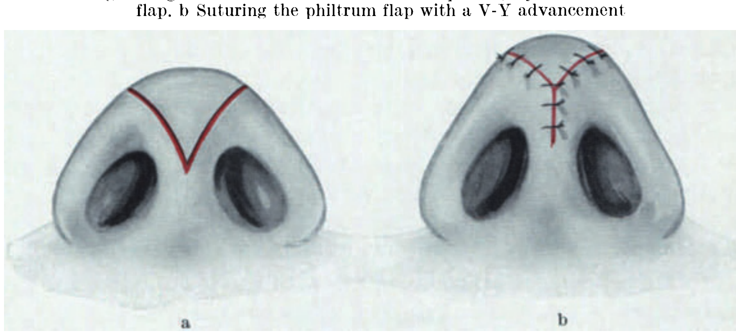
Up to this time we have had good results with the technique of BROWN. It has an advantage over the original method of GENSOUL, in that the lateral walls of the columella are also lengthened. LEXER likewise took this into consideration by making horizontal incisions at the anterior angle of the nostril and on the nasal floor (Fig. 311). These horizontal incisions seem to be inadequate. — We consider the method of BLAIR insufficient, in which the columella is repositioned forward on the nasal tip by means of a V-Y advancement. The underlying, exposed medial crura of the lower lateral cartilages are sutured together after



Figs. 310a—d. Correction of bilateral harelip nose by means of the philtrum flap of BROWN. a Cutting the flap. b Mobilization of the flap and incision in the anterior part of the membranous septum to accept the wedge-shaped side flaps (arrow). c Situation after suturing the flap (side view). d Situation after suturing the flap (view from below)



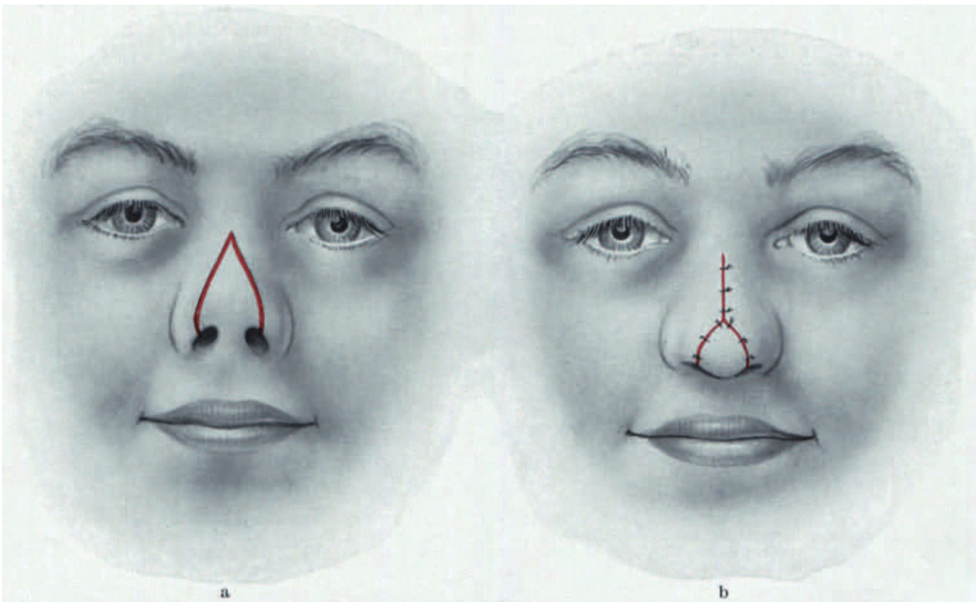
Figs. 311a and b. Lengthening the columella in bilateral harelip nose, by LEXER. a Incision for the philtrum flap. b Suturing the philtrum flap with a V-Y advancement



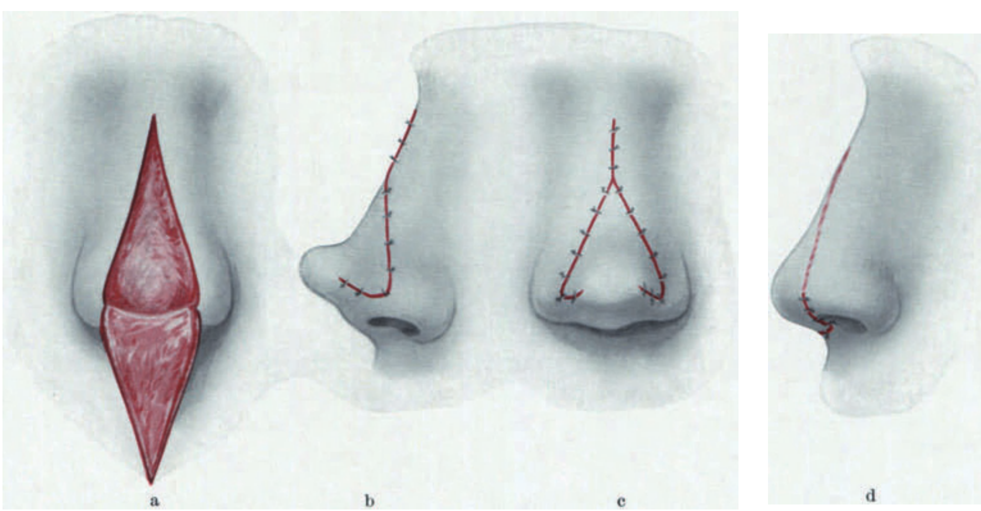
Figs. 312a and b. V-Y advancement on the nasal tip by BLAIR for lengthening the columella

formation of a new angle situated more anteriorly. Because of scar formation at the nasal tip, this method has not been able to gain much attention (Fig. 312).

The old DIEFFENBACH inverted V-Y advancement has also been abandoned (Fig. 313). The lower ends of the acutely angled skin incision on the dorsum lie close to the alar rim, slightly lateral to the anterior angle of the nostril. The Y-shaped suturing of the flap edges brings the lower end of the flap into a definite convexity which is supposed to replace the missing nasal tip and create an



Figs. 313a and b. Inverted V-Y advancement for correction of bilateral harelip nose by DIEFFENBACH

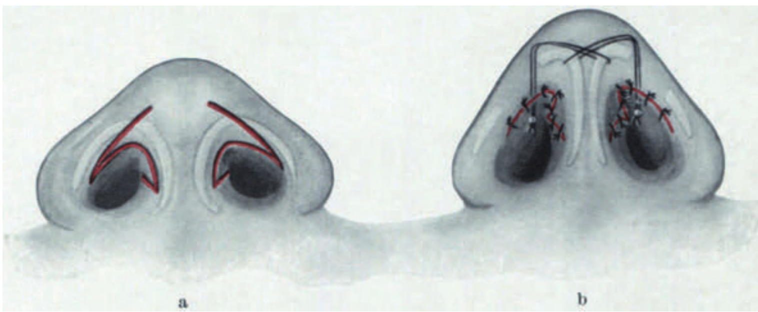


Figs. 314a—d. Two-stage inverted V-Y advancement with "caterpillar flap" by JOSEPH-CRONIN for correction of bilateral harelip nose. a Mobilization of the flap. b and c Flap sutured in the first stage. d Correction of the tip in the second stage and lengthening of the columella. The duplication of the flap is thereby smoothed

apparent lengthening of the columella. Scars occur here, as well, which should be avoided.

This old method corresponds in principle to a newer one which was described by CRONIN (1952) for reconstruction in lack of prominence of the nasal tip. By means of the inverted V-Y advancement, the skin slides down to the nasal tip and forms a duplication there. This is smoothed in a second sitting by letting the skin partially migrate farther onto the columella ("caterpillar flap") (Fig. 314). The technique of MOREL-FATIO is principally the same. It is done during only one step in bilateral harelip nose without endangering the nourishment of the flap. In the same sitting the angles of the lower lateral cartilages are rotated and sutured, while the lateral crura are resected.

A newer procedure by WIRTH (Fig. 315) is derived from the GENSOUL and LEXER method. It differs from the BROWN technique in that two lateral triangular flaps are made at the anterior dome instead of on the vestibular floor. With these two wing flaps WIRTH makes a similar Z-plasty at the dome of the



Figs. 315a and b. Lengthening the columella in bilateral harelip nose by WIRTH. a Formation of the flap for a Z-plasty on the dome of the vestibule. b Raising the arches of the lower lateral cartilages after lateral severing and fixation in this position with sutures which are tied in the vestibule; suturing the Z-plasty

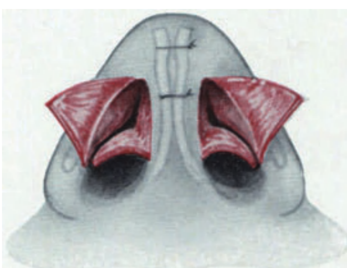


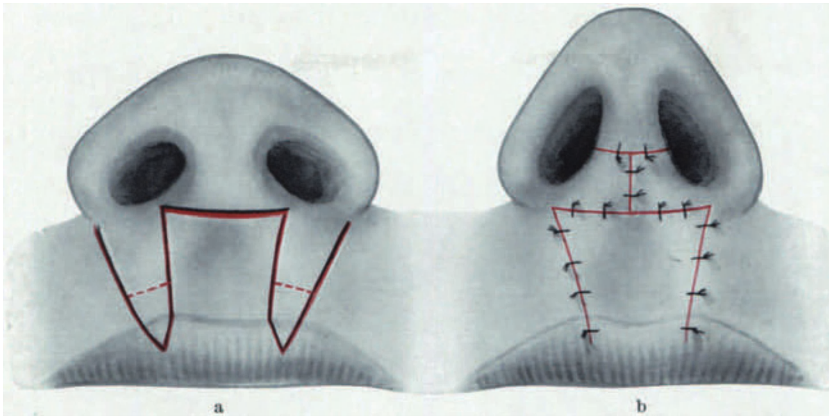
Fig. 316. Correction of bilateral harelip nose by STRAITH. Flap exchange at the dome of the vestibule. The cartilage arches are straightened after being severed laterally. Incisions as in Fig. 287

vestibule as has been seen in unilateral harelip noses as by STRAITH (see Fig. 287). WIRTH places the base of the external triangular flap medially, while STRAITH makes the base laterally on the ala. The bilateral Z-plasty at the angle of the nostril by WIRTH is also used in slight cases of short columella if a philtrum flap is not necessary. With these operations at the dome one can obtain a better shape of the nasal tip and a more acute angle anteriorly in the nostril. Using this technique one can hold the angles of the lower lateral cartilages together with sutures of wire or nylon — with or without lateral severing of the lateral crura for relief of tension.

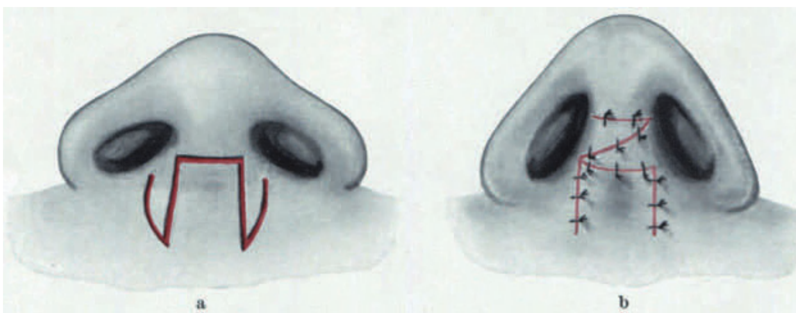
STRAITH uses the flap exchange at the dome of the nostril as mentioned earlier in unilateral as well as bilateral harelip noses (Fig. 316). His maneuver is combined with raising the angles of the cartilage after lateral severing and suturing them together in the tip (see p. 96). This way the nasal tip is raised considerably.

Further ways to lengthen the columella are the use of two lateral flaps from the upper lip. KAZANJIAN cuts two flaps pedicled above at the columella. These are extended toward the nostril and sutured in the middle. The resulting secondary defects are covered by median repositioning of the undermined alae. This way one avoids the occurrence of a third scar in the middle of the upper lip.

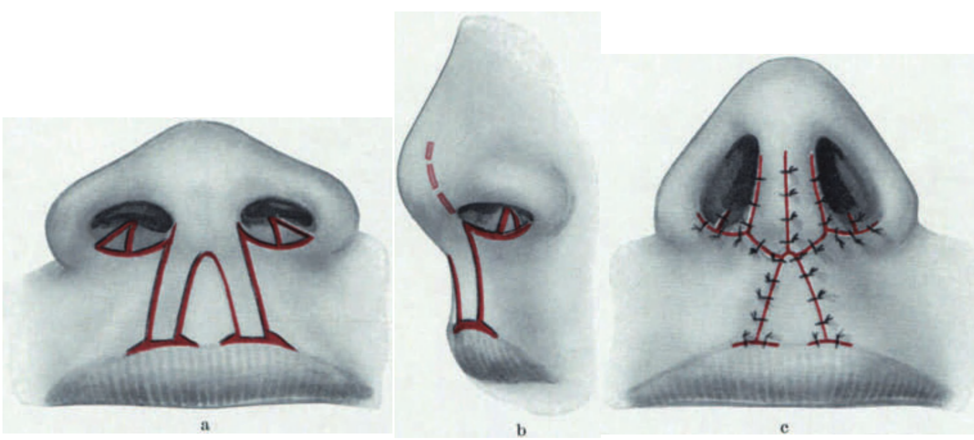
TRAUNER also cuts two vertical skin flaps from the region of the old scars in the closed cleft line. These are turned horizontally and sutured together in midline (Fig. 317). This is nothing other than the bilateral use of his flap exchange described already in unilateral harelip noses (see p. 229).



Figs. 317 a and b. Correction of bilateral harelip nose by means of lengthening the columella, according to TRAUNER. Bilateral rotation of a vertical flap from the upper lip. The tips of the flaps are resected (dotted lines)



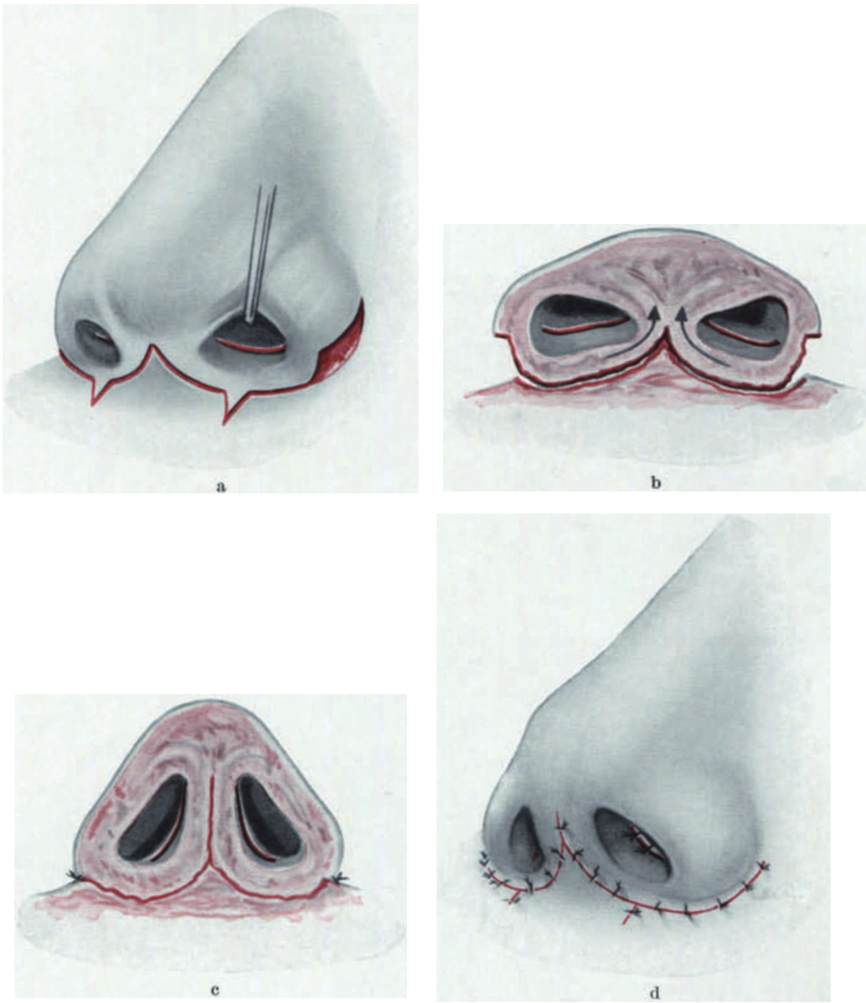
Figs. 318 a and b. Correction of bilateral harelip nose and similar malformations by means of lengthening the columella, according to MARCKS-MEYER



Figs. 319a—c. Correction of bilateral harelip nose by MILLARD and F. BURIAN. a Formation of a forked flap on the upper lip; excisions on the nasal floor for narrowing. b Side view of the incisions; the columella is undermined toward the tip. c Lengthening the columella by forward advancement of the forked flap; suturing the sites of excision on the nasal floor bilaterally for narrowing the nostrils and suturing the forked flap. Closure of donor sites on the upper lip

MARCKS and his colleagues (1957) proceed in a similar manner. But they place the two flaps which have been turned horizontally over each other (Fig. 318) so that a greater degree of lengthening is obtained in the columella. In 1956 we mentioned the same procedure for correcting a different nasal malformation (see p. 288).

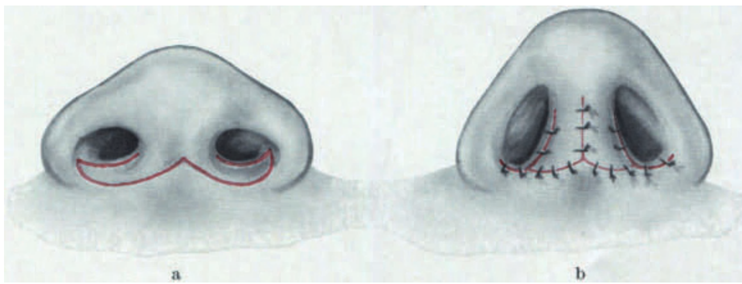
F. Burian and Millard also raise lateral flaps (a "forked flap") on either side of the philtrum, rather than one central philtrum flap. This leaves the shield-shaped philtrum intact, so that a better cosmetic result is obtained at the



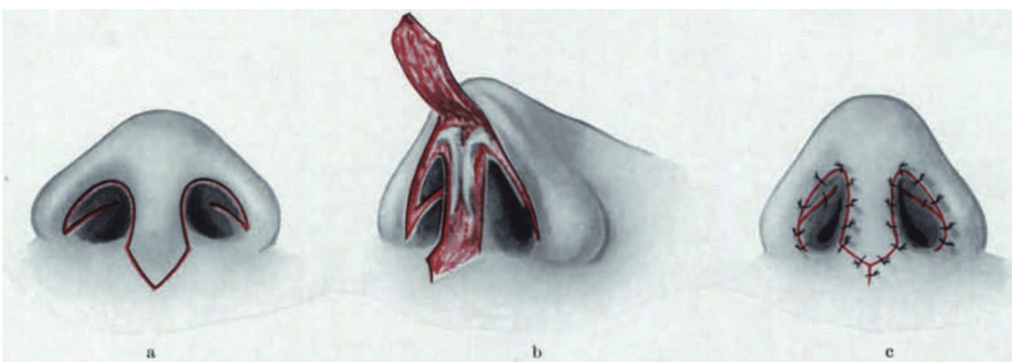
Figs. 320a—d. Correction of bilateral harelip nose by Cronin. a Formation of strip-like bridge flaps by means of undermining the vestibular floor. b Bridge flaps in cross-section; the arrows indicate the direction of rotation toward the nasal tip. c Situation after rotation of the flaps; columella lengthened. d Situation after completion

lip. The two skin flaps are not turned but are left in their longitudinal position, advanced forward in the manner of Gensoul and sutured as columellar skin (Fig. 319). The good cosmetic results of the Millard technique can be confirmed in our experience.

To lengthen the columella Cronin uses the skin of the vestibular floor bilaterally. He mobilizes it from the underlying tissue as two strip-like bridge flaps and rotates them onto the columella (Fig. 320). Thus the skin of the nasal vestibule is rotated bilaterally inward and upward as Sheehan did unilaterally, so that the skin from the nasal floor now lies on the newly created columella. The parallel incisions are slightly curved at the nostril. Anteriorly on the columella, an inverted V-Y advancement is made. Because of this a triangular piece of skin remains at the base of the columella. A small comma-shaped skin excision is made laterally at both alar attachments to facilitate rotation of the alar attachment inward. In the upper lip two paramedian triangle excisions complete this plastic operation. It is said that CARTER and CONVERSE, before CRONIN, advocated the use of skin from the nasal floor for lengthening the columella.



Figs. 321a and b. Raising a flat bilateral harelip nose, according to CRONIN. a Cutting the bilateral skin flaps on the vestibular floor. b Lengthening the columella by means of inward rotation of the two flaps



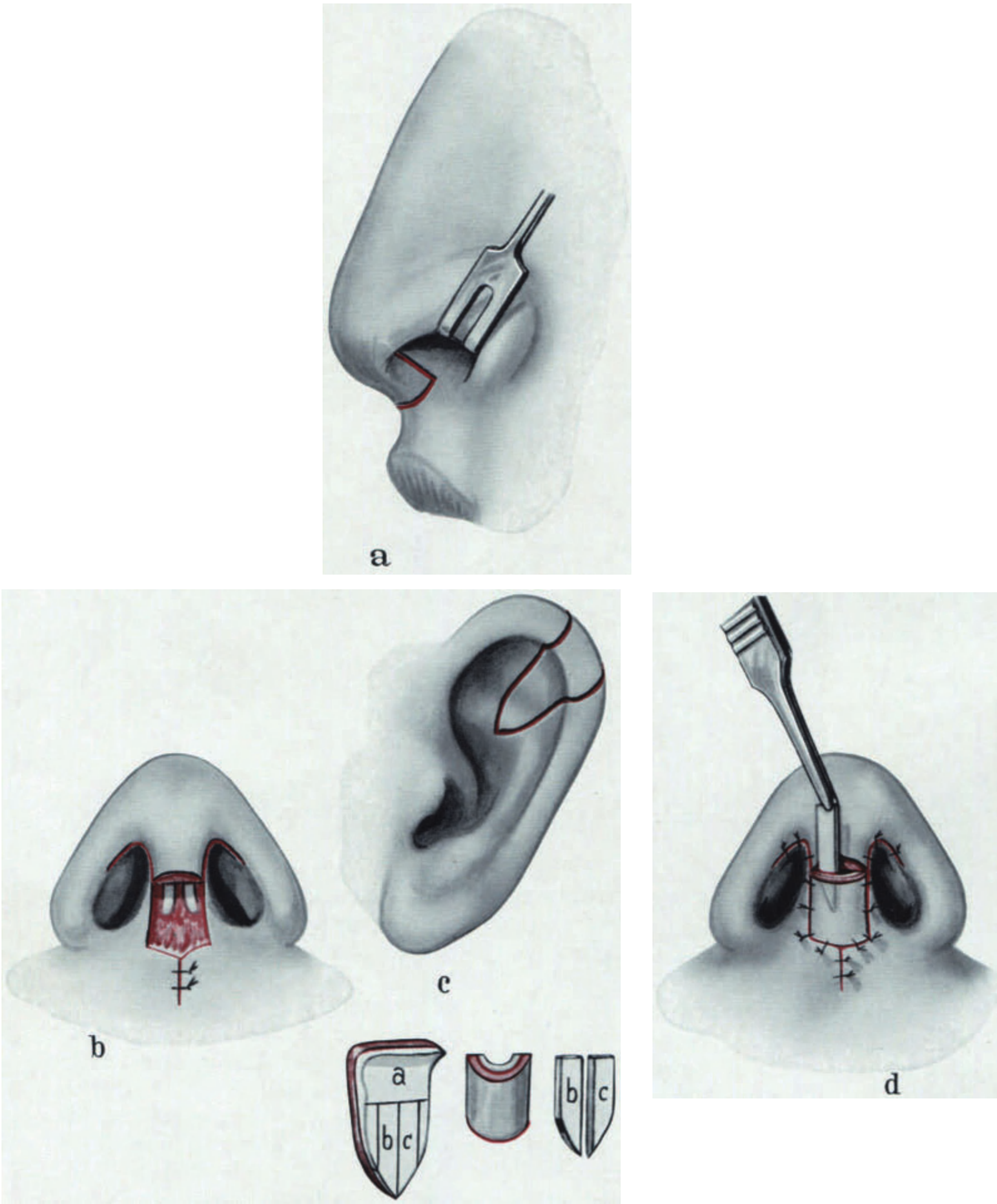
Figs. 322a—c. Correction of bilateral harelip nose by POTTER. a Cutting the philtrum-columella flap and the V-flap on the inner surface of both alae for the V-Y advancement. b Mobilization of the flaps. c Suturing the triple V-Y advancement

For slighter cases of short columella CRONIN uses the same technique. He makes the floor flap somewhat smaller, leaves it pedicled medially and does without the lateral relief excisions at the alar attachment and the upper lip (Fig. 321).

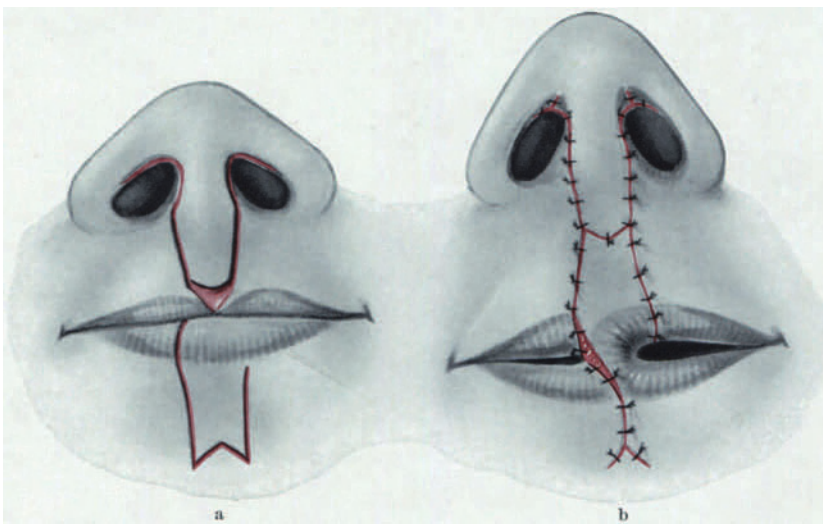
As an addition to the GENSOUL and LEXER method the POTTER procedure should be mentioned, which has been described for the unilateral operation (see p. 235). In its bilateral use, a philtrum flap is cut similarly and the incision laterally on the columella is extended into the nasal vestibule. A V-Y advancement is made on both lateral vestibular walls, which raises the entire vestibular vault. The lateral crus of the lower lateral cartilage is included in the V-Y advancement bilaterally (Fig. 322).

We have modified the bilateral technique of POTTER as we did the unilateral one (see p. 236). The membranous septum and the enclosed medial crura of the lower lateral cartilages are included in the columellar flap which is to be swung upward (Fig. 233).

We have already used composite auricular grafts, like those described below in alar and columellar defects (see p. 330), with good success in bilateral harelip noses for lengthening the columella. The composite graft procedure comes from Fritz Koenig and is promoted by Brown and his colleagues. It was first introduced into harelip surgery in 1944 by Pegram and Pelliciari. The proce-



Figs. 323 a—d. Correction of bilateral harelip nose by Meade. a Incision around the shortened columella. b Forward advancement of the columella and V-Y advancement on the philtrum. c Removal of a free-composite auricular graft; graft consists of skin and cartilage. The graft is divided into a larger piece with skin attached (a) which covers the defect on the columella; cartilage strips (b) and (c) without skin are used as reinforcing grafts in the columella. d Insertion of graft for reinforcement after partial suturing of the composite graft dure has the advantage of making no additional scars on the upper lip, but the disadvantage that the free graft does not "take". The graft consists of skin and cartilage from the auricle or only of skin from the ear lobe (MUSGRAVE). PEGRAM also obtains it from one alar attachment, but he also must shorten the other one by the same amount (see Fig. 155). MEADE considers free grafting of segments from the auricle to the columella particularly suitable for secondary corrections in children. He severs the short columella horizontally in the middle. He cuts around the anterior part and into the vestibule. He then pulls the columella far forward to immobilize it there with a suture on each side and finally closes the defect at the base of the columella with a composite graft. He uses two thin strips of cartilage from the ear as inner supports for the columella (Fig. 323).



Figs. 324a and b. Combination lengthening the columella according to GENSOUL-LEXER with the lip operation of ABBÉ-ESTLANDER. a Cutting the flaps. b Suturing the flaps (first stage of the ABBÉ-ESTLANDER operation)

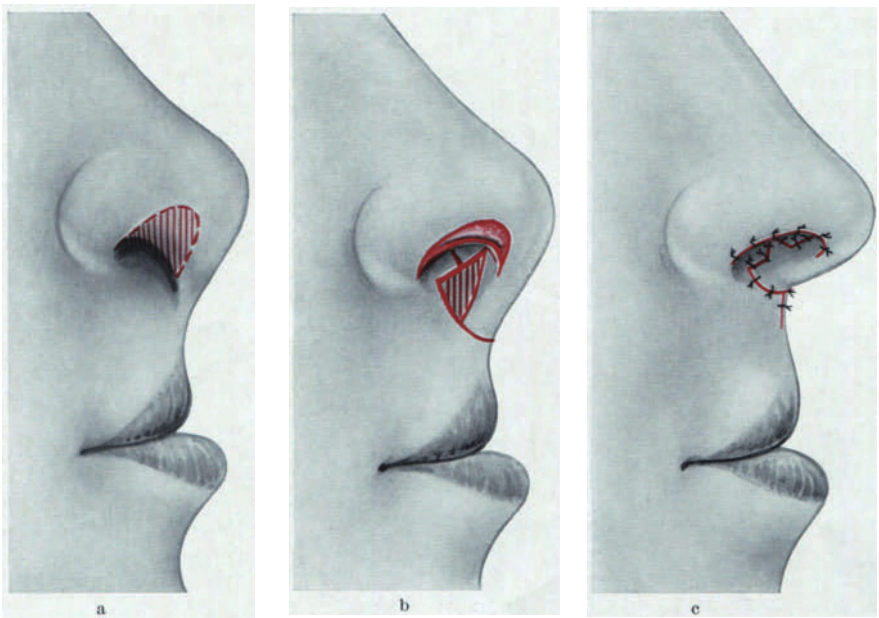
We do not consider this method reliable enough since the three free grafts lie next to each other and might be nourished poorly.

For lengthening the very short columella in bilateral harelip noses one can also use thin tubed pedicle flaps from the inner side of the upper arm (RAGNELL; see p. 319) or from the "snuffbox" of the hand (YOUNG; see p. 318).

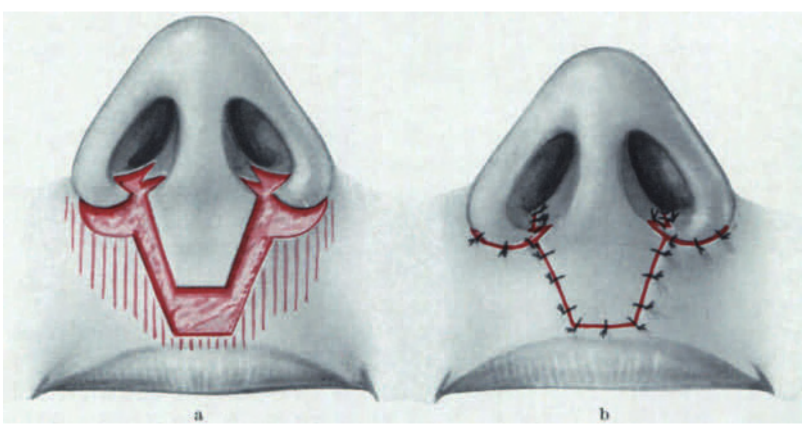
The sharp outward bend of the alae has been described above and gives the nose an *appearance "like the nose of a sheep"* (BROWN and MCDOWELL). As a rule we do not excise the bend as STRAITH does. Instead we flatten the ala by implantation of a strip of auricular cartilage as suggested by KLICPERA, HERFERT and others. In these cases we bilaterally sever the lower lateral cartilages laterally after the old method of STRAITH (Fig. 316), swing them into midline and suture them together with catgut. This makes the nasal tip more prominent. For the removal of folds and unevenness in the nasal vestibule, the same is valid as for the correction of unilateral harelip noses (see p. 237). Once the columella has been lengthened, the nose can be straightened with an L-shaped rib graft or with other implants (see p. 154). This can be done in a second sitting.

In some cases little material is present in the middle of the upper lip anyway and the profile is deformed due to receding chin (microgenia). The upper lip defect resulting from lengthening the columella must be covered by means of an

ABBÉ-ESTLANDER flap (see Vol. II) at the same time. Usually this procedure can be combined with lengthening the columella as by GENSOUL-LEXER (Fig. 324) or with the POTTER operation (see p. 247).



Figs. 325a—c. Correction of bilateral harelip nose with pronounced flattening of the tip and absence of columella (R. MEYER). a Red hatching shows excision in skin cartilage and vestibular skin. b Situation after excision on the ala. Red hatching shows excision through the membranous septum and severing of the columellar base. c Situation after completion



Figs. 326a and b. Narrowing the nasal base and upper lip and shortening the upper lip in bilateral harelip nose by RAGNELL. a Area of excision; red hatching shows area to be undermined. b Suturing the wound

This replacement plasty of ABBÉ-ESTLANDER on the upper lip is indicated much more frequently in bilateral than in unilateral harelip nose. If a large cicatricious area is present after the ABBÉ-ESTLANDER plasty on the upper lip, we excise the cicatricious area according to SCHMID and replace it with a free full-thickness skin graft.

Sometimes the columella can not be lengthened with philtrum skin as according to GENSOUL and LEXER, BROWN or MILLARD because of extensive cicatricious tissue on the upper lip. Then additional material is provided from the very wide nasal tip which is pulled downward. We (R. MEYER) obtain this best by means of an extended half-moon shaped excision of the external skin, the lower lateral cartilage and vestibular skin of the anterior dome of the nostril bilaterally. At the same time the base of the columella can be repositioned rearward by means of a triangular, perforating excision in the membranous septum (Fig. 325). Excisions at the anterior dome of the nostril can be made also in correction of alar asymmetries and additionally in the methods for correction of unilateral harelip noses mentioned above (MUSGRAVE, MILLARD, R. MEYER), but naturally not so extensively as in "sheep nose".

Today one rarely finds the anomaly of bilateral harelip nose, especially with overly wide alae, accompanying an ugly, long, retruded upper lip. These are effects of poor surgical technique in lip closure, as often seen formerly following HAGEDORN operations. Such cases can be improved not only by a forward repositioning of the upper lip by lining it with cartilage or bone, but also by narrowing the upper lip. RAGNELL has suggested skin excisions for this, which we have used with good success (Fig. 326).

XV. Surgical treatment of nasal atresias and stenoses

1. Correction of anterior nasal atresias and stenoses

Anterior atresia of the nose can be unilateral, bilateral, complete, or partial. There are all degrees of narrowing from complete atresia to slight stenosis. The atresia or stenosis can be located at the entrance to the nasal vestibule, in the interior of the nasal vestibule or in the transition from the vestibule to the nasal cavity. The first description of the anomaly dates from 1864 and appeared in English medical literature.

Both complete obstruction and partial obstruction can be congenital. The congenital form is very rare. It forms in the 6th fetal month. Up to this time the nostrils are closed with a plug of epithelium. When the plug persists, a membranous synechia or complete atresia occurs. A common form of this is angle synechia, which affects the lateral angle of the nostril (Fig. 327). The atresia can be coupled with other facial malformations, with cleft lip and palate, with other facial clefts, or with proboscis lateralis (see section on malformations). It can also be a part of the maxillo-facial malformations and is then allied with maxillary deformities such as prognathy and retrogeny in the PIERRE ROBIN syndrome. — More often one finds atresia after traumas, infections, or operations. Thus atresia and stenosis can be a result of ulcerous processes at the rims of the nostrils, e.g. after smallpox or after the healing of ulcerations due to lupus or syphilis. Cicatricious closure of the nostril can form after burns. As described in the chapter about correction of harelip noses, one also finds stenosis of high degree in the nostril of the cleft side after poor primary repair. The problem of eliminating these stenoses is difficult, especially since chronic inflammation exists in the nose in these cases. Therefore it seems essential not to construct the nasal floor too high in primary repair of complete unilateral or bilateral cleft lip and palate. Later it is much easier to raise than to lower it, i.e. to narrow rather than widen the nasal cavity and the vestibule.

Congenital bilateral complete obstruction requires immediate treatment, since it can lead to serious attacks of suffocation, which have sometimes been the unidentified cause of death. Temporary relief can be provided by incision and dilation. Later surgery should support the temporary result of the emergency measure. Because of exclusively oral breathing in non-congenital atresias, the bilateral obstruction leads to anosmia, rhinolalia clausa, headaches, descendent and recurring infections. Early surgery is important, especially when the atresia is encountered in children. One must wait with the plastic operation only in cases of cicatricious atresias due to tissue destruction in lupus. One should wait until the lupus can be regarded as healed. Surgery at too early a date can otherwise have unpleasant surprises as a result.

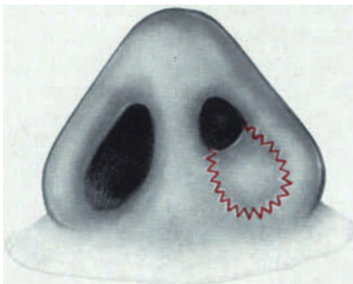


Fig. 327. Unilateral anterior angle stenosis. Red line shows limit of the future enlarged nostril. The skin in the region of the scar can be used for epithelization of the raw edges

The surgical procedure depends upon the location of the atresia or stenosis, on the thickness of the obstructing wall, and on the condition of the ala. If there is a small opening in the obstructing wall, the thickness of the wall can be determined easily with a hook or a probe. If such an opening is lacking, one must incise or drill through the obstructing membrane before the operation in order to determine its thickness and nature.

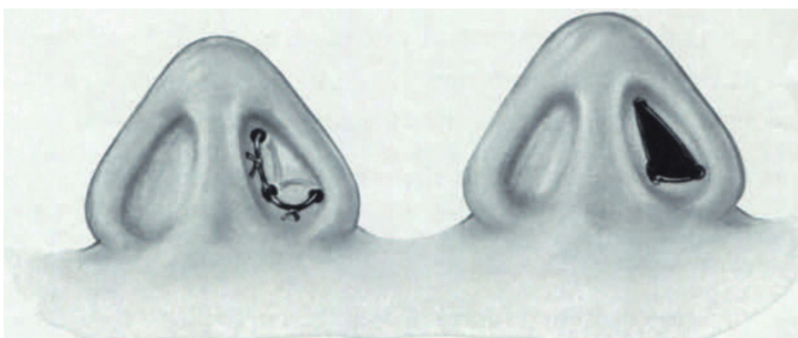
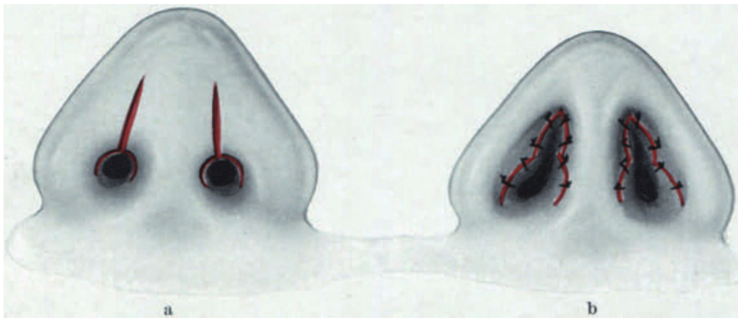


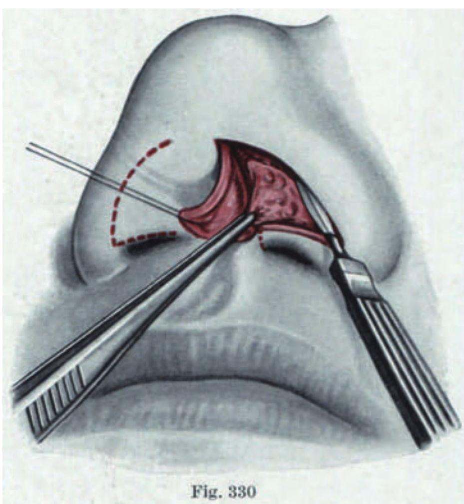
Fig. 328. Correction of anterior atresia of the nose by Lubet-Barbon. Application of knotted threads which cut through the membrane slowly due to their tension (obsolete)

The excision of the obstructing membrane is generally insufficient. The ring-like scar resulting from the excision will always show the tendency to form a cicatricious contraction and thus cause an occlusion again. Even excision of the membrane with a cautery does not suffice, although this method of cutting is said to result in slower formation of scar tissue. The resulting wound scar must be lined as completely as possible with mucosa or with external skin. An inadequate method, which has been abandoned, is that of Lubet-Barbon. In this a thin, non-stenotic scar was to be obtained at the point of removal. This was to be accomplished by applying threads which were tied externally and left in place for a certain time. They gradually cut through the membrane (Fig. 328). Lemoine cuts a laterally pedicled flap from the membrane. This flap is swung to the nasal floor and lateral vestibular wall and is immobilized at the alar attachment with a mattress suture. Dufourmentel, Sr. combines this method with a free retro-auricular full-thickness skin graft or a Thiersch graft on the inner surface of the ala. This skin graft is attached to the ala by means of through-and-through mattress sutures. This method as well is hardly used today. Bockstein forms two flaps from the funnel-shaped membrane. These are then positioned laterally. He covers the defect with a mucosal flap rotated from the inner side of the upper lip.

Smaller lateral angle stenoses or stenoses of the anterior dome can be incised simply as by FOMON and his colleagues. After excision of the scar, the posterior membrane is sometimes removed, and the anterior membrane placed inward against the wall and sutured (Fig. 329). The skin is held against the wall by means of packing.



Figs. 329a and b. Correction of anterior stenosis by means of vertical incisions (FOMON). a Incisions. b After excision of the scars, the epithelium in front of and behind the stenosis is sutured



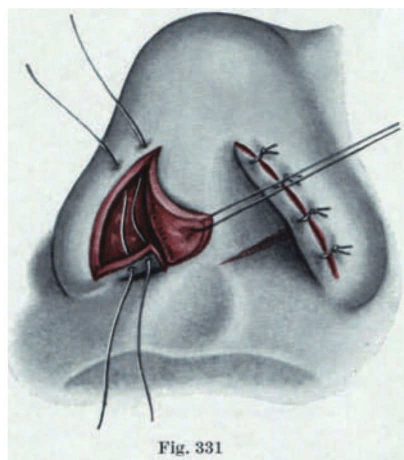
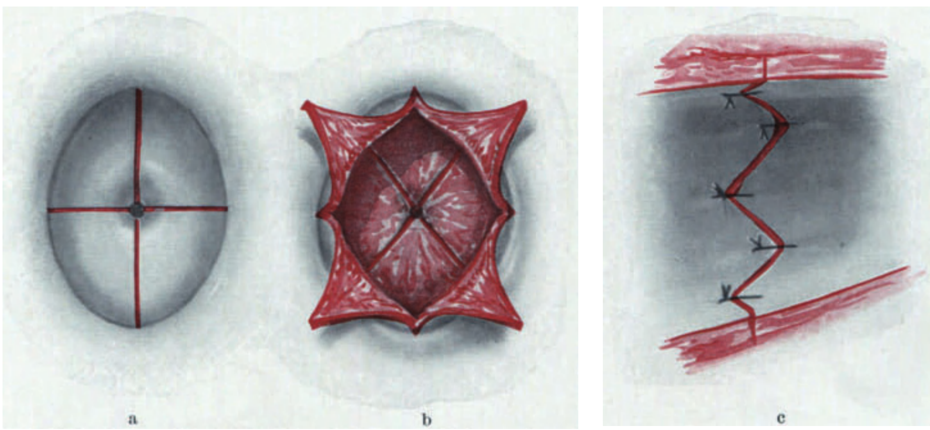


Fig. 330. Surgical enlargement of stenotic nostrils by JOSEPH. Right side of the nose: the dotted line shows the incision for formation of the first skin flap which is used to line the septum. Left side of the nose: the first skin flap has been cut and is swung outward. Surplus fat tissue in the region of the future nostril is excised. — The dotted red line shows the incision for formation of the second skin flap which is obtained from covering the stenotic nostril. This is used for inner lining of the ala. (From H. J. DENECKE)

Fig. 331. Surgical enlargement of stenotic nostrils by JOSEPH. Right side of the nose: the second skin flap is raised and is sutured as inner lining of the ala. The first skin flap is swung outward in this illustration to show the flap more clearly. Left side of the nose: the second skin flap is sutured, and the first skin flap has been swung inward to line the septum. (From H. J. DENECKE)

In *stenoses and atresias of the vestibular entrance* which are caused only by a thin membrane, the method of JOSEPH can be used advantageously. He forms a triangular skin flap on the atresia membrane in such a manner that the base is toward the septum and that the more anterior of the two incisions corresponds to the alar rim which is to be formed. A traction suture is passed through the skin flap at its apex, and the flap is lifted to facilitate the removal of the underlying connective tissue and fat. Because of this a second skin flap is formed from the posterior nasal surface of the membrane. This flap remains attached laterally and is pulled to the ala for lining of the lateral vestibular wall and is sutured there. The first triangular flap is used to line the septum and is swung inward. This old but still very usable corrective method can also be applied in complete nasal reconstruction. It can then be used for enlargement of the stenotic nostrils if a tubed pedicle flap was used for complete replacement. In such cases the nostril lies like a narrow slit under the thick end of the tubed pedicle flap. The nostril is then enlarged by turning the two thin skin flaps inward following extensive removal of fat and scar tissue. This way one obtains a thin ala (Figs. 330 and 331).

A similar procedure was proposed by CONVERSE for elimination of atresias and stenoses at the transition from the vestibule to the nasal cavity. But he leaves the anterior triangular flap, which is of vestibular skin, attached laterally



Figs. 332a—c. General technique in atresias according to STRAITH. a Vertical cross incision in the anterior membrane of the atresia. b Mobilization of the four flaps of the anterior membrane; oblique cross incision in the posterior membrane set at 45° to the one in the anterior membrane. Suturing the zig-zag line where the flaps lie adjacent to each other

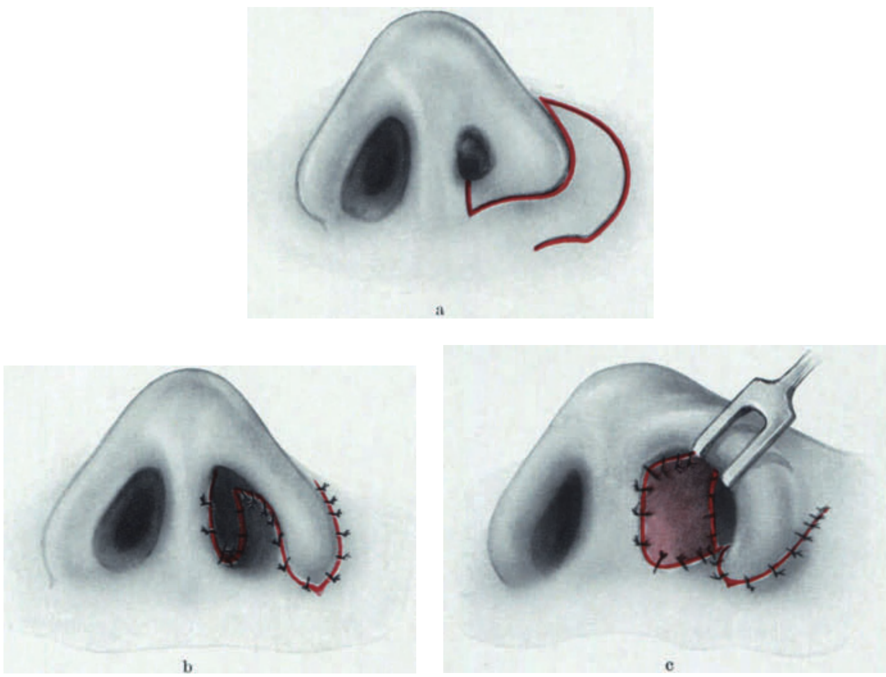
and folds it inward onto the lateral wall of the nasal cavity. The medially attached triangular flap made of the posterior surface of the membrane, which is usually covered with mucosa, is swung forward onto the septum.

For the correction of inner atresias or annular stricture of the nasal vestibule *at the transition from the vestibule to the nasal cavity*, the method of STRAITH has also proved useful in our experience. It is suitable for the correction of all membranous stenoses and atresias, also for those in the auditory passage. A vertical cross incision is made in the anterior membrane and an oblique cross incision in the posterior one. Thus four flaps are formed from the anterior membrane which are swung rearward. Then the four flaps of the posterior membrane are swung forward. The eight flaps come into an approximately congruent position and are thus pressed against the wall. If necessary and if possible they are sutured and held tight with packing (Fig. 332). — Small lateral membranes on the ala or cicatricious synechias can usually be eliminated by means of a Z-plasty.

In case of slight *narrowing of the nostril*, one can also use the method of JOSEPH for enlarging the nostrils which has already been discussed (see p. 109 and 237). One obtains the enlargement of the nostril by means of a flap swung inward from the skin area located lateral to the alar attachment.

One can enlarge upon this technique and make a flap exchange at the ala in case of almost complete atresia (R. MEYER). A flap from the paranasal region is used to line the interior alar defect and the nasal floor in the vestibule, and a free skin graft completes the lining of the vestibule on the columella-septum wall (Fig. 333). Another procedure was described by us (R. MEYER) in 1959 for correction of pronounced unilateral stenosis in harelip nose. A skin flap is swung from the sound nostril, if this nostril is large enough, into the stenotic nasal vestibule (Fig. 301). A somewhat more complicated method comes from MOERS and was likewise described in the chapter on harelip nose (see Fig. 304).

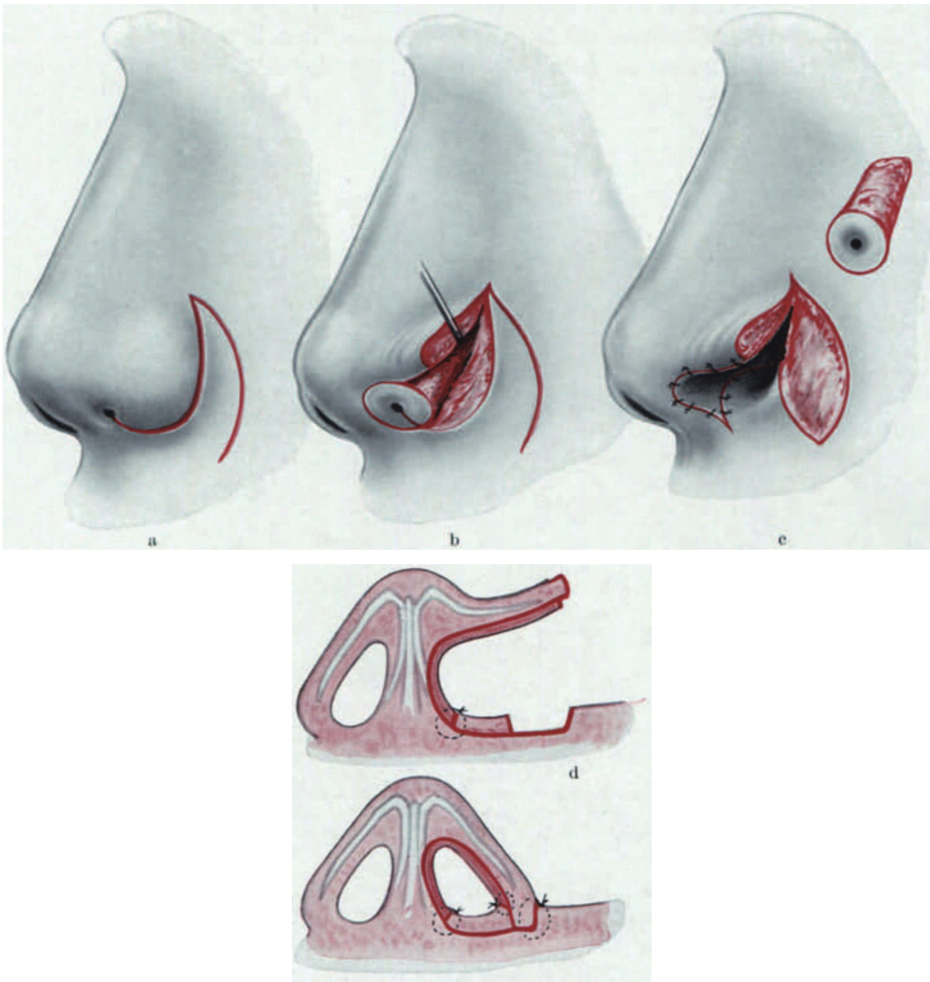
To eliminate anterior atresia, a lateral transposition flap is swung onto the nasal floor following removal of the atretic passage as by DUFOURMENTEL and



Figs. 333a—c. Correction of an almost complete vestibular atresia by R. MEYER. a Incision. b The transposition flap is swung onto the vestibular floor. The remaining raw area on the columella and septum is covered with a free skin graft. c Oblique view of the vestibule and the sutured graft

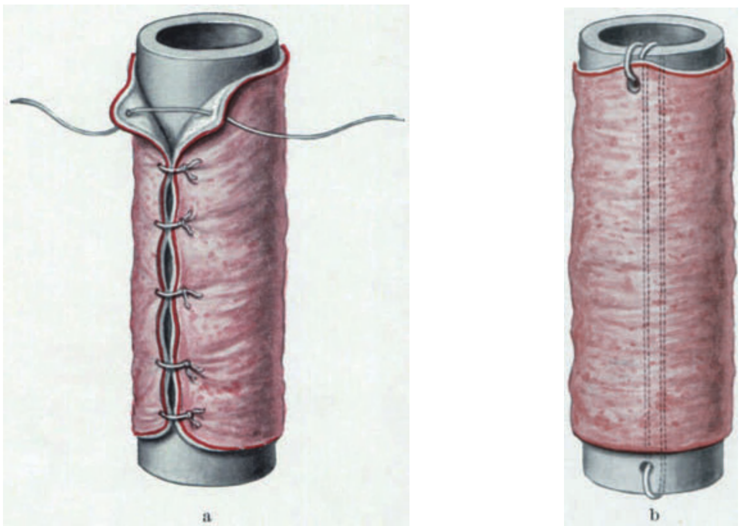
MOULY. The lining of the nasal vestibule in the region of the columella and ala is made with a free full-thickness skin graft (Fig. 334).

If the *atresia extends farther inward*, the scars are excised and skin grafts of varying thickness are applied. A new lining must be provided for the vestibule using free skin grafts. After excision of cicatricious tissue in cases of cicatricious closure of the nostril due to congenital lues, VOGEL places an epidermis graft in the nostril. The graft is immobilized by means of a rubber finger packed with gauze. The same procedure was also used by ESSER (also quoted from BACH). JOSEPH likewise used a THIERSCH graft and fastened it to a rubber tube by means of sutures for insertion into the vestibule and the nasal cavity. The tube should be as soft as possible to avoid pressure necroses (Figs. 335 and 336). The well-fitting THIERSCH graft is sutured tightly at one end of the rubber tube so that it does not slip from the tube while being inserted into the nostril. The raw surface of the graft is on the outside. To keep the tube from sliding from the nose it is sutured or held in place with adhesive tape. After 8 to 10 days the fixation sutures are cut, and the tube is removed. This method was also described by BLAIR and by O'CONNOR. It was also described by BARSKY who uses an intermediate thickness graft and sutures it at the borders. It is also used by CONVERSE and GALTIER, who likewise use a graft of intermediate thickness, by MAY, who uses a thick THIERSCH graft, and by SELTZER. All of these authors wrap the skin to be grafted around a stent mold instead of a rubber tube. The



Figs. 334a—e. Elimination of anterior atresia by DUFOURMENTEL and MOULY. a Formation of a lateral transposition flap. b Removal of the passage closed by atresia. c Transposition flap is sutured on the nasal floor. The medial wall of the vestibule and the inner surface of the ala are covered with a free full-thickness skin graft. d and e Cross-section of sutured flaps. The lateral border of the ala is sutured lateral to the transposition flap

mold is pressed into the cavity to be lined in a warm, soft condition to give it the right shape. GALTIER inserted a rubber tube into a hole made through the mold to permit nasal breathing. The skin graft has taken hold after about one week. CONVERSE removes the stent mold after 4 to 5 days and replaces it with an acrylic plug which has been made in the same shape. This is kept in the nasal vestibule for about 1 month. BARSKY replaces the mold after 7 days with a plug of latex, rubber, or guttapercha (stereoisomer polyisoprene). After a few more days the second plug is removed and the cavity is packed daily for about 6 months. SELTZER also proceeds similarly, but he does not use packing for such a long time. The mold is fixed either with adhesive tape or is fastened to a dental prosthesis by means of a wire. In such cases, which are actually very rare, we likewise use a dental stent mold with an 0.25 mm thick dermatome graft. We are careful to exaggerate the enlargement of the nostril, to over-correct it, since one must



Figs. 335a and b. Insertion of THIERSCH grafts in nostrils closed by atresia, according to JOSEPH. A THIERSCH graft with its raw surface outward is fastened to a rubber tube so that it is practically immobile. a Suturing the THIERSCH graft. b The THIERSCH graft is sutured to the upper end of the tube so that it does not slip off the tube while being inserted into the nostril. (From KLEINSCHMIDT)

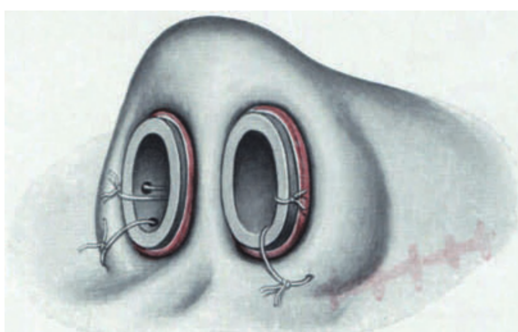
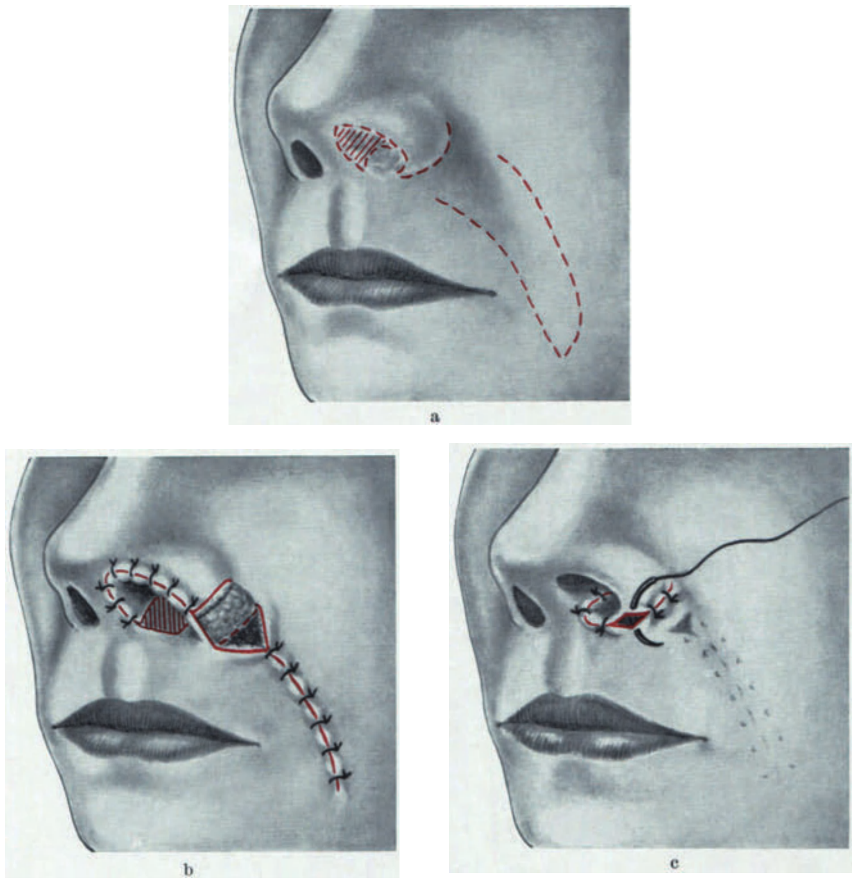


Fig. 336. Insertion of THIERSBH grafts in nostrils with atresia, according to JOSEPH. The tubes covered with THIERSCH grafts are inserted into the surgically enlarged nostrils. (From KLEINSCHMIDT)

count on a certain shrinkage even with very good adaptation of the graft. In order not to disturb the healing of the free graft, we advise against changing the plug before one week has elapsed. — Some authors also suggest using acrylic material as a pliable mass (DOWD, KYANDSKY).

RÉTHI published five original procedures for the treatment of stenoses and atresias of the nostril. In his first type for *cicatricious atresias in the nasal vestibule* he lines the entire vestibule after excision of the scar. He cuts a pedicled flap from the nasolabial sulcus. This is swung under the separated alar attachment into the vestibule and sutured. At the beginning the scars on the nasal floor are not removed. The raw surfaces on the interior of the ala and on the membranous septum are first covered with the skin flap. The subcutaneous layer of fat is left thin at the end of the flap and thicker at the base of the flap. The donor site is closed by means of approximation. The sutured flap is now left pedicled laterally and is severed from the pedicle after $3^1/_2$ to 4 weeks. Only then is the remaining scar on the vestibular floor removed down to the bone. The



Figs. 337a—c. Opening a cicatricious atresia in the region of the vestibule by Réthi. a Position of the nasolabial flap; dotted red line shows incision; red hatching shows the raw area in the vestibule. b Scar excised and nasolabial flap transferred to the raw surface in the vestibule; also illustrated is the part of the base which will later be swung onto the raw surface indicated by red hatching. c The remaining cicatricious area on the nasal floor is excised, the base of the flap is swung onto this, and the alar attachment is finally sutured

basal end of the flap which has healed onto the ala is then rotated with its raw surface onto the prepared nasal floor. This closes the ring of skin in the vestibule by being sutured congruently to the other end of the flap at the base of the septum. The external skin on the nasal attachment is likewise sutured in place. The donor area of the pedicle of the flap is closed by approximation (Fig. 337).

In some cases due to trauma, a *synechia of the ala with the septum* and destruction of the lateral end of the ala have taken place. In such cases the second procedure of Réthi can be used. The same nasolabial flap as in the first type is swung onto the inner surface of the laterally separated alar attachment and sutured. But in a second sitting it is to be adjusted so that it also covers the external defect of the lateral third of the ala. After three weeks the flap has fused with the ala and its vascularization is assured. Now the scars on the vestibular floor are also removed. The nasolabial flap is severed so that the new defect on the vestibular floor can be lined with it. Thus the interior of the defective ala as well as the floor of the vestibule are covered with skin. The external alar defect is covered with the remaining stump of the nasolabial flap. To do this one folds the end of the stump over and joins it to the skin of the cheek at the alar attachment. The edge of the stump which has been folded over is also sutured. After 3 more weeks this part of the ala has healed, and the stump of the flap which has been folded over can be severed at the level of the defect and replaced on its site. Now the scars on the septum are removed. A transfixion incision is made behind the columella. The lower, i.e. columellar side of the transfixion incision is sutured with the vestibular skin of the normal side. One thereby obtains a columellar strut which is covered with skin on all sides and behind this a defect in the membranous septum. To obtain sufficient covering of the strut more mucosa from the septum should be included on the normal side. — We consider the formation of an anterior and certainly disturbing septum perforation in such a correction of atresia to be unnecessary, since various methods of skin grafting are applicable for closure of the septal defect.

RÉTHI proceeds in quite another manner in cases of *thinner obstructing membranes in the nostril.* His incision is made in the anterior third of the columella and extended to both sides at the rim of the vestibule parallel to the edge of the ala. He then swings the skin of the nasal tip upward and elevates (undermines) the skin of the nasal tip from the lower lateral cartilages at their anterior angle using a scissors. The cicatricious plate is then excised together with a strip on the caudal border of the lower lateral cartilage and a strip of the medial wall of the septum and the vestibular floor. If the excised membrane is thin and the strip of wall also removed is narrow, the borders of the skin in the vestibule can be joined on all sides by means of several button sutures. On the other hand, if the width of the excision does not make this possible, here too, as in the last method of RÉTHI, the columella must be separated from the cartilaginous septum by means of transfixion and enclosed within the mucosa and skin of the normal vestibule on the inner side. To do this the epithelium of the septum on the normal side must be incised farther back, as in type 3, so that it is sufficient for covering the raw surface on the inner side of the columella. Thus a small septum perforation again occurs as in the method last described. The objections mentioned above apply to this procedure as well.

The fourth RÉTHI method is used in thick obstructing scars. After removal of the cicatricious mass a wide circular wound is left in the nasal vestibule which must be covered. To do this two mucosa flaps from the septum must be used. A rectangular hole is made in the septum since septal cartilage must be removed. The mucosa flap on the side with the atresia is pedicled at the nasal floor and is used to cover the lateral part of the circular wound ring on the ala. The other epithelium flap is swung through the hole from the normal side of the septum into the vestibule of the side with the atresia and reaches the anterior medial part of the circular wound. Finally the remaining scar on the vestibular floor is removed and replaced with a pedicled mucosa flap from the upper lip or from the mouth. After the suggestion of BOCKSTEIN, RÉTHI considers it practical to remove the bony threshold at the base of the nostril, the caudal border of the piriform aperture, so that the vestibule can be enlarged even more.

We consider this fourth method too complicated and, with regard to the septum, too destructive. In any case we would not sacrifice so much of the septum when it is not really necessary, and put up with an anterior septum perforation with subsequent crust formation, whistling and other possible functional disturbances. In such cases we prefer a *free graft of mucosa from the cheek or of retroauricular skin* for lining the interior surface of the ala. In some circumstances the oral mucosa can be grafted with a pedicle by means of tunnelling under the vestibular floor. In some cases we have even had to cover an almost complete circular wound with a free graft. Strong over-correction of the width of the nasal vestibule to be lined is of great importance here as well, since one must count on shrinkage, as already mentioned in the treatment with THIERSCH grafts. The free grafts of full-thickness skin, dermatome skin of intermediate thickness, or oral mucosa naturally do not "take" with 100% certainty. But we have never experienced complete loss of the graft, but at most only partial loss. Thus it is sometimes necessary to continue the replacement of skin at a later sitting. We feel it important that the graft is sutured meticulously with many nylon button sutures and held against the walls by packing with petrolatum gauze. Before packing we cover the graft with aureomycin ointment gauze.

RÉTHI proposes his fifth method of correction of atresia for cases in which the *atresia is accompanied by more pronounced destruction of the nasal tip and columella.* He grafts a thick pedicled flap from the nasolabial fold onto the columella and severs the pedicle in a later sitting. The flap is swung onto the nasal tip, enabling him to cover the wound surface of the area of atresia as well. Such procedures are also recommended by other authors (MAY) for cases of greater destruction. They will be described later in the chapter on reconstructive rhinoplasty (see p. 312).

In closing, an additional technique by DOUGLAS should be mentioned. It is suitable for very extensive enlargement of the obstructed nasal vestibule in some cases. Just as the above mentioned removal of the basal threshold on the piriform aperture was recommended by BOCKSTEIN, DOUGLAS uses a chisel or a bone forceps to remove a half-moon-shaped section of the piriform crest. By this means the nostril is enlarged considerably at least with regard to the bony limitation. This bone removal has also been described in the chapter on narrow nose (see p. 76).

2. Correction of choanal atresia

Congenital choanal atresia is a rare affliction. It is found bilaterally, but usually unilaterally. In a few cases it is membranous, in 90% it is bony. One differentiates between complete and partial bony atresias.

The first description of a bilateral choanal atresia goes back to the year 1829. It was an observation by OTTO in an autopsy. Further cases were published in 1905 by ZARNIKO.

Choanal atresia is the result of abnormal embroyologic development. In the opinion of various authors the naso-buccal membrane is invaginated into the nose as a blind sac during the formation of the nasal cavity, while the bucco-pharyngeal membrane forms a sac in the choanal area from behind. These two invaginations rupture at their point of contact so that a continuous passage is formed. Choanal atresia occurs with the persistance of these two membranes and a mesoderm layer between. The bone is supposed to be formed later from the mesodermal part. — Now and then congenital choanal atresia is coupled with other anomalies like facial asymmetries, absence of the malar processes, double tragus, iris coloboma and cleft palate. In 1947 SHEARER described five cases which strangely were all combined with cleft lip and palate. The FRANCESCHETTI-ZWAHLEN syndrome or the TREACHER-COLLINS syndrome also occur in combination with choanal atresia according to McNeill and his colleagues. — But there are also acquired forms of choanal atresia.

With regard to the exact location of the atresia in the choanae, there are also two forms. One of them, which is always membranous, is located far back at the edge of the soft palate. The second, more frequent, almost always bony atresia occurs somewhat more anteriorly at the transition from the bony to the soft palate. Choanal atresia is present more often on the right side than on the left. It occurs more often in females than in males.

Unilateral choanal atresia is suspected in infants with unusual breathing difficulty during breast feeding or with continuous nasal discharge from one side. Rhinitis is practically always present. By alternately holding one nostril closed the diagnosis can be made clinically. In infants one probes the nose. If the tip of the probe does not extend into the nasopharynx, but one senses an

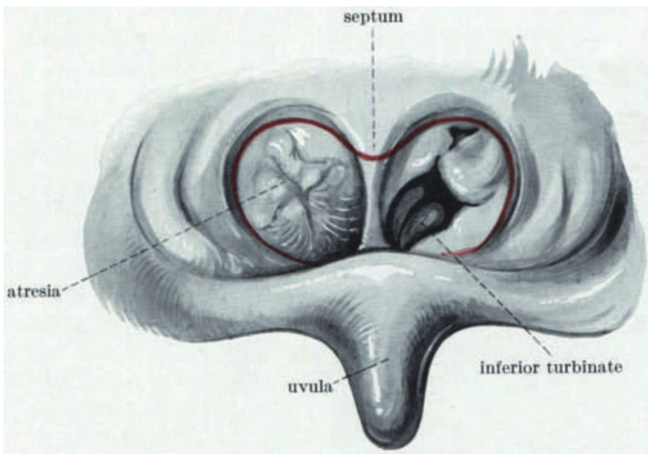


Fig. 338. Surgical removal of choanal atresia. Red line indicates region in which the atresia plates must be removed. (From Lautenschläger)

impregnable resistance at the appropriate depth, there is choanal atresia. In adults posterior rhinoscopy can give a clue to the position and nature of the atresia membrane.

For certain diagnosis and accurate localisation of the atresia one can also use contrast demonstration of the nasal cavity. One lets a contrast medium flow into the nose of the reclining patient. In the positive case one recognizes the stop in the choanal area on the X-ray. Iodized oil such as Lipiodol, Ioduron, etc. can be used for this. One treats choanal atresia as early as possible since it causes considerable obstruction of nasal breathing for the patient, even if it is only unilateral.

In the newborn, bilateral choanal atresia causes a serious obstruction in breathing which sometimes can make emergency surgery necessary. Often it is not recognized as the cause of an asphyxia in the newborn. Many infants close the mouth even more tightly than normal as a reflex action in case of obstructed nasal breathing. In a newborn child which has died of asphyxia an autopsy usually reveals atelecstasis of the lungs, while choanal atresia remains unnoticed. Recurrent cyanosis and dysphagia, asphyxia symptoms while breast or bottle feeding indicate the existence of bilateral choanal atresia. The surgical treatment of membranous and bony bilateral choanal atresia must be undertaken as soon as possible, or sometimes with preliminary tracheotomy. As far as we know, the elimination of bilateral choanal atresia is done in infancy, if not as an emergency measure, by all authors with the exception of CINELLI. We feel that unilateral choanal atresias should be treated at the age of 5 months at the earliest. CINELLI suggests delaying the operation 2 years by means of painstaking care. Various authors recommend waiting a few years. BEINFIELD even advises postponing the correction of unilateral atresia with adequate nasal breathing until the age of 16.

If the operation is done on an infant, after BEINFIELD, the membranous closure should be pierced with a stiffened catheter or incised with a scalpel guided by one finger placed in the nasopharynx. Bony atresias are perforated by means of a sharp curette, and the opening enlarged by means of twisting motions. In this way the pharyngeal mucous membrane can be pressed uninjured against the pharynx wall. Then it must be severed, again under guidance of the fingers, and swung over the rim of the new bony opening.

We recommend the use of the perforating burr for boring through the medial wall in maxillary sinus surgery. After introducing a small pledget into the nasopharynx the choanae are penetrated bilaterally with the perforating burr and the holes enlarged with an appropriately thin punch.

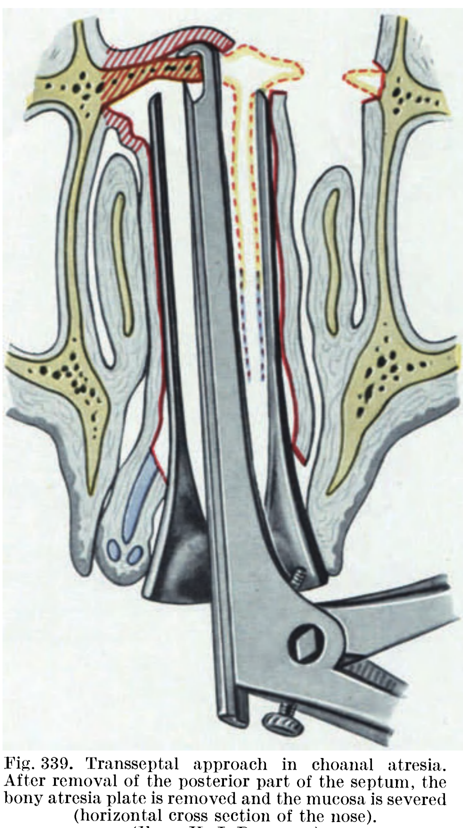


Fig. 339. Transseptal approach in choanal atresia. After removal of the posterior part of the septum, the bony atresia plate is removed and the mucosa is severed (horizontal cross section of the nose). (From H. J. DENECKE)

Other authors, as is described below, have later used the trans-palatal approach for surgery of bilateral choanal atresia in infants.

Among others, SIEBENMANN, VON EICKEN, UFFENORDE and SCANES-SPICER have distinguished themselves with working out the surgical methods. Four approaches are recognized today: transseptal, transantral, transnasal and transpalatal.

a) Transseptal approach

The *transseptal approach* was recommended by UFFENORDE and VON EICKEN. In this method the submucous septum resection is done with a standard technique. The vomer is resected as far as the choanal region. Then the mucosa in front and behind the atresia wall is separated and the bone between is removed with a chisel and punch. One chisels a hole medially in the bony plate. This is enlarged with the punch or chisel laterally until the choana is of adequate size. Now one severs the mucous membranes bilaterally working from the nasal cavity by means of a vertical incision, and the disturbing mucosa borders are removed. As a rule passage through the choanae is thus guaranteed. The above horizontal cross-section illustrates the method (Fig. 339). J. HEERMANN recommends additional resection of the floor and the lower anterior wall of the sphenoid sinus for even greater enlargement of the choana.

b) Transantral approach

The *transantral approach* was recommended by WRIGHT, SHAMBAUGH, GREEN, VOGEL and others. In this one opens the maxillary sinus from the oral vestibule as by CALDWELL-LUC. Then posteriorly and below on the medial wall of the maxillary sinus a window is made through to the lower nasal passage. The posterior end of the inferior turbinate as well as the posterior part of the septum is resected to extend the approach to the atresia. In doing this one must make sure that one does not penetrate the neighboring sphenopalatine groove. If one can view the posterior portion of the nose, one removes the bone which forms the atresia plate with the chisel, working from the maxillary sinus. Bleeding from the A. palatina is to be avoided, if possible.

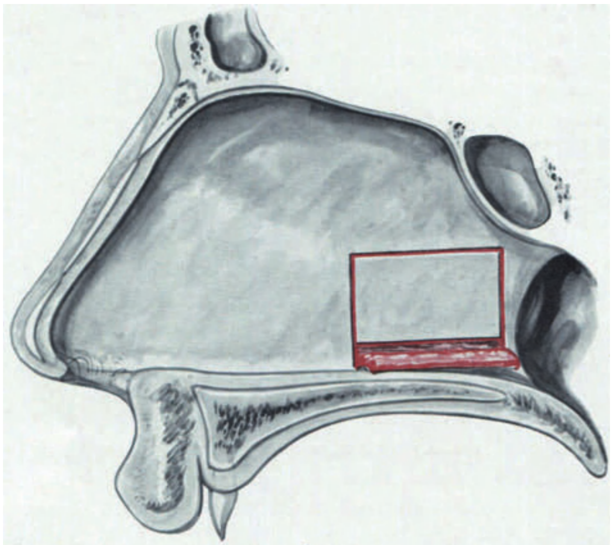
c) Transnasal approach

RÉTHI chooses a partially endonasal and partially transseptal approach (Fig. 340). In case of unilateral atresia he makes a horizontal mucosa incision on the normal side from the posterior border of the septum to the posterior limit of the middle third of the septum. This incision is 1 cm above and parallel to the nasal floor.

A mucosa strip is elevated and raised and swung downward onto the nasal floor after an additional vertical incision in front and in back. The posterior vertical mucosa incision is extended upward so far that it reaches the upper limit of the choana. Now the base of the septum which has been denuded of mucosa is severed with a wide straight chisel. Then one chisels through the septum along the upper mucosa incision, parallel to the base, and through the vomer plate as well, along the vertical incision on the border between the posterior and middle third of the septum. Using a forceps the bony plate can be removed carefully in one piece after one has vertically severed the septum posteriorly about 1 cm from its border. One must be sure not to injure the mucosa of the atresia plate. The septal mucosa on the atresia side must be severed at the border of the atresia plate. The obstructing plate can be seen through the window in the septum. A lateral flap and a lower flap are formed from the mucosa of the atresia plate. After separation of the mucosa the bony atresia wall can be removed with the posterior end of the vomer. The new choana is formed with the chisel. The lateral and lower mucosa flaps are swung rearward and cover the edge of the bone removal. The basal mucosa strip from the septum is likewise replaced medially and covers the threshold between the left and right nasal cavity. The mucosa flaps can be immobilized by means of packing.

The transnasal approach for surgical removal of choanal atresia in infants and small children as an early operation was mentioned above. LEMOINE likewise recommends this method in infancy. He removes the bony plate with an electric fraise.

BEINFIELD chooses the transnasal approach for the operation in adults as well. In the first step of this operation the inferior turbinate is luxated upward. By means of a U-shaped incision on the nasal floor and bilaterally to the atresia wall, he raises a mucosa flap which can be lifted up from below. After swinging this flap upward he removes the bony wall by means of concave chisels and makes a round hole in the mucosa of the epipharynx. The mucosa flap which is swung upward also includes mucosa strips from the septum side and from the lateral nasal wall as far as the attachment of the inferior turbinate. This flap is rotated back into place and covers the newly formed choanal aperture. An appropriately large window is cut in the flap, so that the borders of both mucosa perforations lie on each other and cover the bony border. In doing this it is important that the flap is made large enough and extends forward far enough especially on the nasal floor. Thus it forms the covering of the bony borders like a frame without pulling.



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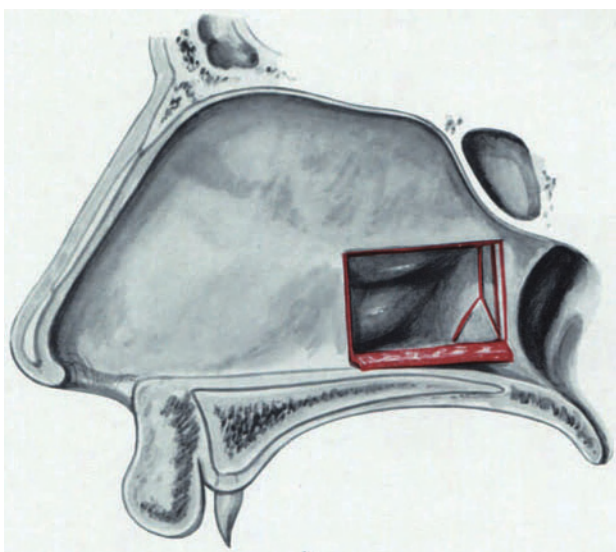


b

Figs. 340a—c. Removal of unilateral choanal atresia by Réthi. a Incision of an area in the mucosa of the posterior part of the septum to form a window. b Formation of a flap on the floor; resection of the bony part of the septum and incision of the nasal mucosa on the atresia wall

According to Blegvad the method of Beinfield is the best method for elimination of the atresia if it is combined with removal of the posterior part of the vomer. This makes the difficult immobilization of the two borders of the mucosa perforation is unnecessary, at least on the medial side. As early as

1921 JAQUES had also recognized this and recommended extended resection of the posterior part of the vomer. Other proponents of the endonasal method are CALICETI, UFFENORDE and LEMARIEY.

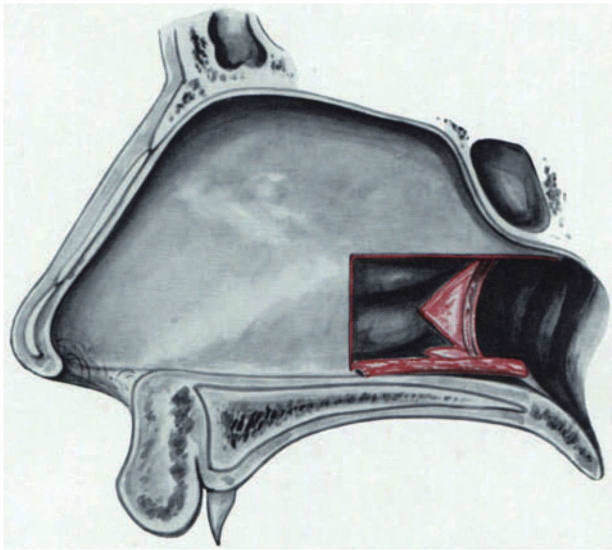


Fig. 340c. Situation after resection of the bony atresia wall including the pharyngeal mucosa and posterior edge of the vomer. The nasal mucosa flaps which have been formed cover the resulting raw surfaces. Of the three nasal mucosa flaps the medial one is removed with the atresia wall

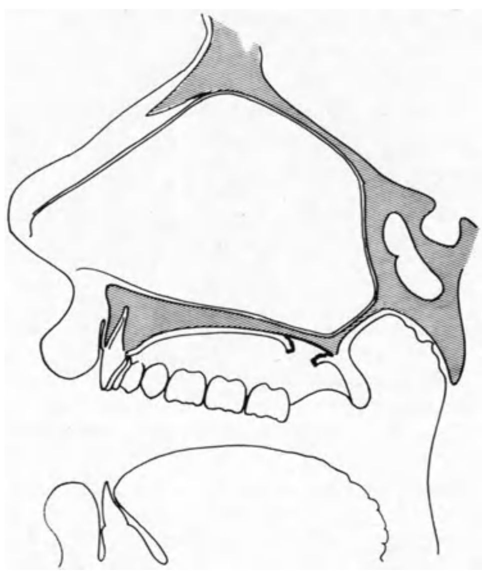
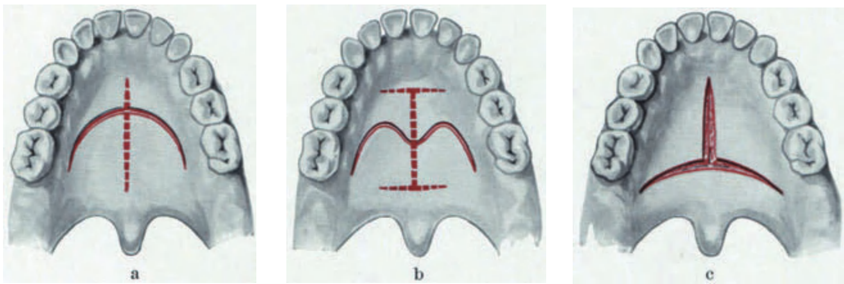


Fig. 341. Transpalatal approach for elimination of choanal atresia (side view)

d) Transpalatal approach

The transpalatal approach (Fig. 341) is probably used most today. SCHWECKENDIECK, SHEEHAN, SWANKER and RUDDY have indicated this approach. HANCKEL, DOLOWITZ and HOLLEY, ABOULKER, BAUDEQUIN, BLAIR, STEINZEUG, WALKER, Wilson, McGovern and Albrecht have worked on it further. We consider the transpalatal method the most certain and use it in infants after the 5th month as well as in small children and adults.

Various incisions in the palate have been described for exposure of the atresia plate. There are a median incision by Blair (Fig. 342a), one curved anteriorly



Figs. 342a—c. Incisions for transpalatal approach in removal of choanal atresia. a Median incision by Blair (dotted line); anteriorly curved incision by Ruddy (solid line). b Door-like incision by Schweckendieck (dotted-line); M-shaped incision by Steinzeug (solid line). c T-shaped incision by R. Meyer

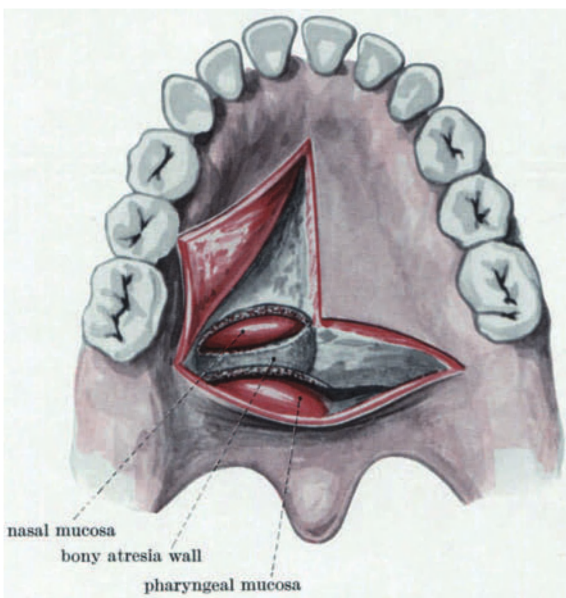


Fig. 343. The palatal flap is folded back on the side with the atresia and the soft palate is pushed rearward. The nasal cavity is opened in front of the atresia while the nasal mucosa is protected

after Ruddy (Fig. 342a), an M-shaped incision likewise curved anteriorly by Steinzeug (Fig. 342b) and a door-like one by Schweckendieck (Fig. 342b). We (R. Meyer) make a T-shaped incision with the long limb medially toward the front and the short top the T in the soft palate (Figs. 342 and 343). — After the incision, the mucoperiosteal flap is separated far enough and reflected so that the area of atresia is exposed. Now one separates the posterior, i.e. nasopharyngeal mucosa from the posterior border of the hard palate as far as the atresia plate. Experience shows that this is not situated exactly in the frame of the choana but is a few millimeters farther toward the nose (Fig. 343). The bony border behind the atresia is removed with the chisel or with a punch, so that the mucous membrane can be separated (eleoated) from the atresia plate as far as its cephalic border. The basal mucosa covering of the atresia plate is found and likewise separated from the bone. In this way the bony atresia wall is finally exposed and can be removed with a forceps or with the chisel. A window the size of the choana is now made in the two separated mucous membranes. Then the border of the perforation is incised a few millimeters at various points so that it can be pressed better against the wall of the choana. This way a mucosa seam covers the area of bone removal from front and back. — The separated mucous membranes can also be used in another way for epithelization of the newly formed bony choana. In some cases we have made the following maneuver with the mucous membranes (cul de sac): The tips of both mucosa coverings are incised half way up; then the lower half is resected from the anterior (nasal) membrane, and the upper half from the posterior membrane. A few border incisions are made in the remaining portions of the membranes, and the membranes are packed against the choanal wall. In this way the posterior mucosa flap lies on the nasal floor and on the lower part of the lateral walls, and the anterior flap is pressed against the roof of the choana and on the upper part of the lateral walls. WILSON makes three mucosa flaps which cover the bony surface. If possible we apply a few mattress sutures to the mucosa which covers the nasal floor and pass them through the mucoperiosteal palatal flap which has been sutured in place. The mattress sutures are tied in the mouth.

In infants and small children, in whom the conditions are narrower and more difficult, we remove the posterior part of the vomer together with the mucosa. Thus the posterior border of the vomer is simply situated farther forward, i.e. in front of the original area of atresia. As already mentioned, BLEGVAD extends his atresia surgery with this additional measure, a modification after BEINFIELD. WILSON also does it in his transpalatal approach. BROWN and MCDOWELL proceed transpalatally in this manner only in cases of bilateral atresia.

The advantage of the transpalatal method is that the bony plate to be removed is completely exposed and can be removed under direct vision. If one sutures the palatal mucosa with 4/0 or 5/0 nylon, after a few months hardly a scar is to be seen.

An important problem is *retaining the size of the lumen obtained by surgery.* One encounters particular difficulty in infants and small children. In them the danger of cicatricious stenoses due to narrow conditions is much greater than in adults. SHEARER leaves a rubber catheter with a rubber plug in the nose at the area of atresia for 4 to 6 weeks. The plug is vulcanized to the rubber catheter. The catheter is inserted into the nose from the pharynx and is pulled forward. He uses two catheters for bilateral atresias. The patient can breathe through the catheter. LEMOINE leaves a NÉLATON catheter or a special rubber tube in the nose for at least 1 month. In infants BEINFIELD inserts rubber tubes at intervals for several weeks until the danger of renewed closure due to cicatricious stricture has passed. In adults he leaves the rubber tube in the nose for only 5 or 6 days. WALKER inserts a No. 8F catheter into one nostril, passes it around the posterior border of the vomer into the other nasal cavity and out the other nostril. The two ends are attached to each other in front of the columella. He leaves this catheter in place for 14 days. Following this he dilates once a week for 4 months with a thinner catheter. In small children, however, one should be cautious with insertion of this catheter, in order to avoid a decubitus on the columella. MARROW inserts a polyethylene tube into the nose to keep the surgically obtained lumen open. Since epithelization is not as complete with the endonasal procedure as with the transpalatal procedure, we feel, as BECK does, that the catheter must be left in place much longer, i.e. about 3 months. In the transpalatal procedure if a good mucosa covering has been obtained, the treatment does not take as long with packing.

At the end of the operation we place a roll of aureomycin ointment gauze in the choanal area. In doing this we make certain that the borders of the mucosa do not overlap and that they are flush against the bony wall. The roll of ointment gauze is attached to a thread which extends from the nostril. By means of this the tampon can be withdrawn after 1 week. This can be followed by additional catheter treatment at any time.

e) Surgical treatment of cicatricious choanal atresia

Complete cicatricious closure of the choanae can be the result of lues or another specific infection. As mentioned above, the choanae can also be closed by membranes congenitally. Bilaterally this is very rare.

Like unilateral bony choanal atresia, unilateral cicatricious choanal atresia hardly causes a rhinolalia clausa, so that surgery is not always absolutely necessary. At any rate it is better to leave an overly narrow choana in which the soft palate is possibly contracted by scars, than to make it too wide surgically. If the latter is the case, then disturbances in speech and swallowing can occur. The removal of the cicatricious closure is done as it is in bony atresias. The posterior end of the septum, together with the cicatricious wall is removed by means of the approaches mentioned above (see p. 262). The cicatricious wall usually narrows or closes both choanae. After this removal new mucosa must often be provided for epithelization of the resulting defect. We use the transpalatal approach and apply free grafts from the cheek mucosa which must be sutured in place with most painstaking accuracy.

The lasting results in therapy of cicatricious atresia are essentially poorer than in bony stenosis, because not as much normal mucosa is available for covering the newly formed defect. The tendency is greater for renewed postoperative scar formation if inflammatory symptoms are still involved.

Some authors (like L. Rüedi) use an obturator in the treatment following enlargement of the choanae. The obturator can be attached to the upper teeth or the upper dental plate, as in treatment of rhinolalia aperta following inadequate closure of cleft palate (see Fig. 345).

3. Correction of naso-pharyngeal atresias and stenoses

The main type of stenoses and atresias in the area of the pharynx is palatopharyngeal. This is a connection between the soft palate and the posterior wall of the pharynx. Pharynx stenoses and atresias situated lower, which do not affect the posterior part of the nose, as well as glossopharyngeal types will be discussed later in detail in the chapter on plastic surgery of the pharynx (see Vol. II).

A few decades ago lues was still assumed to be the only cause of stenoses and atresias in the nasopharynx. But today it is certain that same features can be caused by rhinoscleroma, tuberculosis, diphtheria and sometimes also scarlet fever, measles, smallpox, leprosy, pemphigus and coryza. Cases of stenosis after tonsillectomies and adenotomies are also known, as observed by Figi, Dohlman and Thulin. They have also occurred after tumor surgery, accidents, and erosion. Velo-pharyngeal stenoses are considerably less frequent than formerly due to the successful fight against lues, tuberculosis and the other infectious diseases.

Very rarely are they found as congenital malformations. In a large percentage of the cases the origin remains unclear. — Transnasal observation of the width of the nasopharynx and of the velar function by means of an endoscope (DENECKE) is to be pointed out especially.

One finds the same symptoms in velo-pharyngeal stenoses as in choanal atresias: collection of nasal secretions in the nasal cavities, rhinitis, eustachian tube stenoses, chronic otitis, and frequent upper respiratory infections as a result of exclusively oral breathing. The speech of the patients is sometimes disturbed only a little; it is without nasal resonance, which is particularly noticeable in the formation of nasal tones.

Fig. 344. Insertion of a rubber obturator to keep the surgically treated nasopharyngeal stenosis open (PORTMANN)

As already mentioned, it is important in surgical correction that the opening is made too small rather than too large. To prevent postoperative fusion and cicatricious narrowing, complete epithelization of the borders of the stenosis as well as of the adjacent exposed areas is desirable. Simple separation of the soft palate from the posterior wall of the pharynx or a *simple incision* through the cicatricious diaphragm, as indicated by GOODYEAR, usually does not reach the goal. The stenoses or atresias can recur within a short time due to renewed cicatricious formation. Such a simple procedure can be successful only when the surgically obtained lumen is kept open with dilatation or with an obturator. — The obsolete method of LUBET-BARBON for correction of anterior atresia of the nose, as mentioned above, was formerly used in naso-pharyngeal stenosis and atresia. The method was recommended over 60 years ago by NICHOLS in cases of syphilitic fusion in the pharynx.

Various rather complicated techniques have been described for separating the wound surfaces and for their quick epithelization. Simple severing of the fusion can be done with a curved scalpel or by means of diathermy and electrocautery. The latter was particularly recommended by French authors. From the small lumen of the stenosis one incises crosswise.

Sometimes it is necessary to split the entire soft palate while protecting the uvula, in order to reach the scars, if they are somewhat farther forward toward the choana. Then the border of the bony palate may need to be removed, as Réthi has described.

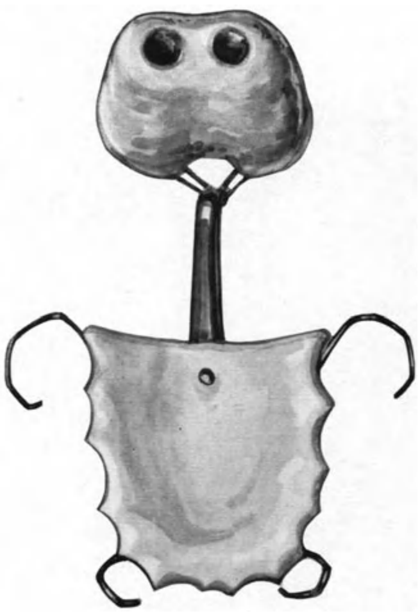


Fig. 345. Acrylic pelotte anchored to a dental prosthesis to keep a surgically treated nasopharyngeal stenosis open (Rüedi and Käser)

Fig. 346. Correction of nasopharyngeal stenosis by Réthi

In older literature *obturators* are described to keep open the lumen obtained by means of ordinary incision or excision. These obturators are inserted either through the nose as in the choanal atresias, or they are fastened to a palatal plate. In his surgical text of 1932 Portmann describes a rubber obturator which he inserts into the nasopharynx to keep the new lumen open which was made by means of cross-shaped incision (Fig. 344). Rüedi and Käser recommend an acrylic plug pierced with two metal tubes and fastened to a palatal plate. After surgical separation of the synechias, it is worn for 4 months (Fig. 345). Several *dilators* shaped like forceps, which the patient could use himself, were also described. One by Réthi is inserted into the nose daily and is kept in place for a few hours. This is naturally very demanding on the patience and perseverance of the patient.

Technically more difficult, but at the same time more satisfactory, is immediate covering of the resulting defects. This can be done either with a *free skin graft* or with appropriate mucosa flaps from the surrounding area. Siebenmann described epithelization of the defect by means of a Thiersch graft. McLaughlin, Denny and Wilson use skin grafts. These three describe a technique in which they cover the entire naso-pharyngeal ring with the skin graft. Free skin grafts are tolerated well in the oral cavity and in the pharynx. In the nose they can cause objectionable odors and can lead to atrophic rhinitis. In a few cases we have used free flaps from the cheek mucosa for coverage of the defect after scar excisions. These are sutured with fine catgut or nylon button sutures or with mattress sutures. Such skin or mucosa grafts can also be fixed on the defect by means of sponge rubber plugs or firm obturators. These are best when they are attached to a palatal plate, as described above. However, absolute immobilization of the graft on the posterior wall of the pharynx and on the velum is not possible in this way, since the throat muscles move with every act of swallowing, which can cause displacement. In order to counteract renewed scar formation, a naso-pharyngeal obturator attached to a palatal plate must be worn for at least 4 weeks.

If possible, *pedicled mucosa flaps from the surrounding area* should be used to cover the raw surfaces on the borders of the stenosis. The healing of such flaps is much less endangered by the movement of the pharyngeal and palatal muscles than that of free grafts.

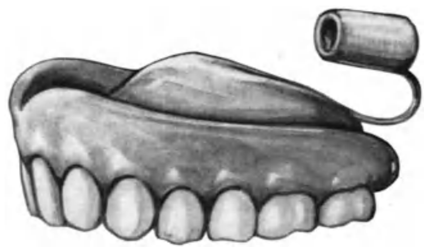
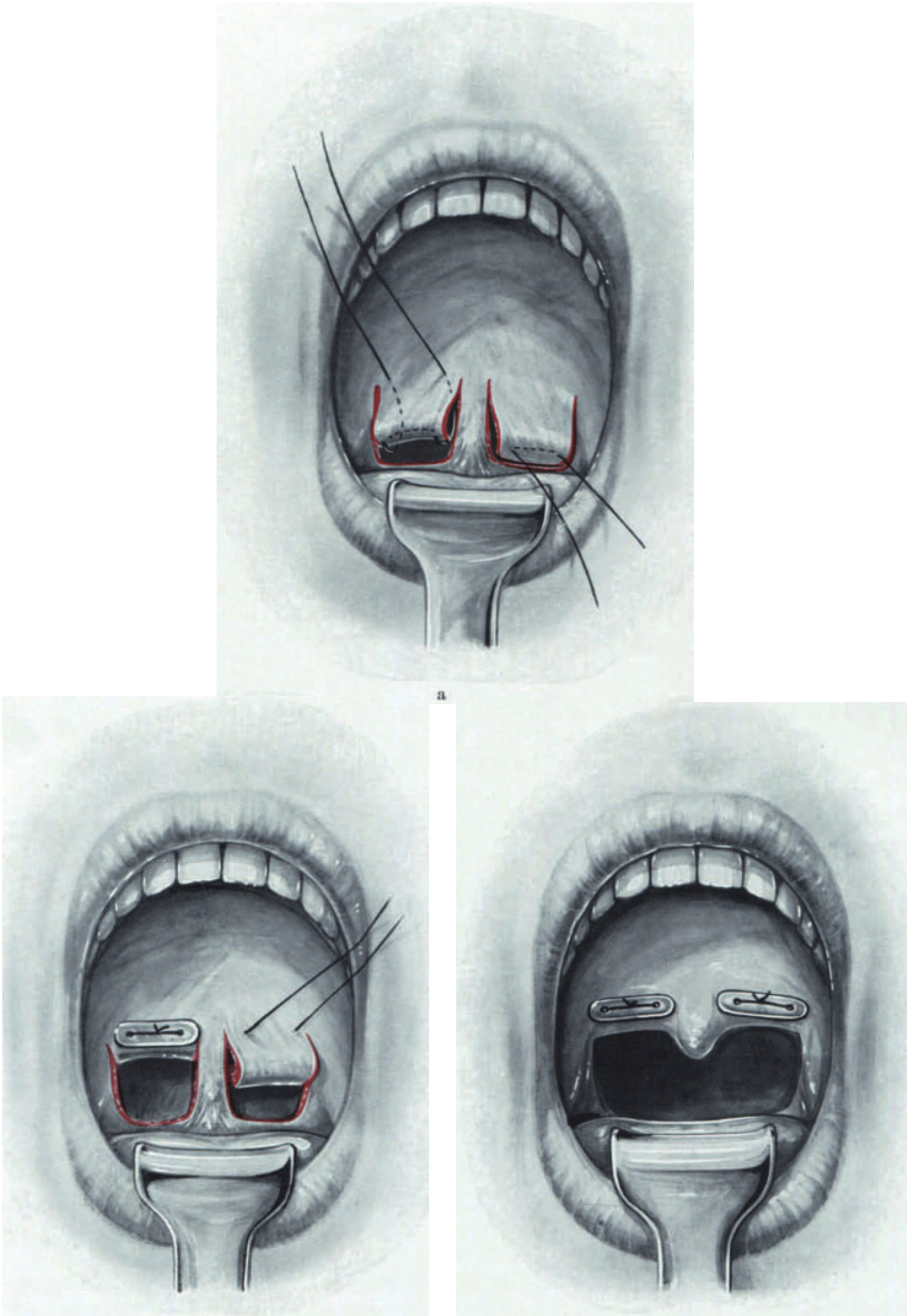


Fig. 347. Nasopharyngeal obturator with anchorage on dental prosthesis for use in atresias, according to Kertész

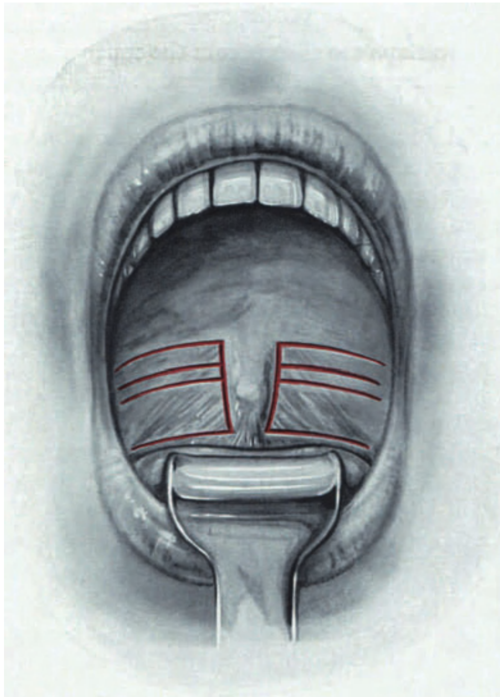
After removal of scar tissue in slighter cases, in which defects occur only on the soft palate and not on the wall of the pharynx. Réthi has described a method by Diakonoff, in which a laterally pedicled mucosa flap is cut on the posterior pharyngeal wall. This is rotated onto the freshened posterior surface of the soft palate and immobilized there by means of mattress sutures. If the posterior pharyngeal wall in the epipharynx also has a defect, Réthi covers it with a 2 to $2^1/_2$ cm wide mucosa flap from the entire length of the septum. This method seems to be technically too complicated and might cause synechias in the nasal cavity if the cavity is small.

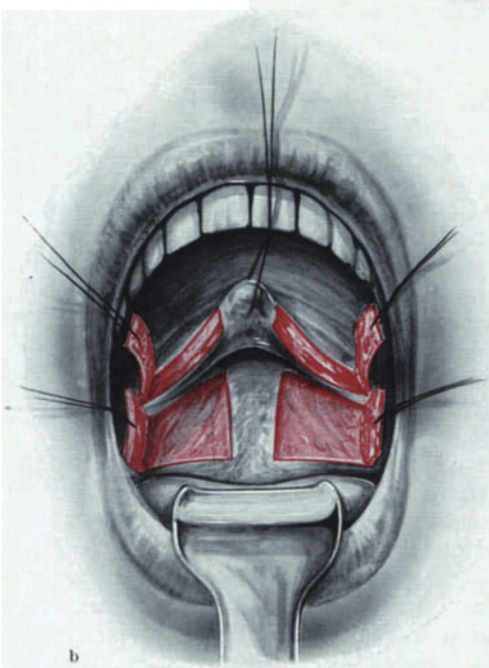
In an atresia or an almost complete stenosis in which there is only a small opening behind the uvula, the obstructing membrane is split with a T-shaped incision according to a further procedure of Réthi. In this way a triangular flap is formed on either side of the median incision. The mucosa of these flaps is carefully dissected away from more deeply situated scars. The cicatricious soft palate substance is removed together with the dissected mucosa of the diaphragm on the nasal side. The free triangular mucosa flap of the soft palate is swung inward toward the nose on each side. It is sutured to the border of the wound in the nasal mucosa (Fig. 346), so that a frame covered with mucosa results. The tendency to shrink is supposed to be minimal. Sometimes a strip from the nasal mucosa of the diaphragm can be left and used for covering the horizontal wound on the pharyngeal wall which results from removal of the fusion. To keep the lumen open Réthi recommends the naso-pharyngeal obturator of Kertész (Fig. 347).

Mackenty uses two mucosa flaps pedicled above. These are raised from the soft palate and its transition to the posterior pharyngeal wall. The flaps are swung onto the border of the soft palate which has been severed from the pharynx and thus prepared, as well as onto the nasal surface of the soft palate (Fig. 348). The defect on the posterior pharyngeal wall, which resulted from the separation of soft palate, remains uncovered.



Figs. 348a—c. Correction of nasopharyngeal atresia by MacKenty. a Mucosa flap with its base above is formed from the posterior wall of the pharynx. After removal of the scars, the mucosa flaps are folded over and sutured for epithelization of the raw areas situated toward the nose on the soft palate. b Mucosa flap on one side is folded over toward the nose by means of sutures. On the other side the flap is sutured tightly. c In complete atresia, the uvula is formed from the medially situated mucosa. Situation after suturing the mucosa flaps bilaterally





Figs. 349a—c. Elimination of nasopharyngeal atresia by VAUGHAN. a Incision of the lateral adjacent flaps. The lower incision must extend to the middle in complete atresia. The ratio of width of the flaps to each other can vary according to the width of double border line. b Raising the flaps and excision of the scars; nasal velar mucosa visible by drawing the palate forward using a bridle suture. c Suturing the two upper flaps to form the edge of the nasal velar mucosa. Advancement of the two lower flaps to the rear wall of the pharynx. Upper flaps are sutured to the nasal velar mucosa

A similar procedure by VAUGHAN is derived from the method of MACKENTY. In this not one, but two flaps are raised from the mucosa on either side (Fig. 349). The flaps are pedicled laterally on the pharynx. The two smaller flaps of the four right and left are cut just in the region of the soft palate and extend to the uvular attachment. The two wider, posterior flaps are lower and already belong to the region of the posterior pharyngeal wall. The soft palate is separated from the pharynx at the upper incision border of the lower flap and the scars are excised. The two small flaps are used to cover the defect at the site of removal on the soft palate and are sutured to the nasal velar mucosa. The wider flaps are pulled upward as advancement flaps and cover the site of separation on the posterior pharyngeal wall. They leave a triangular relief defect below. The formation of the upper flap is unnecessary if the velar defect at the site of separation can be closed by advancement of the nasal mucosa alone. After the end of the second week a metal dilator (Fig. 350) is inserted into the lumen by the patient every day over a period of several weeks. The dilator just fits the new naso-pharyngeal opening and prevents contraction of the borders.

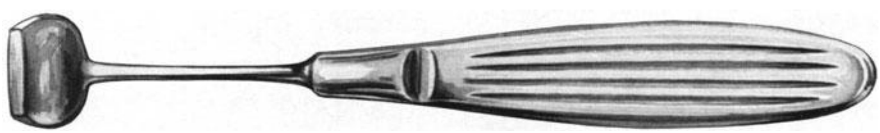
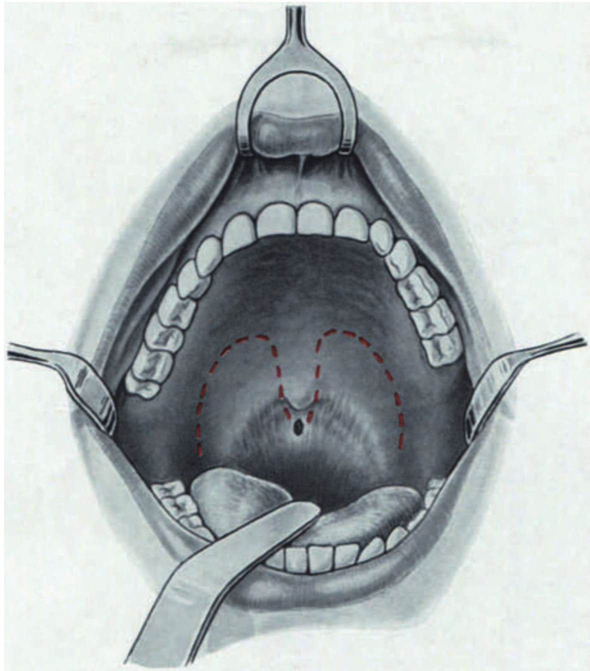


Fig. 350. Dilator by VAUGHAN for postoperative treatment of nasopharyngeal stenosis

Two procedures for correction of naso-pharyngeal stenosis by KAZANJIAN are well-known. In one, the mucosa flaps are not pedicled laterally but below on the posterior pharyngeal wall. After formation of the flaps on the oral velum-pharynx wall and release of the adhesions of the velum with the posterior pharyngeal wall and excision of the scars, these mucosa flaps are spread over the defect on the posterior pharyngeal wall. The nasal mucosa above the scar is retained and swung over as a flap pedicled forward and above to form the border of the velum. Packing assures contact of the pharyngeal flap with the posterior epipharyngeal wall. Additional advancement flaps from the adjoining areas are used to cover the remaining secondary defects. Like the methods described before, this procedure is used bilaterally. Thus two flaps are cut on either side and used to cover raw surfaces. BAUMGARTNER used the method on only one side and has obtained a functionally adequate result.

The second method of KAZANJIAN is the better of the two and is the choice in case of thicker scars (HOLLENDER, DENECKE). The velo-pharyngeal flap formed on the oral side of the atresia is pedicled below, bilaterally as in the first method, and extends about as far as the middle of the soft palate (Fig. 351a). It is used to cover the posterior epipharyngeal wall here as well. A transposition flap from the cheek mucosa is used to cover the resulting defect bilaterally on the soft palate. When making this one must be careful not to injure WHARTON's duct and its opening. This second procedure is suitable for cases which have thicker scars on the membrane and in which the nasal mucosa of the membrane is no longer usable after removal of the scars. Unilateral treatment is sufficient to afford adequate air passage for elimination of nasal speech and ear disturbances. That the unilateral opening in the velo-pharyngeal region is sufficient is also shown in cases in which there is unilateral paralysis of the soft palate and pharynx due to cranial nerve paralysis. In such cases a stenosis of the velo-pharyngeal passage is created surgically on the paralyzed side (DENECKE). If the air passage is not



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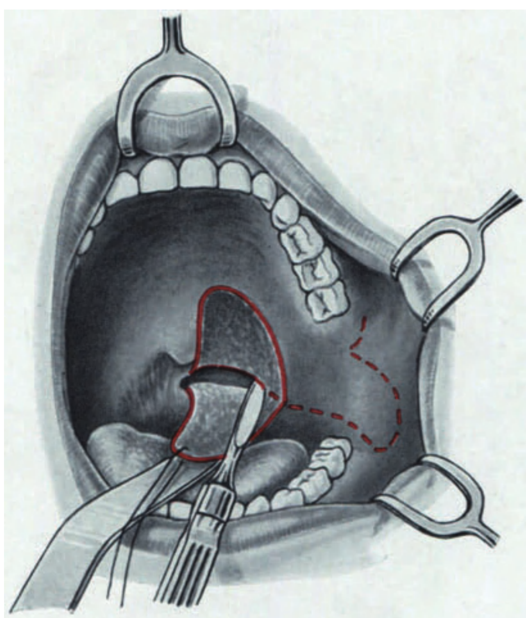
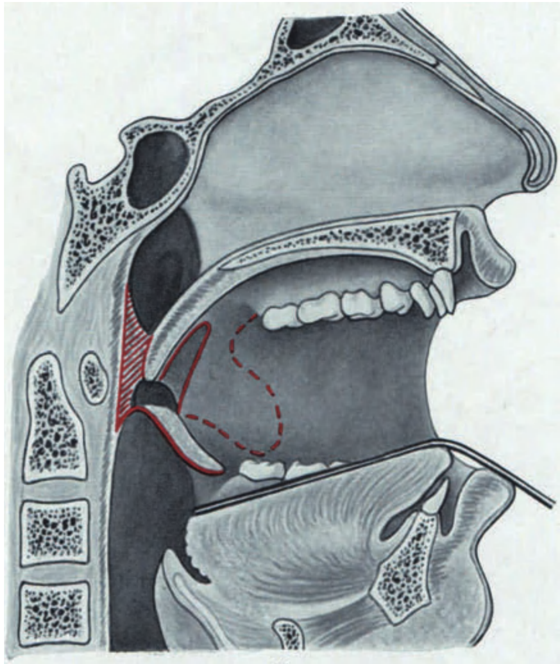


b

Figs. 351a—f. Correction of nasopharyngeal atresia by KAZANJIAN. a Dotted red line shows incision for formation of the velar mucosa flap pedicled below. b Velar mucosa flap with its base below is swung forward. The scar is severed. Dotted line indicates the donor site of a mucosa flap from the cheek for covering the raw surface on the anterior surface of the soft palate



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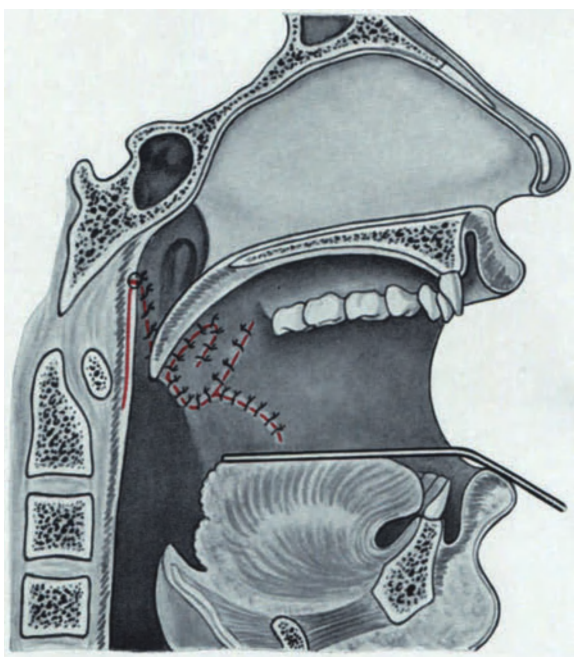
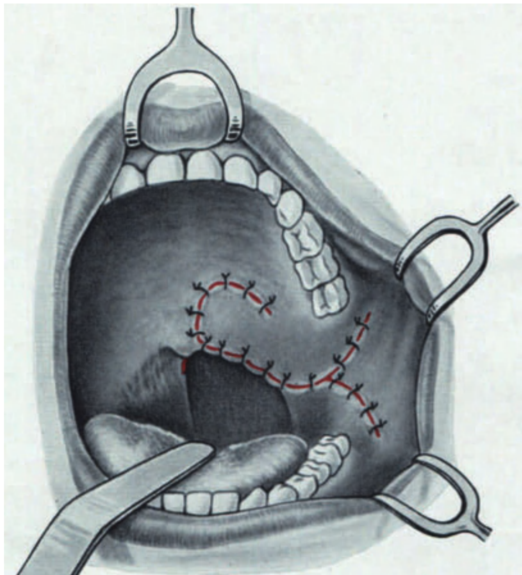


d

Figs. 351 c and d. c Side view. Red hatching shows cicatricious area to be excised. Mucosa flap for covering the area of scar excision has been formed and is hanging down below; dotted red line shows the donor site for the mucosa flap from the cheek below the papilla. d Area of scar excision covered with the mucosa flap from the anterior surface of the soft palate; mucosa flap from the cheek sutured into the velar defect adequate, the other side can be treated in a similar manner a short time later. — The function of the palate is surprisingly good with the second method of KAZANJIAN.



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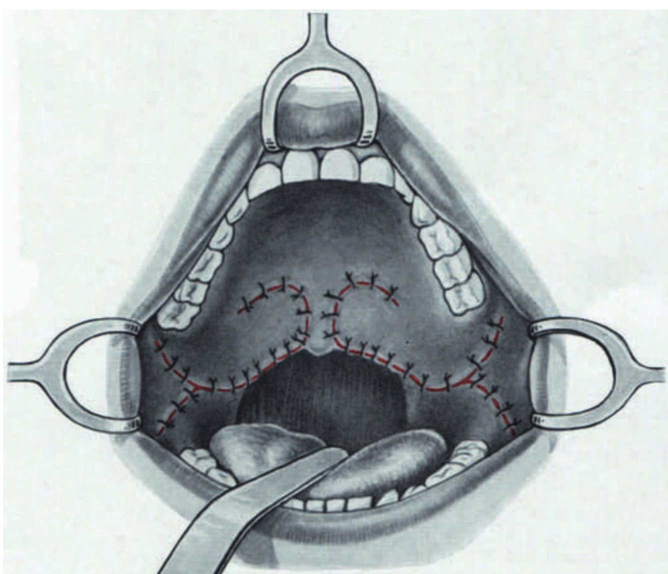
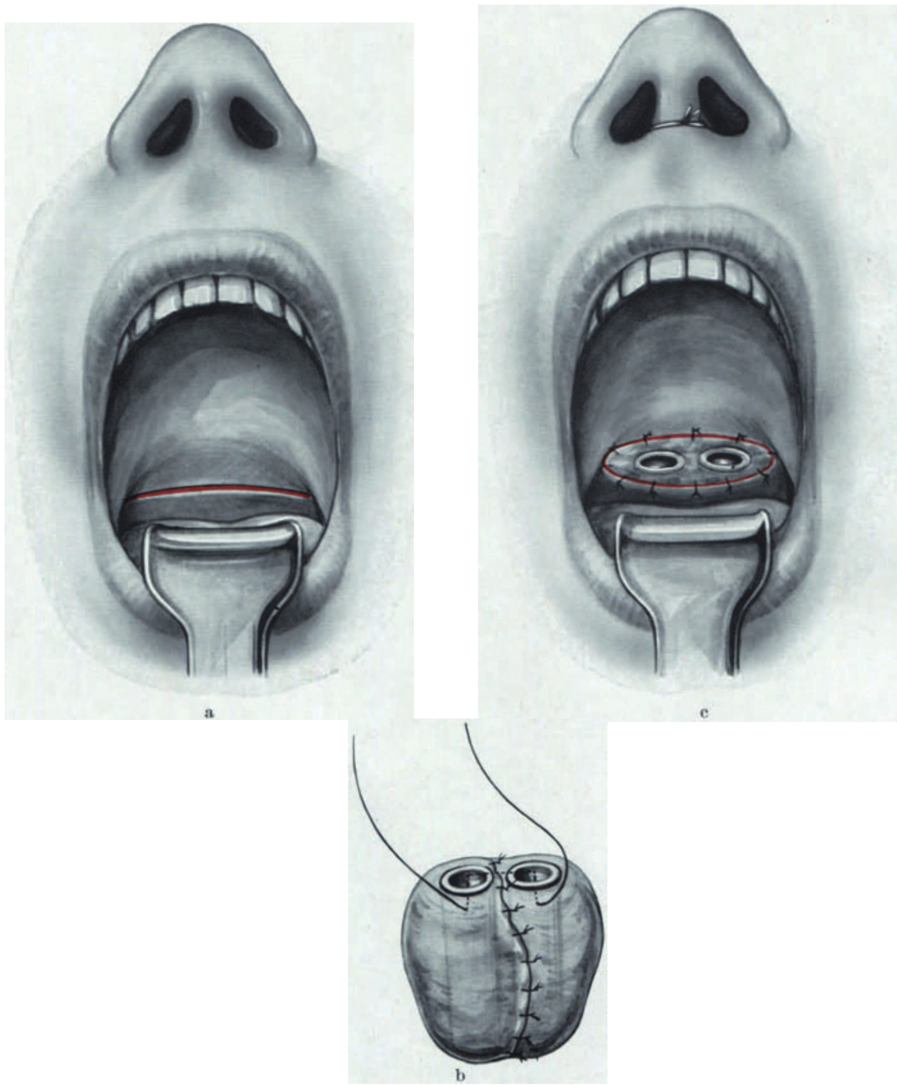


f

Figs. 351e and f. e Front view after unilateral treatment of the atresia. f Situation after bilateral elimination of the atresia; cheek mucosa has been swung onto the donor sites on the anterior surface of the soft palate bilaterally

If the velo-pharyngeal stenoses have existed since earliest childhood, it may be that septum and sinus changes can also exist as a result of obstructed nasal breathing. After correction of the velo-pharyngeal stenosis these can further hinder the flow of air through the nose. Appropriate treatment is to be made additionally in such cases.

After a successful operation one can do without dilation. This is a considerable relief to the patient in the postoperative phase. Insertion and immobilization of



Figs. 352 a—c. Correction of nasopharyngeal stenosis by FIGI. a Incision is made horizontally through the stenosis. b Sponge rubber inlay covered with Thiersch graft. Tubes permit passage of air. c Inlay sutured in place and anchored to the columella. It is better to tie the anchoring suture over a roll of gauze

plugs in the epipharynx (PORTMANN and others) after release separation of the scars without epithelization of the defect can not attain the good and quick success of the method after KAZANJIAN and of other epithelizing methods, since the subsequent contraction is considerable without the plastic reconstruction.

O'CONNOR lines the raw ring resulting from scar excision in naso-pharyngeal stenosis according to the method described on p. 255. He wraps a THIERSCH graft around an *obturator of stent* and lines the pocket in the nasopharynx with it. By this means the skin graft is pressed against the raw surface. In this method of grafting FIGI uses a plug of sponge rubber with two tubes to permit breathing (Fig. 352). He sutures the borders of the skin graft to the borders of the horizontal incision on the soft palate and at the posterior pharyngeal wall. However, the healing of free grafts in this region is often very uncertain.

For keeping the lumen open postoperatively FIGI recommends an obturator of acrylic derivatives. The obturator has a small circular collar at both ends. These prevent the obturator from slipping upward or downward (Fig. 353). A similar obturator was described by RÉTHI.

Fig. 353. Self-anchoring obturator of plastic in pharyngeal stenosis by FIGI

XVI. Plastic surgery in hereditary nasal malformations

Congenital nasal malformations are rare, and because of this one finds few reports about their treatment. Descriptions of pathological anatomy and embroyologic theories about their origin are treated in textbooks on pathology and on ear-nose-throat diseases.

Since malformations have been observed more frequently during recent years because of medications and radioactive substances, this will be discussed in more detail with regard to surgery.

One differentiates between monsters, congenital clefts in the region of the nose, malformations genetically related to facial clefts, unilateral and bilateral harelip nose, and finally partial aplasias and dysplasias.

1. Monsters (cyclops eye in total absence of nose)

These extraordinarily serious malformations are not discussed here since they are hardly encountered in newborn which are capable of living.

2. Correction of congenital clefts in nasal region

a) Median nasal cleft

Median nasal cleft was called "bulldog nose" by TRENDELENBURG. The term, schizorhinia, is less common today. On the other hand, one often finds the malformation under the name, hypertelorism, since it almost always accompanies an abnormal distance between the orbits. In English and American medical literature the name, bifid nose, is often used.

The first publication about bifid nose and its correction was made by ROE in 1887. In general one differentiates between bifid nose of slight, moderate, and high degree. In all cases there is a median groove along the dorsum due to separation of the anterior part of the septum into two plates. In slight cases the groove is restricted to the lower portion of the nose in the area of the lower and upper lateral cartilages. The angles of the lower lateral cartilages diverge considerably, and sometimes the upper lateral cartilages also diverge. SCHMIDT called it "furrowed" bifid nose.

In bifid noses of moderate degree a considerable widening of the bony nasal structures is already present. There is a longitudinal groove along the midline of the nose in the bony as well as in the cartilaginous part.

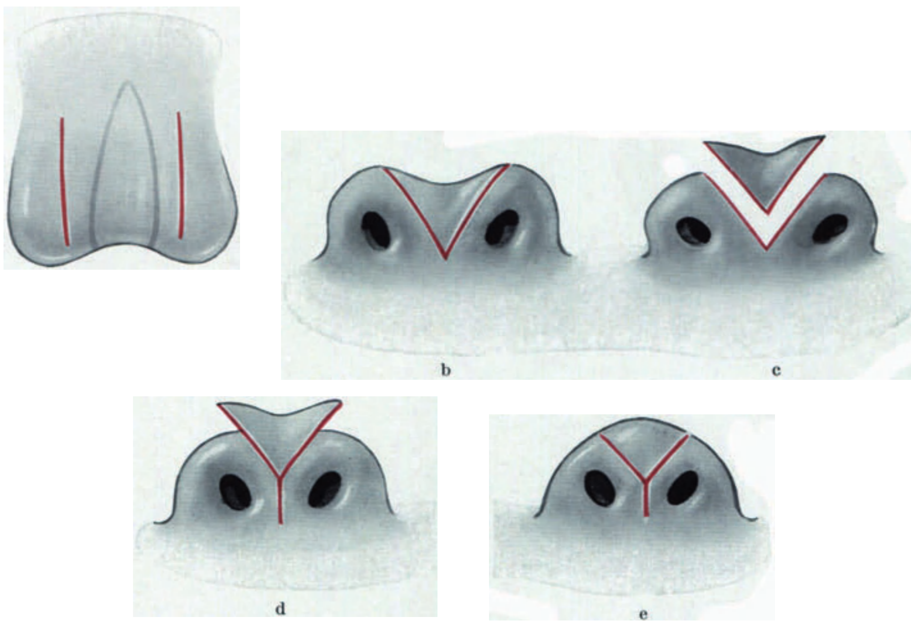
The high degree of malformation is bifid nose with a pronounced cleft in which there was no union of the bones lateral to the septum during embryonic development. There can sometimes even be complete division of the external nose into two halves, or there can be grooves several centimeters wide with considerable widening of the upper part of the face. In addition to a gap in the bone and cartilage there is also insufficiency of the skin covering. Therefore the nasal tip can sometimes be completely flattened. In most of these extreme cases the two halves of the nose are like cartilaginous tubes whose median walls hardly touch or no longer touch at all. The hypertelorism in these cases is also considerable. Due to the absence of the nasal bones the piriform aperture extends to the glabella or can even continue upward, if a forehead cleft is also present.

Cases of median nasal cleft of high degree have been described which were combined with teratoma formation. In these the teratoma located in the cleft was the cause of the malformation. The teratoma was regarded as the primary formation and the nasal cleft the secondary one. We (R. MEYER) described a similar case in 1946. In this patient the union of the halves of the nose was prevented by a lipoma. The treatment of the case will be discussed later. Recently KITLOWSKI presented a paper about a case of median cleft of the nose and lip with a cyst in the middle of the nose. Here as well it was a matter of a child capable of living.

Most reports about bifid nose say nothing or scarcely anything concerning its surgical correction (WARYNSKI, LEHMANN-NITSCHE, quoted from ZAUSCH).

The *slight cases of bifid nose* without hypertelorism, as one occasionally encounters them, can be corrected with simple surgery. We use the methods which have been described in the discussion of correction of wide noses (see p. 67) and wide nasal tips (see p. 97). It is primarily a matter of eliminating the depression between the two angles of the lower lateral cartilages by partially resecting the angles or by only approximating them. A similar result is had with the insertion of a cartilage graft between the two angles, as recommended by ESSER. Narrowing of the bones can be done as in the technique the correction of wide noses (see p. 67). GELBKE treated a slight case of bifid nose only by means of an oval skin excision from the hair line down into the philtrum. In some circumstances slight hypertelorism can also be improved in this simple manner.

JOSEPH proposed the so-called "plastic raising of a wedge" for correction of bifid nose of slight degree (Fig. 354). The furrow-like depression in the skin is raised by means of a lateral wedge incision, lifted from its former low position, and immobilized in the raised position. The two lateral incisions are made diagonally inward so that they meet deeply subcutaneously in midline, thus mobilizing a prism-shaped flap of skin and connective tissue. The raised, prismatic flap is sutured in place after the two lateral borders of the incision have been approximated by means of mattress sutures in their lower levels. The mattress sutures are passed through the nostrils. In cross-section this procedure is a V-Y advancement. When suturing the median flap one makes appropriate subcutaneous



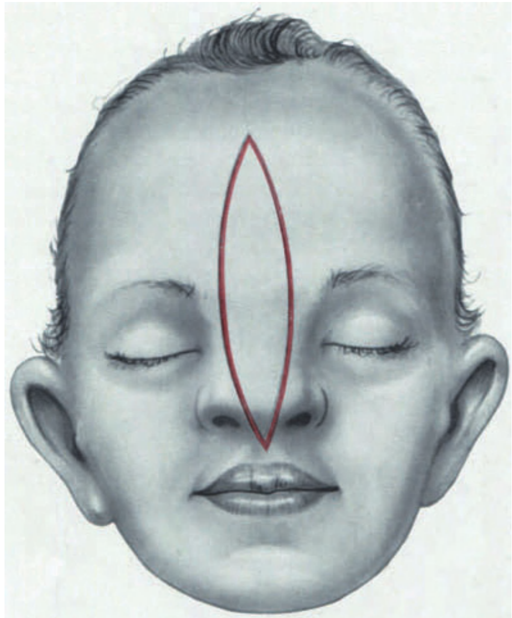
Figs. 354a—e. "Plastic raising of a wedge" by JOSEPH for correction of bifid nose. a Incision. b Location of the wedge. c Separation of the wedge. d Upward and forward advancement of the wedge with closure of the cleft in the substance of the cleft. d After appropriate excision on the raised wedge the borders are sutured

border excisions so that the formerly valley-like, concave surface is now convex and forms the new nasal dorsum in the lower part.

According to ESSER *bifid noses of moderate degree* with bone and cartilage gaps in midline are treated by means of fracturing the bones, implanting a bone graft and columellar correction.

WEBSTER and DEMING reported in 1950 on 10 cases of bifid nose. They gave detailed information concerning a surgical procedure for correction of this anomaly. After making an oval skin excision from the forehead to the upper lip, they narrowed the widened bony nasal structures by means of median, lateral and transverse osteotomies. By means of excision in the region of the upper and lower lateral cartilages they narrowed the vault and approximated the cartilages in midline (Fig. 355).

MARINO and DAVIS likewise collected a respectable number of nine cases, some combined with harelip nose, cleft palate and lid coloboma. Surgically they proceeded as WEBSTER and DEMING do. They recommended terminating the necessary corrections before school age and making secondary cosmetic corrections later.



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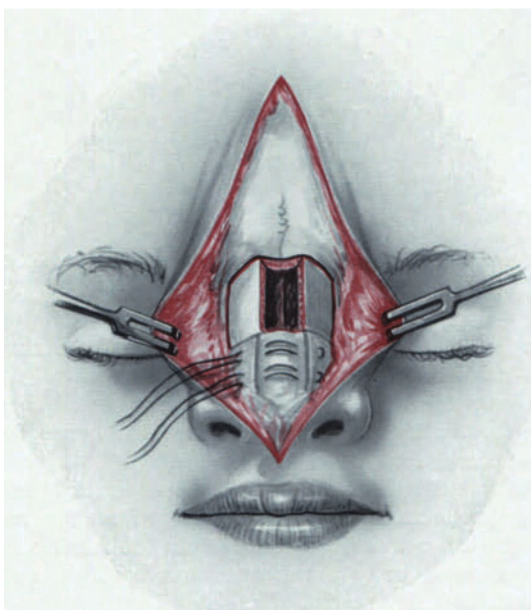


b

Figs. 355a—c. Bifid nose of moderate degree with skin incision for correction by WEBSTER and DEMING. a Incision. b Osteotomies on the nasal bones and approximation sutures in the overly enlarged "upper lateral cartilages" and in the lower lateral cartilages

MACHADO also followed the procedure of WEBSTER and DEMING in the correction of a case of bifid nose of moderate degree.

In 1954 Femenic reported on the median realignment of both halves of the nose, combined with surgical closure of the lip in a case of bifid nose and median

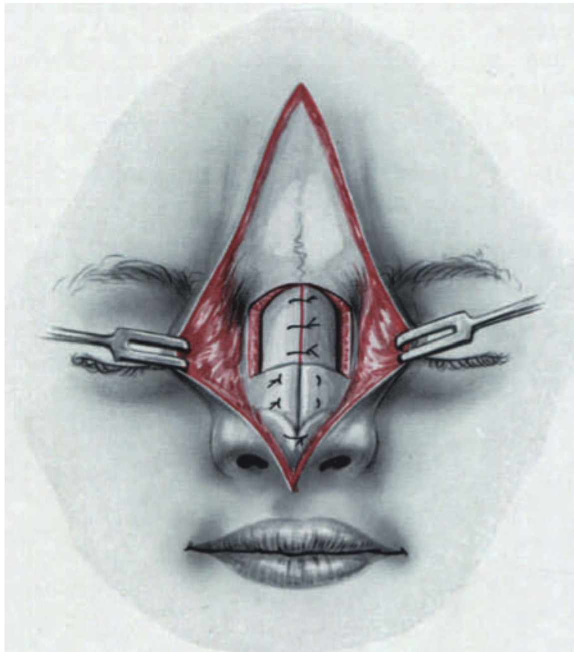
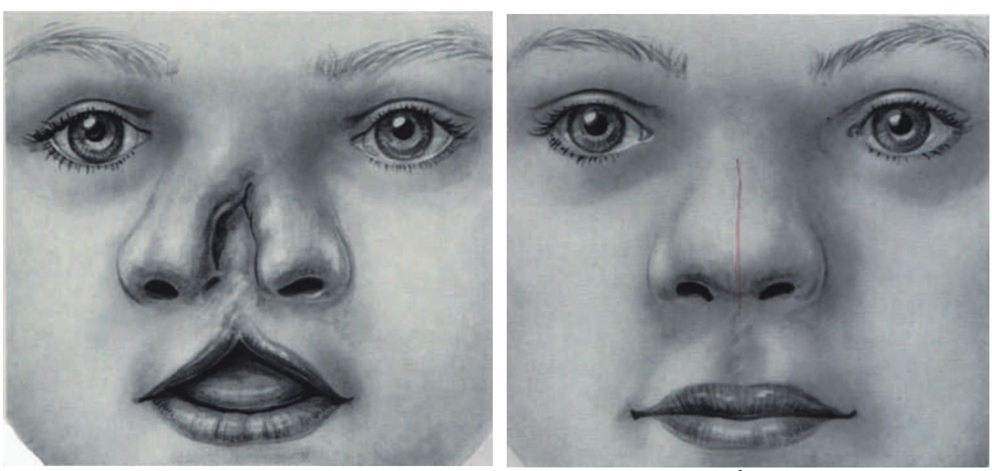


Fig. 355c. Situation after medianward advancement of the mobilized nasal bones and approximation of the cartilage arches



a b

Figs. 356a and b. a Bifid nose of high degree. b After a median spindle-shaped excision and adaptation of the lateral parts of the nose, the upper lip is lengthened in the same stage operation

cheilognathoschisis (cleft lip and palate). This corresponds basically to the procedure of Webster and Deming.

In 1956 we (R. Meyer) described a method for correction of bifid nose of moderate degree with pronounced hypertelorism. Here also, the treatment was similar to that by Webster and Deming. The patient was a 16-year-old girl. The oval skin excision above the nose had to be extended above the hairline because an almost vertical strip of skin with hair reached to the glabella and also had to be excised. In the glabellar region there was also a rhomboid bone gap which was filled with a solid cicatricious plate. The two wide vaults of the nasal bones and the cartilaginous structures were exposed. At the bottom of the wide furrow between the bony vaults was the anterior edge of the club-like, thick septum. This was left in place and used as the new nasal dorsum after complete removal of the nasal bones. The bony mass of the septum could be modelled into the shape of a normal bony nasal structure by means of a Luer

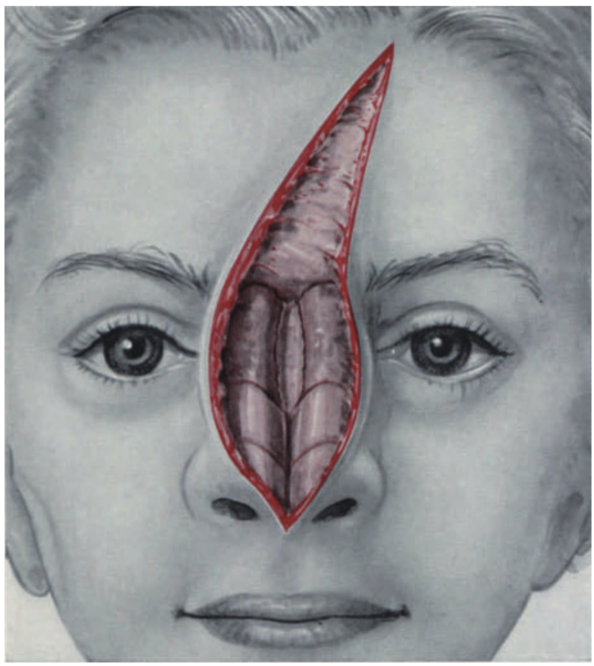


Fig. 357. Situation upon surgical opening of a bifid nose (R. Meyer). Exposure of the nasal structures after skin excision as far as the hairline

forceps and a Rowland forceps. Due to the extensive bone removal wide gaps in the bone occurred on both sides. These gaps later filled in with scar tissue. The underlying mucosal vault was carefully separated and pushed inward intact before the bone removal. The nasal cavities were considerably enlarged in their upper part. In the region of the naso-frontal duct the nasal cavities formed a large recess bilaterally. However, these recesses did not continue into the forehead since the frontal sinus was lacking (Fig. 358). The skin over the new nasal structure could be closed well. Then the lower and middle nasal vault had to have a new shape. The middle vault had to be narrowed extensively. The normally "triangular" upper lateral cartilages were large, tunnel-like quadrangular plates. The lateral parts of the cartilaginous vault were excised. The medial parts which were joined to the septal cartilage at a great depth in the median furrow were incised paramedially and sutured together. The middle parts of the cartilaginous vaults were sutured over the median part in midline. The less abnormal-looking but still wide lower lateral cartilages were treated in the same way. As in the correction of wide nasal tip they were incised, sutured together medially and also generally reduced in size. The borders of the spindle-shaped skin excision were sutured in midline over the new bony and cartilaginous nasal structure with the finest nylon material. The columella had to be reconstructed in a second stage operation 6 months later because the base of the columella was so narrow that the columella was practically missing. This correction was made by rotating two small flaps from the philtrum.

Similar surgery in a case of bifid nose with median furrow and hypertelorism was done by Horowitz in 1958. The dorsum was split longitudinally from the glabella to the upper lip. The skin furrow and the nasal bones were resected,

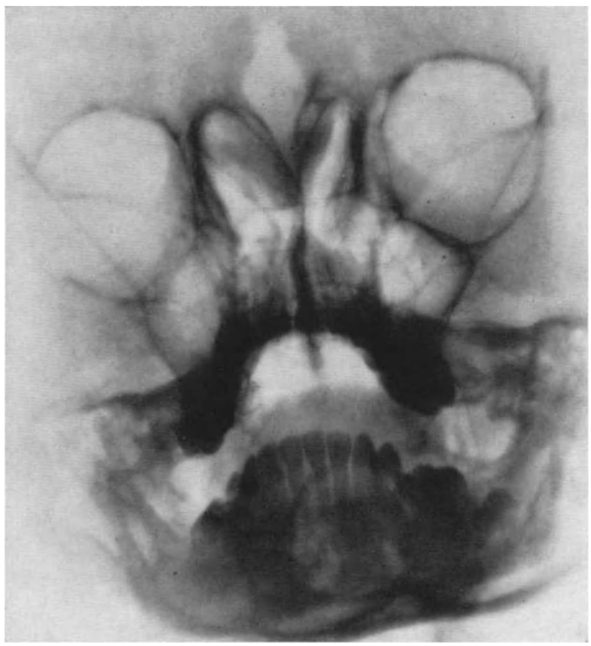
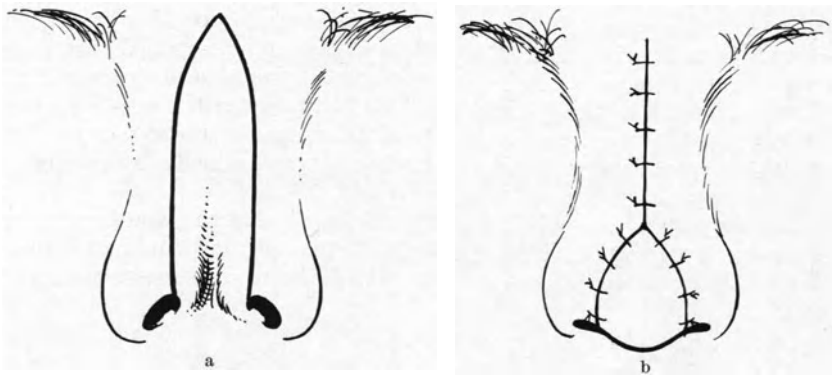


Fig. 358. X-ray of the bifid nose in the same case: the double formation of the nose with enlargement of the upper nasal cavities in the bony nasal structure is quite clear

the 1 cm wide cartilaginous septum narrowed and the two frontal processes of the maxilla fractured toward midline. The medial crura of the lower lateral cartilages were fastened to each other after resection of all subcutaneous tissue, and the nostrils narrowed.

Joseph used a sliding flap with an inverted V-Y advancement in cases of bifid nose of moderate degree with retruded nasal tip. The procedure was developed by Dieffenbach (1848) and later by Neumann and Ollier (1864) for larger defects of the lower part of the nose. The method has already been described in the discussion of compound saddle nose (see p. 243). Joseph called it the glabellar method of schizorhinoplasty. The tongue-shaped flap (Fig. 359) of glabellar and nasal skin is moved downward longitudinally much like the creeping of a caterpillar ("caterpillar flap"). This forms a fold with skin duplication at the tip. In a second stage a few weeks later, this is flattened to lengthen the columella.

The glabellar method of Joseph was also used by Brown and McDowell in a bifid nose with hypertelorism.



Figs. 359a and b. Correction of bifid nose of high degree by means of V-Y advancement according to JOSEPH (glabellar method). a Incision. b The flap is sutured with its base in the region of the columella

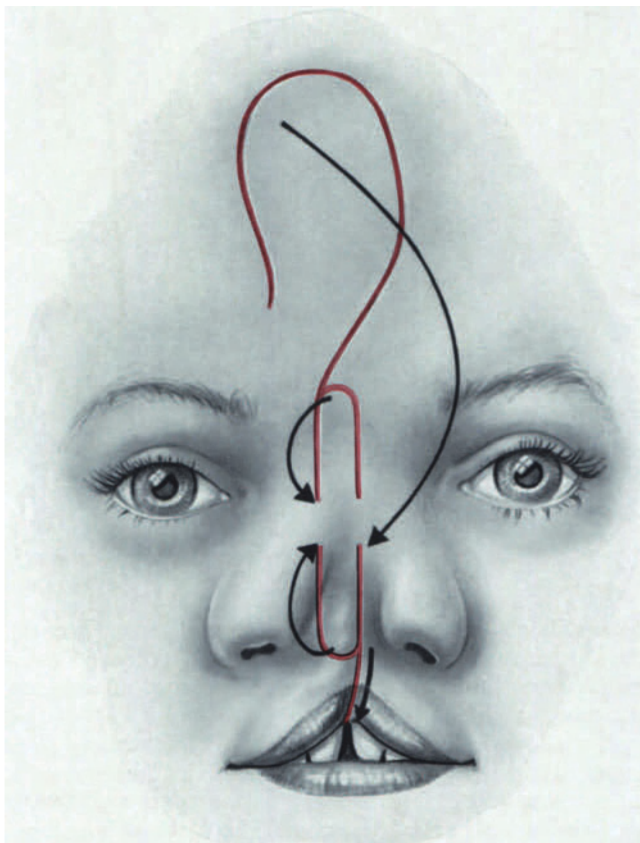


Fig. 360. Fronto-nasal method for correction of high degree of bifid nose, according to JOSEPH. The two tongue-shaped flaps in the groove are folded over and sutured form the inner lining of the nasal cavity. The forehead flap is then swung down to the nose. The nose can be narrowed by removal of the frontal processes of the maxilla

The procedure of GENSOUL and LEXER for formation of the nasal tip and columella from the philtrum was termed the "labial method of bifid nose surgery" by JOSEPH. This method has already been discussed in columella surgery and harelip noses (see p. 111).

According to Esser bone grafts must sometimes be used to form a medial dorsum even in bifid noses of moderate degree.

a

b

Figs. 361 a and b. Correction of bifid nose of high degree. a Median nasal fissure. b Reconstructive rhinoplasty using forehead flap by Esser

Fig. 362. Congenital malformations of the external nose (lipoma) and partial atresia of the nostrils and nasal cavities

To construct a nasal dorsum Lexer made small bony plates from the wide, flat frontal processes of the maxilla and placed them upright next to each other in midline.

Bifid nose of high degree, or median nasal fissure (Esser), with considerable distance between the two halves of the nose, must be corrected in several stages.

Joseph (Fig. 360) and Esser (Fig. 361) used forehead flaps and implanted bone or ivory grafts for the construction of the middle part of the nose and the alae. According to the experience of Kania, the tubed pedicle flap as by Filatov and Gillies proved to be more advantageous for this purpose. Kania reported eight cases of bifid nose in all three degrees of severity. He forms the nasal profile by implanting plastic prostheses made of polymerized acrylic acid.

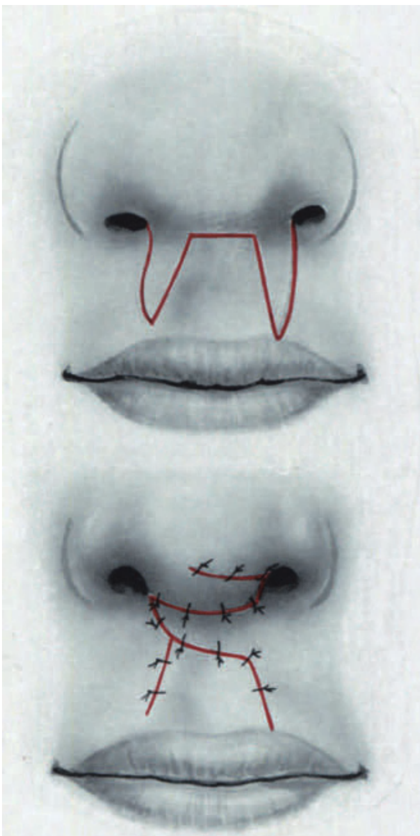


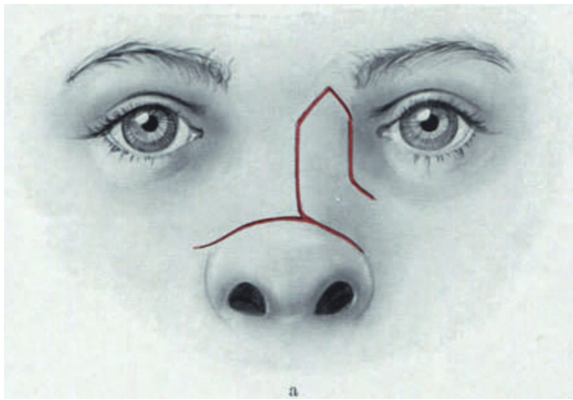
Fig. 363. Lengthening the columella according to R. Meyer

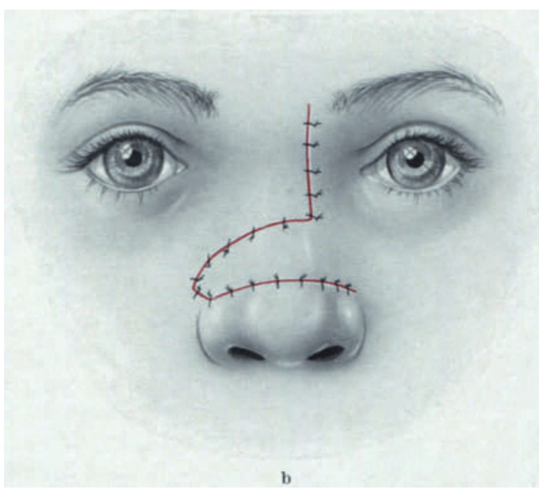
In a case of severe bifid nose with median cleft lip, Kazanjian and Holmes were only able to bring the two parts of the nose closer. In a second stage operation 3 years later, when the patient was $3^1/_2$ years old, they completed the union of the alae.

Stupka also named teratoid tumors and hereditary tumors as causes of bifid nose. These tumors occasionally occur on the nasal dorsum and are then capable of causing a median nasal furrow by means of their interposition. Picker also had the same opinion, basing it on his own observations. These are extreme forms of this malformation which almost belong in the section on monsters and are only rarely encountered in children who are capable of living. The cases of median nasal cleft combined with teratoma formation described by Trendelenburg, Stewart and Kredel have already been mentioned. In these the teratoma located in the region of the cleft is the cause of the malformation. Stupka described a case of human arhinencephalia with partial defect of the middle nasal process and median cleft lip. This serious malformation, which was not compatible with life, was combined with complete bilateral obstruction of the choanal region by solid bone (maxillary, palatal, and sphenoid bones). In the brain the corpus callosum was lacking.

A few years ago there was the case of a 2-month-old boy who, at this time, is still living. He had aplasia of the nose with pronounced hypertelorism and median cleft lip, combined with absence of the great transverse commissure between the two hemispheres (corpus callosum). Bell and van Allen pointed out that the embryologically interesting combination of external malformations with absence of the corpus callosum has been observed several times. This combination of malformations is not only embryologically important but is also important for limiting the indication of plastic surgery in congenital anomalies. The child described by Bell and van Allen was not given any plastic correction of the central facial area because of the poor neurological prognosis. The malformation of the brain was proved by means of a pneumoencephalogram. We also believe that proof of brain malformation as secondary findings contraindicates surgical treatment of facial malformations. The diagnosis of absence of the corpus callosum can be decisive for treatment in the case of such external malformations.

In our publication of 1956 (R. MEYER) we also described such a case of monsterism which, however, was not combined with absence of the corpus callosum. It was a dysplasia of the external and internal nose due to interposition





Figs. 364a and b. Rhinoplasty after removal of a lipoma. a Transposition flap from the lateral nasal wall for lengthening the nasal dorsum. b Flap sutured. The nasal tip is thereby advanced downward

of a tumor, as described by STUPKA. The 3-month-old boy had a large lipoma in the middle of the face which displaced the orbits to a pronounced hypertelorism and also forced the nostrils apart (Fig. 362). The normal structure of the nasal cavities was entirely absent. The region of the nasal cavities was completely filled with a partly spongious, partly sclerotic bony mass, which left a narrow slit open on either side as a nasal lumen. The narrow nasal passages could be probed from the nostrils which were a great distance from each other. There was hardly space for a thin catheter. Nasal bones were completely absent. Ethmoid cells and small maxillary sinuses were present. There was a minute sphenoid sinus, but the frontal sinuses were missing. The floor of the anterior cranial fossa was very deep in the region of the cribriform plate. Neurological symptoms were lacking so that facial surgery was indicated. The now 10-year-old boy has developed very well mentally, so that the series of corrections was worth it.

Fig. 365. Formation of a star-shaped flap on the upper lip for lengthening the columella. Incision along the side of the nose for lengthening the nose

Figs. 366a and b. a Incision seen from the side. b Flap for raising the nasal tip and lengthening the columella sutured

The first operation was for removal of the large prenasal lipoma. A flat nose resulted from this. 2 years later the interior of the nose was treated. The central bony mass had to be removed. A septum could not be formed from the partially spongious bone. On the other hand a bone graft was reimplanted anteriorly in the region of the columella as a bridge on which the external nose was later constructed. The nostrils were brought closer together. A kind of columella was formed by rotation of two flaps from the upper lip an suturing them one above the other. This procedure was used 1 year later by Marcks and his colleagues for lengthening the columella in cases of bilateral harelip nose (see Figs. 318 and 363). The walls of the newly created nasal cavity without septum were covered only minimally with mucosa. As a result the bare surfaces of bone were soon covered with foul-smelling crusts and an ozena-like condition developed. However, after 1 year the entire cavity was epithelized and the crust formation disappeared for the most part. Then one could begin modelling the external nose. First skin had to be provided in the region of the dorsum so that a prominent tip could be formed from the flat nose. By means of a transposition flap skin was obtained on the length of the nose at the cost of the width (Fig. 364). After another year the nasal tip was formed after the method of BROWN (Figs. 365 and 366), which is primarily for correction of harelip nose (see p. 242, Fig. 310). Now that the skin was no longer stretched flat, it could be lined with a support. At intervals of about $1^1/_2$ years thick implants were placed in the nose. The first was Acrylith, the second Polystan and the third rib cartilage. For insertion of the implant each time the still overly wide columella was incised all the way around and swung upward and narrowed before being resutured. In this case we obtained cartilage from the 7th rib on the right for the first time in a boy who was only 8 years old. Today the reconstructive nasal surgery on this boy has reached a satisfactory point. Naturally further corrections still must be made.

In 1959 KITLOWSKI published a similar case in which a large cyst occupied the entire region of the nose and the center of the forehead, preventing union of the two halves of the nose. The bifid nose of high degree with a tumor was combined with a median cleft lip as in the cases of FEMENIC and of BELL and VAN ALLEN. This boy who was born 7 years before publication of the case had normal mental development, so that facial surgery was begun at 5 years of age. First the cleft lip and palate were closed and the cyst removed. Nasal corrections must still be made, but with the presence of a high degree of hypertelorism, the conditions can be improved only to a certain degree.

b) Double formations

Double formations of the nose are not known in the literature of plastic surgery. Therefore the reader is referred to the summary of ZAUSCH in the textbook for diseases of the ear, nose and throat by DENKER-KAHLER. A case with two noses, two mouths and two tongues observed by LOW should be mentioned here.

UNGERECHT reported on a partial duplication of the external nose in an 18-year-old male, which was corrected by us (H. J. DENECKE). One external soft nasal structure overlaid another. The actual nose containing the lower and upper lateral cartilages was overlaid by another part of the external skin like a foreskin. Only the inner part of the nose contained cartilage. The case presented no surgical problem. The pocket which was lined with delicate epithelium was removed. As this was done the epithelium had to be removed carefully from the nasal cartilage and the inner surface of the foreskin-like layer. After this raw, epithelium-free surface was created, the external part was sutured in the region of the columella and the rims of the alae so that the lower lateral cartilage lay just beneath the skin. Smaller postoperative corrections in the region of the columella and the alar attachments completed the treatment.

c) Lateral nasal clefts

For this rare malformation as well, only a little information is to be found in medical literature concerning surgical correction. According to STUPKA only 20 cases were known up to 1950. The publication of the first case probably was by NASH in 1898.

The cleft is triangular and extends from the ala more or less toward the nasal root according to the degree of severity. GRÜNBERG described a very slight case with scar formation in the skin of the lateral nasal wall.

The "congenital notch" in the ala as mentioned in Anglo-American literature is regarded as a slight degree of lateral nasal cleft. It can be eliminated by combination of advancement flaps and Z-plasty (GRIFFITH) (see p. 339) or by means of other replacement surgery as described in the chapter on reconstruction of the alae.

In 1954 TENNISON and WALLER showed a simple procedure for elimination of lateral nasal cleft. A full-thickness flap in of the ala at the upper and lateral border of the cleft was rotated downward to the proper level of the rim of the nostril. The flap was sutured here medially to the tip. The newly created upper defect was closed by means of a rotation flap from the upper lateral wall of the nose as by KAZANJIAN. This method will be described in more detail in the discussion of reconstructive surgery of the alae (see p. 344). Other methods from that chapter can also be used for the correction of congenital lateral nasal cleft.

A correction similar to that of TENNISON and WALLER was published in 1958 by FILATOV.

The malformation called "naso-maxillary cleft" in American literature is to be regarded as a more extensive form of lateral nasal cleft in this context (WARREN, DAVIS, KEITH, GUNTER, etc.).

GUNTER differentiates between two groups in this anomaly. In the first the cleft runs through the lip, the base of the nose, and the displaced alae. In the second it runs diagonally next to the alar attachment with normal formation of the nose. Usually a lid coloboma is combined with this. No particular techniques other than the customary plastic procedures have been recommended for treatment of this. GUNTER also points out that one should not increase the number of operations at the cost of the patient's well-being.

3. Correction of congenital malformations related to facial clefts

a) Correction of nasal aplasia

This malformation is extremely rare. In the work by ZAUSCH only one case of absence of the nose has been described. In this anomaly kept at the Dresden Institute of Anatomy both the external and internal nose were lacking.

According to information given by TRENDELENBURG, MAISONNEUVE is said to have treated a 7-month-old child whose external nose was completely missing. Only two 1 mm wide nostrils 3 cm apart were present. MAISONNEUVE is supposed to have enlarged these and used the central part of the upper lip to form the nose.

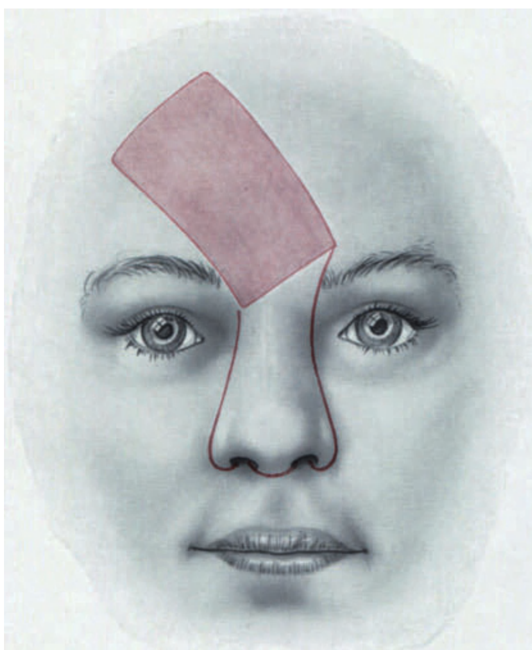
In a case of nasal aplasia described in the textbook by BROWN and McDOWELL, the external nose is entirely absent. In addition, no nostrils are present (Fig. 367). The nasal cavity had to be created with the chisel and lined with THIERSCH grafts. A diagonal forehead flap was used for construction of the external nose. In 1956 PEET reported on a case of congenital absence of the nose.

One case of unilateral congenital nasal aplasia is described in the textbook on plastic and reconstructive surgery by FERRIS SMITH. On one side the external part of the nose was lacking, together with the nasal cavity and sinuses. However, information about the plastic reconstruction of the absent half of the nose is not given.

b) Correction of proboscis lateralis

This malformation is characterized by a trunk-like or club-like appendage which hangs down in the region of the inner canthus, and sometimes in that of the outer canthus of the eye (Fig. 368). It can be joined with the lateral slope of the nose. Developmentally this malformation is related to facial clefts and is regarded as a variety of median nasal cleft. According to ZAUSCH the trunk formation is supposed to come from the genetic part of the nose on the same

a

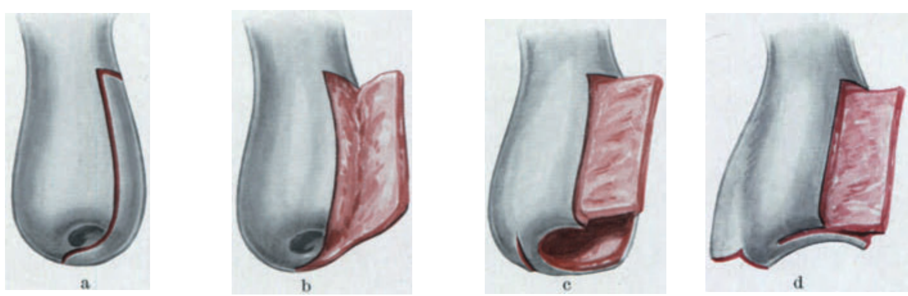


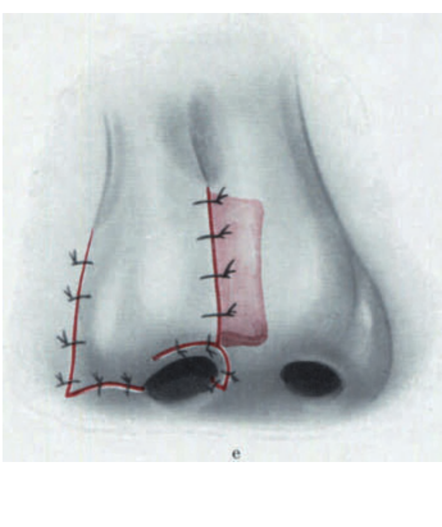
b

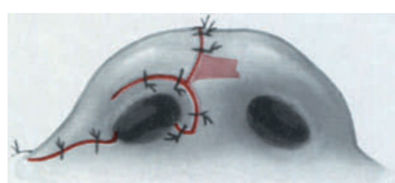
Figs. 367a and b. a Aplasia of the nose. b Correction by BROWN and McDOWELL. After creating the nasal cavity and lining with a THIERSCH graft, an oblique forehead flap is used to reconstruct the external nose

side, which actually should have been used only in forming the rudimentarily developed half of the nose.

Fig. 368. Proboscis lateralis

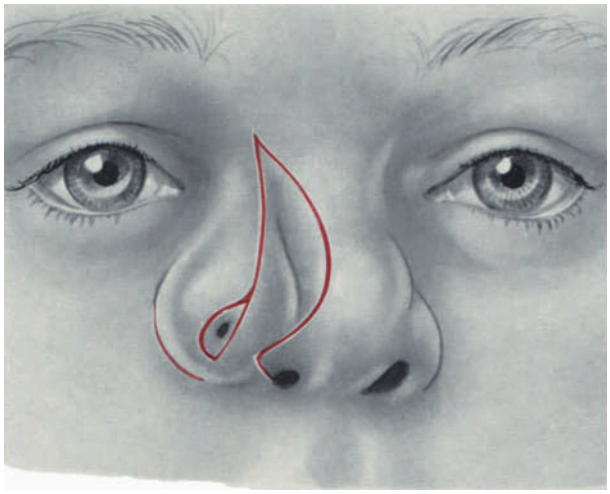






Figs. 369a—f. Proboscis lateralis operation by YOUNG. a Incision on the trunk-like formation. b Formation of a skin flap. c Opening the trunk-like formation. d Flap folded back so that it can be sutured into the nasal wall. e The trunk-like formation prepared in this way is sutured. f View from below

About this, as well, little information is to be found in literature concerning plastic correction. In the Denker-Kahler textbook, Zausch described one case each of proboscis lateralis by Kirchmeyer, Longo and Selenkoff. In 1935 Gusic reported a case of this malformation. In the specialized textbook on



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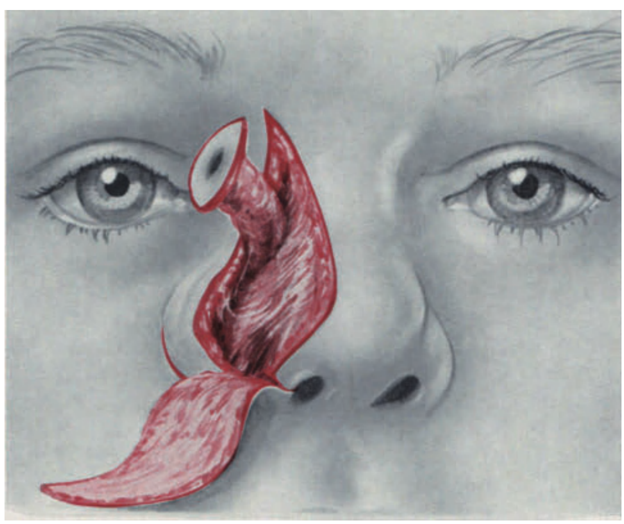


b

Figs. 370a—c. Correction of proboscis lateralis by R. Meyer. a Incision. An incision is made around the opening of the fistula. b The fistula is dissected out and a skin flap is formed which is used for the lateral inner lining of the nasal cavity

dental, oral and maxillary-facial surgery by Rosenthal, one case is illustrated with only a hint of proboscis lateralis. None give any reports concerning surgical treatment. One case of proboscis lateralis by Hartmann from 1939 is known.

The first publication about proboscis lateralis known by us in which correction is mentioned is by F. Young (1949). The surgical procedure of Young is simple (Fig. 369) and leads to a good result even in a one-stage operation.

One swings the trunk upward and spreads out the duplicated skin to form the missing ala on the side of the malformation where aplasia exists, as in the case by FERRIS SMITH. HOLMES (1950) published a similar case as triple "nose". He gives information about plastic correction of the malformation. One nostril was formed from two. The skin and the mucosa could be saved for the most part. The lower lateral cartilages were likewise not disturbed.

In the same year the surgical plan for correction of the malformation was described in the textbook for plastic and reconstructive surgery by FERRIS SMITH and was based on a case. A boy who had a large lateral trunk-like formation, also had an aplasia of the external and internal nose including sinuses on the side with the proboscis. He was treated surgically at the age of 1 year. The proboscis was attached as the right half to the normal left half of the nose. The

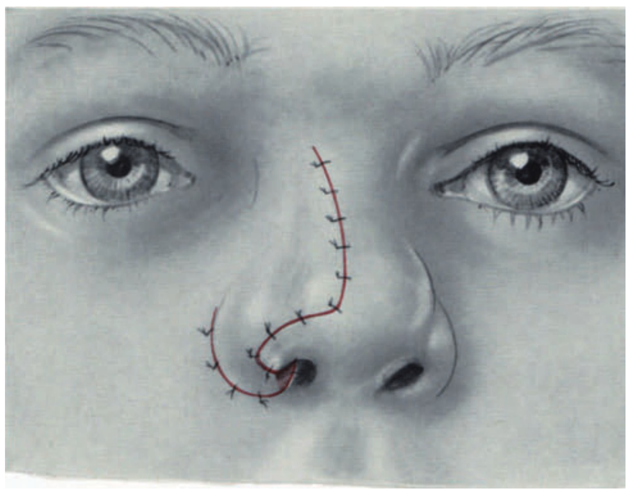
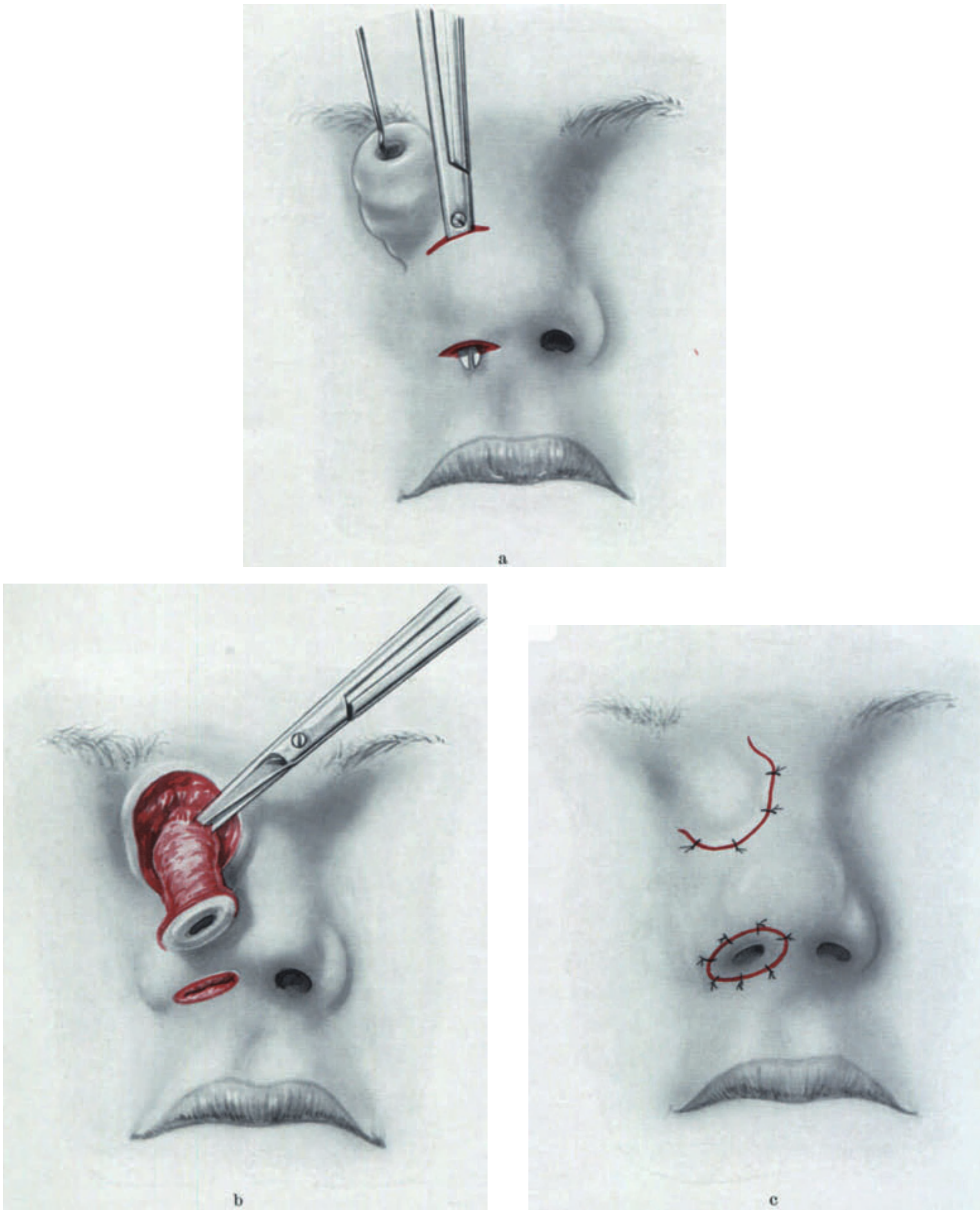


Fig. 370c. Situation after the flap has been swung inward and the external wound has been closed

skin of the medial surface of the proboscis was used to line the nasal vestibule. After 3 months the lacrimal duct was sutured in and excess connective tissue excised. In the third stage $1^1/_2$ years later glabellar scars were corrected and a cartilage graft was inserted into the columella. In the same year a cartilage graft was implanted in the ala on the side of the malformation. In the 5th operation $^1/_2$ year after that the infraorbital region was corrected by means of lining with dermal flaps.

In 1956 we (R. MEYER) also added a case history to this type of nasal malformation. At that time the child, about whom we reported, had not been treated surgically. In making the plastic correction the method of YOUNG was modified. At the time of surgery the child was $1^1/_2$ years old. The left side of the nose was normal externally and internally. The right side was much smaller than the left. On the right side the pear-shaped trunk hung down from the inner canthus of the right eye. It was joined to the nasal skin as far as the ala. The right nostril was only about 3 mm in diameter. The proboscis had a narrow hole which opened into a fistula about 2 cm long. There was also a coboloma of the eye on the side with the proboscis. First the fistula was excised and the trunk swung upward (Fig. 370). At the same time a skin flap pedicled at the base of the right ala was raised from the anterior surface of the ala, and the lateral wall of the nasal cavity was split. The skin flap was used for lining the lateral wall of the nasal



Figs. 371 a—c. Management of proboscis lateralis according to RECAMIER and FLORENTIN. a Tunneling the nasal skin in the direction of the future nostril. b Removal of the skin covering the trunk-like formation. c Situation at completion of the operation. The trunk-like formation is drawn through the tunnel and its end is sutured in the region of the nostril. The base of the proboscis is covered with a skin flap which comes from the original covering of the trunk-like formation. Danger of stenosis formation exists if the tunnel is not split toward the interior of the nose and appropriately sutured to the epithelium of the nasal cavity

cavity. It was swung downward and then rotated into the interior of the nose. The inner lining was fixed with mattress sutures passed through the new ala. The remaining lateral skin of the trunk was then spread on the nose and sutured as far as the enlarged nostril. The very narrow nasal cavity was considerably enlarged by the operation. Both nasal cavities were then packed with petrolatum gauze.

In a case by McLaren the polypoid appendage was attached in the trochlea area with such a narrow base that its removal presented no difficulties. The malformation was combined with a unilateral cleft lip and palate which was also closed surgically.

In a later case publication by Colonna and Costa the removal of the appendage and the plastic covering are only mentioned. The appendage displayed one nasal opening too many and one superfluous ala without any connection with the respective nasal cavity.

At the French convention for plastic surgery in 1956 Recamier and Florentin reported an operation on an infant with a unilateral tube nose ("hémi-nez en tube") and with multiple other facial malformations (Figs. 371a—c). Among secondary findings there were cleft of the lower jaw, median cleft of the lower lip, tongue-tie, a cyst in the cheek, a median fistula in the upper lip, and a coloboma. The trunk was brought into the area of the missing nostril by means of subcutaneous tunnelling and sutured. Later, however, a strong tendency toward stenosis occurred in the surgically treated right nasal cavity. For this reason it was necessary to split the tunnel and bring it into contact with the epithelium of the nasal interior. — Longo, Leto and Nessel remove the trunk without using it in the plastic operation of the unilateral nasal aplasia.

Scherbatov described two cases with the rare malformation of noses with three nostrils, which, at most, are similar to the case described by Holmes. A case of lateral alar cleft, one of bifid nose, and one with a rudimentary nasal vestibule on one side are mentioned as further anomalies. Information about surgical technique was not given.

c) Correction of nose in bilateral facial cleft

We have no experience with the plastic procedure in this extreme serious facial malformation and have found information about it only in a treatise by Guilleminet, Rougier and Gate. Bilaterally there was a lid coloboma, as is usually found in this malformation. Surgery was first performed when the child was 10 months old. Three operations followed until the age of 2. The bilateral cleft lip and palate were closed and the facial clefts covered. The lid colobomas were corrected by means of flap surgery. The nasal cavity was separated from the pharynx by a 1 cm thick bone. The nasal opening was bilaterally very small. Keeping the nostrils open later proved to be very difficult.

d) Removal of median nasal fistulas and dermoid cysts

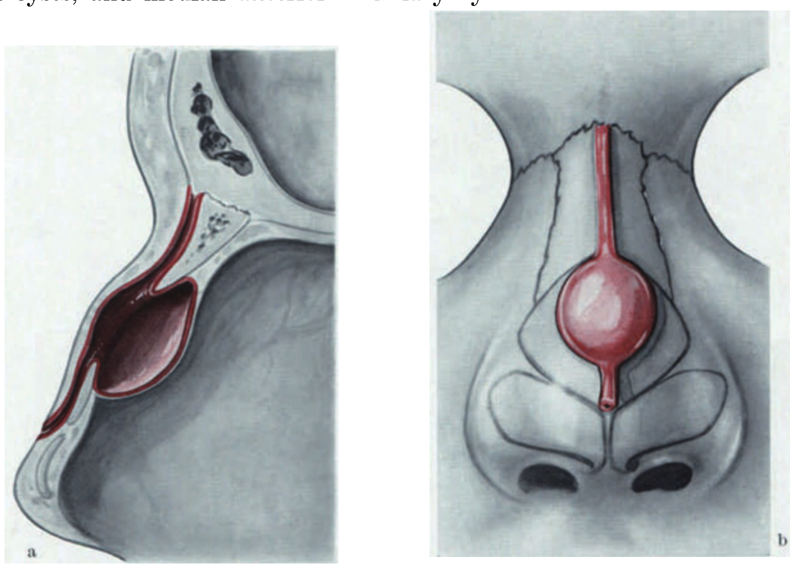
Congenital nasal fistulas and dermoid cysts of the nose are not as rare an anomaly. They are mentioned in the literature of this century, especially in the publications on oto-rhino-laryngology. There have been reports on this subject in the literature of plastic surgery during the past 15 years.

In 1937 New and Erich gave a survey of dermoid cysts on the entire body. 103 of these affected the region of the head and neck. Of these 13, or 12.6% affected the nose. Most of them are located in the bony part of the nose, in the dorsum.

The first case of dermoid cysts in the nose was said to have been published in Germany by Bramann in 1890 and in the USA in 1901 by Birkett. In 1948, according to Ryan, 80 cases were known. It must be kept in mind that certainly not all cases of observed and surgically treated fistulas and cysts were published.

In 1953 KLESTADT published a sketch with the positions of cysts in the face, particularly in the nose, and their relation to various embryonic facial clefts. In general, embryologic displacement of epidermal elements during the intramembranous growth of the nasal bones is assumed.

According to KLESTADT one differentiates between the following cysts of the central part of the face related to facial cleft: median upper cysts of the nose with corresponding fistulas which lead to the dorsum in midline; cysts of the naso-ethmoidal facial cleft; cysts of the subalar facial cleft; glabello-maxillary cysts or cysts of the cleft lip and palate; premaxillary cysts; cysts of Jacobson's gland or nasopalatal cysts of the nasal floor; intermedian nasopalatal cysts; cysts of the incisive foramen; cysts of the palatine papilla; median posterior palatal cysts, and median anterior maxillary cysts.



Figs. 372a—d. Operation to remove a median nasal cyst and fistula with an opening above the nasal tip. a Side view before the operation. b Front view before the operation. The fistula is above the nasal bones. c The cyst has been removed, and the resulting cavity has been filled with cancellous bone. d Situation upon completion of the operation

Differential diagnosis calls for mention of postoperative paranasal cysts (NOMURA and KOIZUMI). The fistulas which lead to upper median dermoid cysts of the nose are located in the midline of the nasal dorsum. The fistula ducts generally run upward under the skin, through the internasal or naso-frontal suture, or they lead around the caudal end of the nasal bones to run under the (nasal) bones for some distance (Fig. 375). They can end blind if no dermoid cyst is present, in which case they are not joined with the nasal cavity or with the sinuses; or they lead to dermoid cysts, which are usually located deep in the septum, the ethmoid, or in the region of the frontal sinus. The can also lie along a bone suture like a "cul de sac" (Fig. 372).

Diagnostically the lateral X-ray view is very useful in determining the extent of the fistula when the fistula passage is filled with a contrast medium like Lipoidol.

SCHWARTZMANN and DAVIS object to the use of this diagnostic contrast filling because it can sometimes cause lesions of the fistula if too much pressure is applied during the instillation. The plain X-ray may show a thinner section of bone in the region of the dermoid cyst.

Nasal fistulas and dermoid cysts are removed surgically for cosmetic reasons and also because of the danger of infection, and deep cysts because of the danger of an infection ascending toward the meninges.

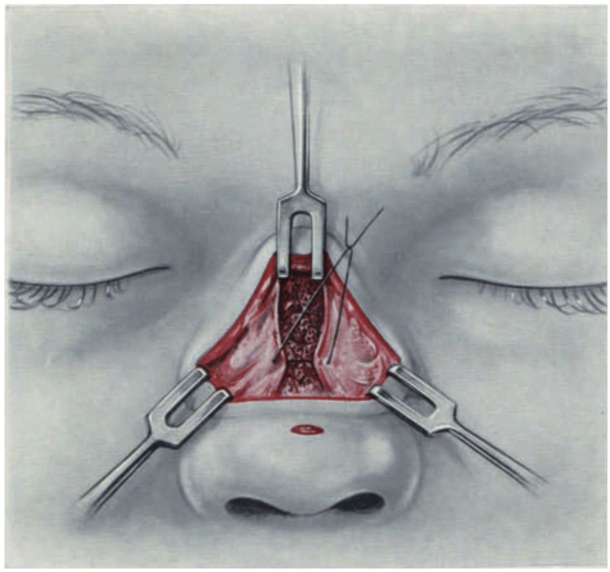


Fig. 372c

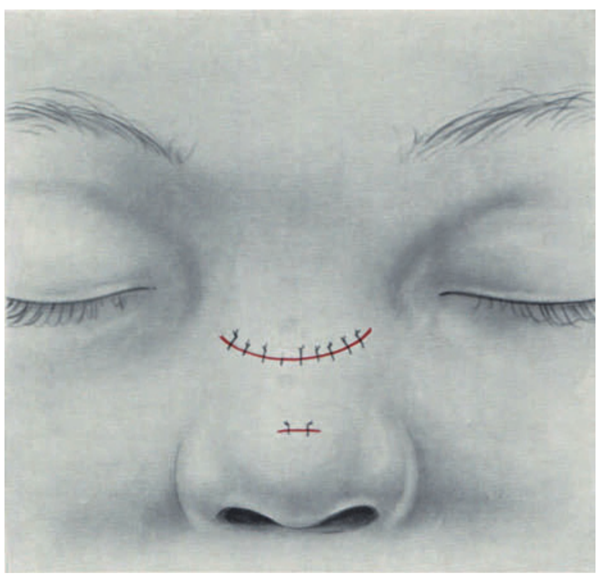
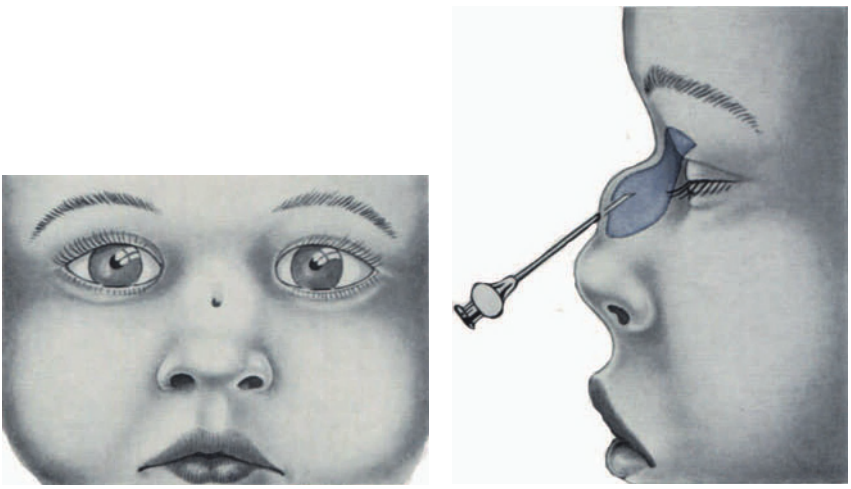


Fig. 372d

Before surgery it is helpful to fill the fistula with an aqueous solution of methyl violet. When doing this one must make certain that the gentian violet does not create a new passage outside the fistula due to too much pressure with the syringe (Fig. 373).

Surgical treatment consists of complete extirpation and removal of the fistula with all of its branches together with the attached cyst. In our opinion coagulation and cauterization with acids do not lead to a lasting result. We reject for example, preparing the fistula with a scalpel and cauterizing with trichlor-acetic acid, as described by MASSON.

In our cases we have proceeded basically as follows: A long, oval incision is made around the opening of the fistula in midline; the fistula is followed carefully through or around the bone and underneath; the cyst, if it is present, is dissected out with a blunt instrument. The cyst should remain intact if possible, so that the semifluid dermoid substance does not escape during the operation. Splitting the nose in the soft tissue region, i.e. an incision in the nasal skin in midline on the dorsum down to the bone is usually necessary to follow the fistula.



a b

Figs. 373a and b. a Median nasal fistula. b Coloring the fistula with methyl violet under gentle pressure

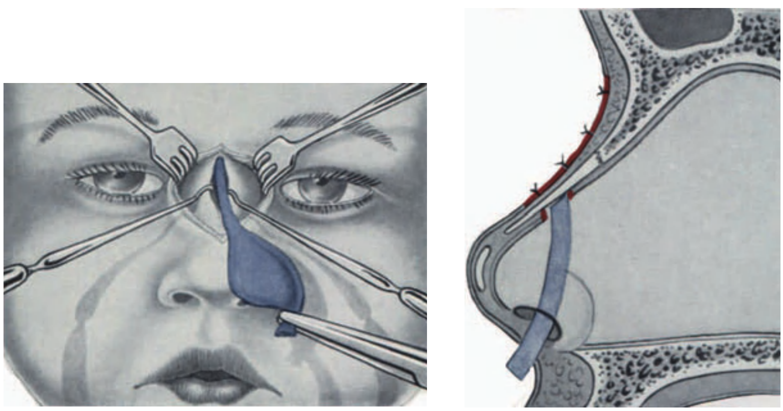
Sometimes one must follow the fistula through the bones or more deeply into the septum by spreading apart the upper lateral cartilages. A recurrence is not to be expected with absolutely complete removal of the epithelium from the fistula (Figs. 372c and d, 374a). Diverting the cystic cavity into the nasal cavity also prevents recurrence and guarantees primary healing (Fig. 374b).

In larger dermoid cysts at the nasal root an inverted U-incision, as described by BRYANT, is indicated. In individual cases, if no fistula is present, the intranasal approach from the intercartilaginous incision can be chosen as described by MASSON and JUERS. On the other hand if there is a fistula, we think this approach is inadequate.

Deep adhesions like fibrous strands must be released or removed at the same time. Excisions on the upper lateral cartilages or at their transition to the septal cartilage may possibly have to be made, as in the cases described by J. K. CRAWFORD and WEBSTER. J. K. CRAWFORD and WEBSTER also show the possibility of a curved incision on the nasal dorsum. By swinging the flap upward, better viewing and a free approach to the deeper parts is possible.

After excision of the dermoid cyst or even only of the fistula if the cyst is absent, a defect and therefore a depression usually occurs on the nasal dorsum. This must be filled with subcutaneous tissue, muscle-fascia flaps, or with cartilage or bone. Into the defect area we have usually rotated a unilateral or bilateral flap of subcutaneous tissue and muscle fibers from the pars transversa of the M. nasalis from the lateral slope of the nose or from the M. procerus from the nasal root, either with or without fascia or underlying periosteum. CRAWFORD and WEBSTER have described cases in which they filled the defect with bone chips. H. CRAWFORD and his colleagues advise correction of the depression of the dorsum by means of filling during a later sitting rather than immediately. They also use flaps from the surrounding tissue or grafts of bone or cartilage.

Naturally the defect which is to be filled should be as small as possible. A cosmetic deformity should not be created unnecessarily by the removal of larger portions of the nose. By means of approximation and suturing of soft structures and possibly also of the upper lateral cartilages severed at the septum, the disturbed anatomical relationships can be restored. — If the duct extends upward



a b

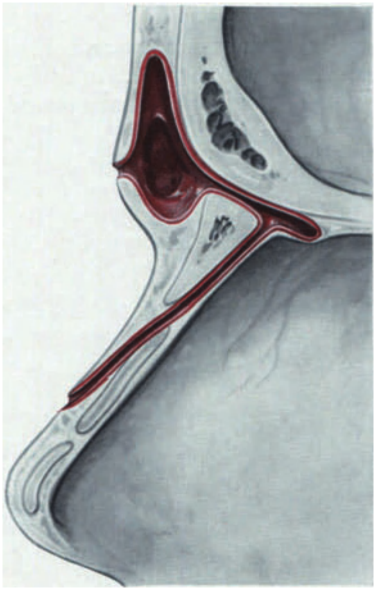
Figs. 374a and b. a The sac of the cyst is dissected out and the nasal bones are drawn apart by means of dermal hooks for better viewing. b The cavity which formerly held the cyst sac can be drained into the nose

into the region of the base of the skull, then caution is advised when dissecting to prevent injury to the dura. In a more extensive malformation one can make the cavity of the fistula or dermoid cyst into a part of the nasal cavity by means of resection of the wall next to the nasal lumen (DENECKE).

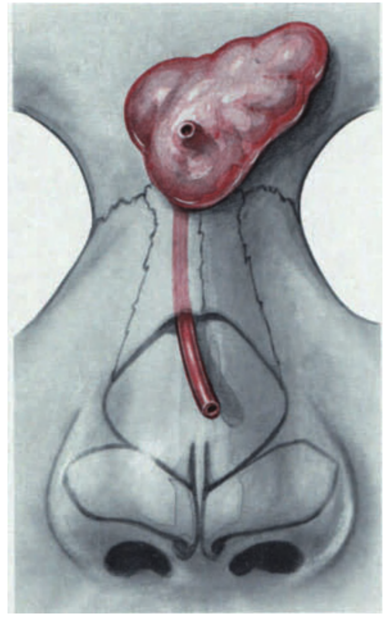
If the fistula has formerly been treated surgically, the procedure is more difficult because of scars.

In most of our cases we have not closed the vertical incision on the nasal dorsum simply but have used a Z-plasty. This procedure avoids a contraction of the surgical scar, as described by PELLICCIA as well.

At the close of this chapter two more cases by J. K. CRAWFORD and WEBSTER are included. They are interesting with regard to localization of the cyst and the fistula and thus to their surgical removal. The first case is that of a 22-month-old boy with a dermoid cyst on the forehead and a fistula with the opening on the dorsum. Neither the cyst nor the fistula were connected with the frontal sinus. The glabella was scarred and in this scar there was a small opening which led into the dermoid cyst. A short duct led from the cyst through the naso-frontal suture into the basal bone of the frontal sinus but not into the sinus itself. A long duct ran downward under the nasal bone paramedially and ended in a pore in midline on the dorsum over the caudal part of the upper lateral cartilage. The scars on the nasal root were removed, and the cyst dissected out. To follow the



a



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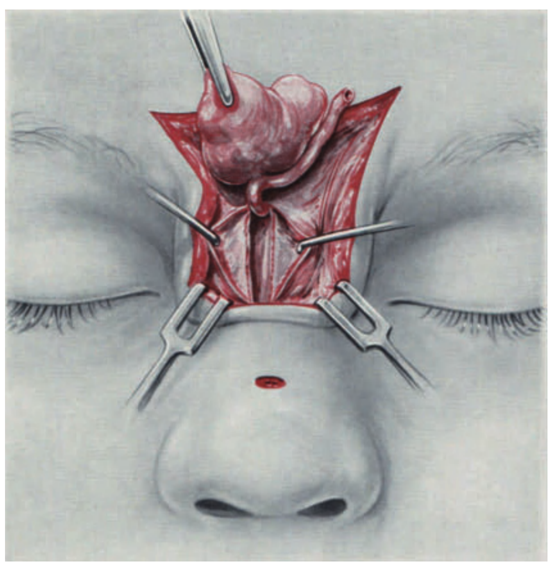


c

Figs. 375a—e. Median nasal fistula and cyst (J. K. CRAWFORD and WEBSTER). a Side view. Median nasal fistula runs upward to the basal bone of the frontal sinus; cyst and fistula in the region of the glabella. b Front view. The fistula runs under the nasal bones. c Extirpation of the fistula and the cyst in the region of the nasal root. d The nasal bones are sutured; the defect is covered by closure of the periosteum. e The naso-frontal angle is newly formed by means of appropriate suturing of the periosteum and closure of the fistula opening on the nasal dorsum

fistula one had to remove the medial part of the nasal bones. After careful extirpation of the fistula down to its opening, the bony cover removed was replaced. The periosteum over the nasal root, the fascia of the M. frontalis, the scar excision wound over the nasal root and the fistula excision wound on the dorsum were sutured (Fig. 375a).

The second case by J. K. CRAWFORD and WEBSTER which is worth mentioning is that of a 26-month-old boy. He had an epidermoid cyst in the middle of the dorsum at the caudal border of the nasal bone. The cyst extended upward under

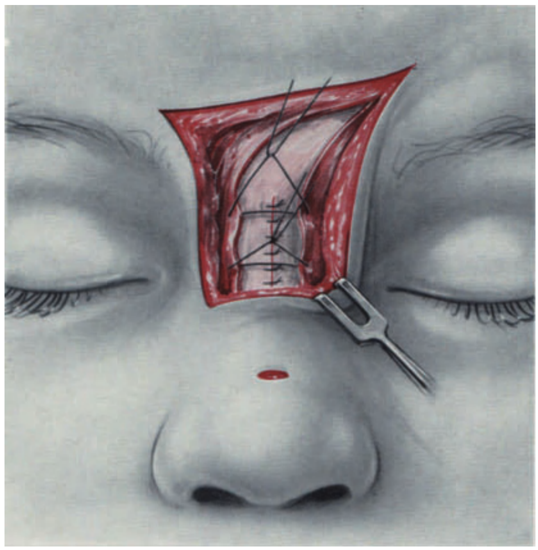


Fig. 375d

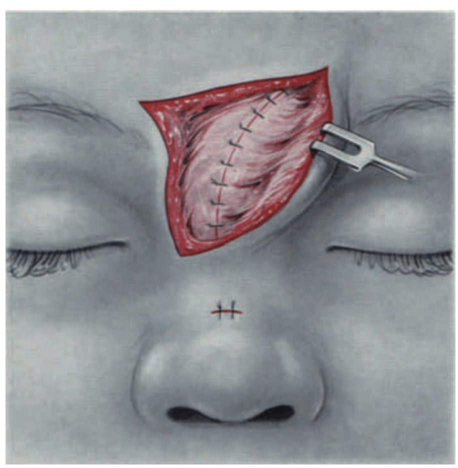


Fig. 375e

the nasal bones like a "cul de sac", spread the upper lateral cartilages apart laterally and turned their medial border upward. It was connected with a coarse strand which ran in midline over the internasal suture to the naso-frontal suture and probably represented an obliterated fistula. A real fistula ran downward to an opening just above the nasal tip. For surgical treatment, a curved incision with the convex side down was made over the middle of the dorsum. The nasal bones had to be partially resected in their lower part to expose the cyst. After removal of the cyst its bed was filled with the bone chips from the resected part of the nasal bones. Subcutaneous tissue was approximated over this and sutured along with the curved incision.

To prevent scars on the dorsum and to proceed with as much cosmetic care as possible, BERENDES approached the fistula from curved incision at the vestibule by means of decortication (ŠERCER). This procedure definitely permits good viewing and certain removal of the epithelium in the region of the nasal root, if the skin covering of the nose is swung upward far enough.

According to MONTREUIL cysts of the nasal vestibule, to which the cysts of the subalar facial clefts mentioned at the beginning are related, are best removed by approach through the oral vestibule.

e) Correction of other nasal malformations

Other congenital malformations of the nose are unilateral and bilateral harelip noses (see p. 224 and 241), flat nose, microrhinia, absence of the septum, and strands in the nose.

α) Correction of flat nose

This is a relatively rare anomaly of the nose with complete flattening of the bony part, considerable flatness of the nasal tip and very short columella. The problem of treatment is similar to that of compound saddle nose (see p. 183). In the child one must stimulate the growth of the nasal skin by lining the flattened nasal dorsum temporarily. One can start this at 4, 5, or 6 years of age, as shown in one of our cases published in 1956 (R. MEYER).

The patient was a four-year-old girl with flat nose and aplasia of the nasal bones. The soft nasal structures were retruded, and the nostrils pressed flat because of lack of columellar support, which had obstruction of nasal breathing as a result. In order to stretch the skin at an early date and make a definitive support implantation possible without additional skin surgery, we decided to implant a temporary two-piece strut of Polystan. The columellar part of the implant was inserted into a hole drilled in the dorsal part. The columella was incised below and on the sides, separated completely from the septum and swung upward. This is our method for insertion of grafts or implants in saddle nose (see p. 182, Fig. 233). In this way the lower lateral cartilages were spread anteriorly in the angle so that the lower end of the dorsal implant would fit between the medial crura. The medial crura were sutured together with nylon above and below the tip of the implant. The columella was swung downward and sutured. Then the columella was lengthened at the base by means of a V-Y advancement.

β) Correction of microrhinia

This anomaly deals with a nose which is small in all aspects. The various parts of the nose are properly proportioned, but the nose as a whole is too small for the rest of the face.

Here one must provide additional skin in addition to enlarging the support structures. The former can be obtained by means of flap rotation or free skin grafts as in compound saddle nose (see p. 183). For enlargement of the structure, grafts or implants are necessary as indicated in the chapter on saddle nose (see p. 154).

γ) Surgery in absence of septum

MCLAUGHLIN reported on the case of a 13-year-old girl whose septal cartilage was lacking. The author assumes trauma at birth to be the cause. Reconstruction was successful with bone grafting from the iliac crest and composite graft for replacement of the columella.

The reader is referred to the chapter on columella reconstruction below.

δ) Strands in nose

In this anomaly transverse reddish stripes run from one side of the nose to the other at the transition from the middle to the lower third of the nose. They can be congenital or occur gradually with the change in shape of the nostril during puberty. This was assumed by CORNBLEET. They can be eliminated by excision and the defect covered with epithelium.

B. Reconstructive rhinoplasty (replacement surgery)

I. Columellar reconstruction

The statement made by VON MIKULICZ in 1884 is still valid today: "Probably no other defect on the face is as small or as hard to reconstruct as that of the cutaneous septum of the nose." Total defect of the columella can occur as a result of syphilis, trauma, and tumor resection. Reconstruction is done by using parts of the upper lip, the neighboring cheeks or the forehead, or by means of small tubed pedicle flaps from the upper arm or by means of free grafts from the ear.

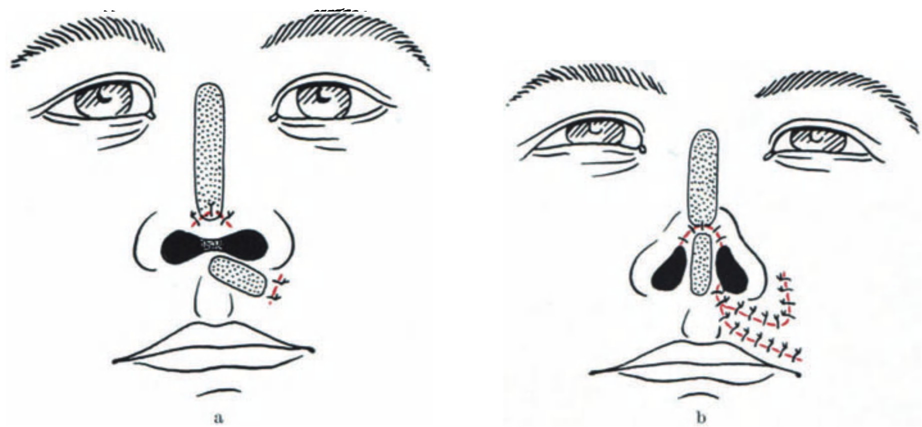
1. Columellar reconstruction with flaps from neighboring area

Sometimes there is only the appearance of a defect of the columella if the columella is drawn upward into the nasal cavity as a result of substance loss in the cartilaginous septum. In such cases one can incise the cartilaginous septum horizontally about 1 cm above the border of the columella. Permits mobilization of the columella and the membranous septum and reposition them downward and forward together with a strip of cartilage. The resulting septum perforation is functionally unimportant. If necessary it can be closed by one of the methods discussed in the chapter on septum perforation (see p. 137).

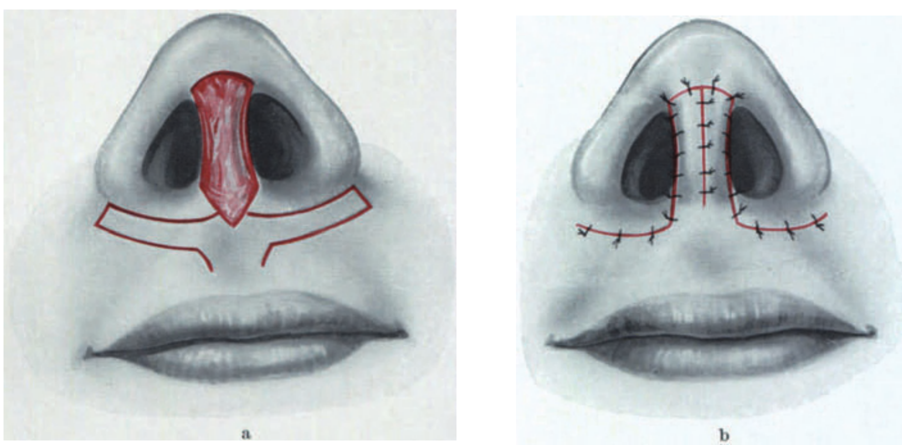
TRENDELENBURG, SZYMANOVSKI and others have used flaps cut vertically from the upper lip for columellar replacement. Some of these old, well-tried methods are still used today.

According to LISTON (1831), V. AMMON, BLANDIN (quoted from LEXER) and DIEFFENBACH, a horizontal flap from the upper lip, with its base in the region of the philtrum, is swung toward the nasal tip (as in Fig. 376). The raw surface faces outward. At that time DIEFFENBACH said this about the method: "The raw surface facing outward dries and assumes the nature of the skin." Certainly epithelization of this raw surface proceeds relatively rapidly, but it can lead to shortening of the columella with retruded tip due to excessive granulation and scar formation. This procedure of LISTON and DIEFFENBACH was improved by JOSEPH. He lined the horizontal skin flap from the lip with a bone graft. From a small incision in the lateral upper part of the upper lip a small bone graft was inserted subcutaneously. In a second stage an incision was made around the bone graft, and the flap with the graft swung onto the nasal tip. The host area had to be prepared accordingly (Fig. 376).

FRICKE and DUPUYTREN did not move the flap by folding it upward but by rotating it so that the skin faces outward. To do this DUPUYTREN formed the flap from the philtrum. A modification of the method of LISTON and DIEFFENBACH comes from DEMONS and RAOULT (1881) (quoted from NÉLATON, OMBRÉDANNE



Figs. 376 a and b. Implantation of a bone graft in the nasal dorsum and formation of the missing columella by means of a transposition flap from the upper lip reinforced with a bone graft (according to JOSEPH). a Bone grafts inserted. b After the pre-formed columella has been swung into place, the donor site is covered with a transposition flap

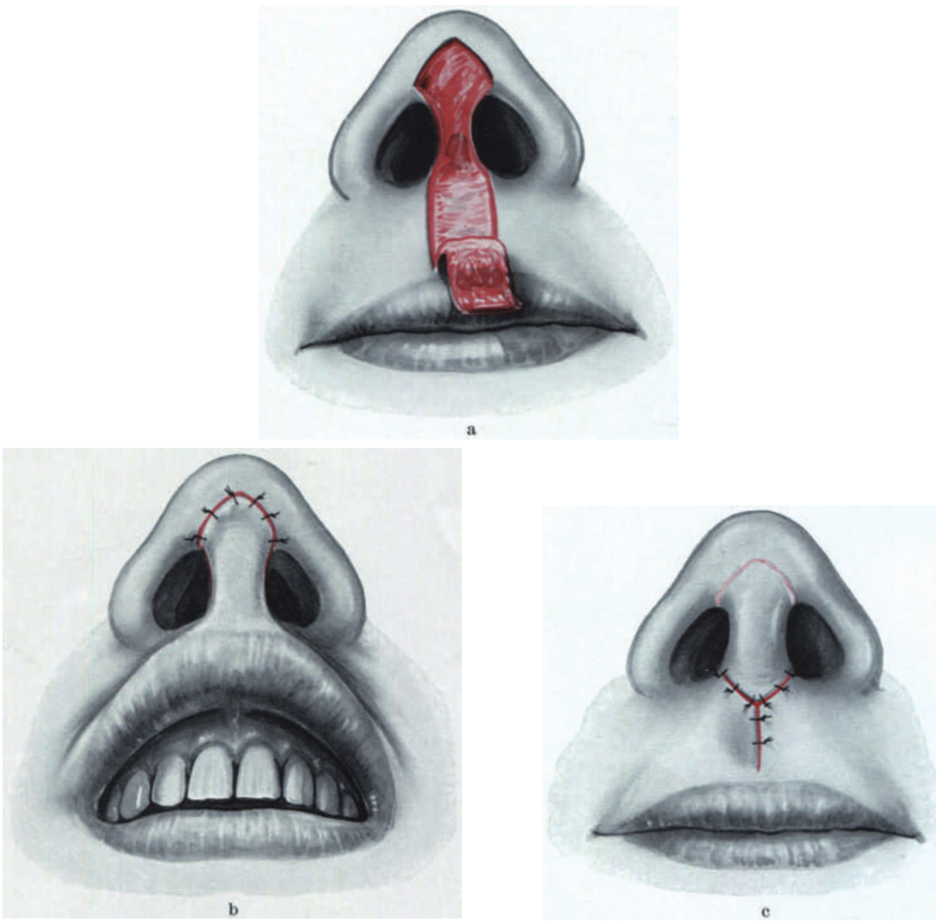


Figs. 377 a and b. Reconstruction of the columella using two horizontal flaps from the upper lip, by DEMONS, RAOULT, GILLIES. a Position of the flaps on the upper lip and defect on the columella. If necessary the incision can be extended to the upper lip in the region of the philtrum. b Situation after reconstruction of the columella; defect and donor sites closed

Figs. 378 a—c. Reconstruction of the columella by GILLIES ("wing flaps"). a The flaps are formed bilaterally on the alar rim. b The flaps are raised and the host site on the columella is prepared. c Situation after covering the defect on the columella and closing the donor sites

and DEMONS). It was taken up again by GILLIES. Instead of rotating *one* horizontal flap from the upper lip onto the nose, these authors raised such a flap bilaterally and sutured them together on the columella (Fig. 377).

Schimmelbusch formed the columella by means of two flaps from the border lining of the piriform aperture (quoted from Lexer). Other old methods by Dieffenbach, Szymanowski, Hueter and Joseph using replacement material from the nose are obsolete because of the disfiguration of the donor areas. Joseph formed the columella with a skin and cartilage flap from the middle part of one ala with the base at the nasal tip. This had to be turned 180° onto the base of the columella. A deforming reduction of the ala is thereby unavoidable, and



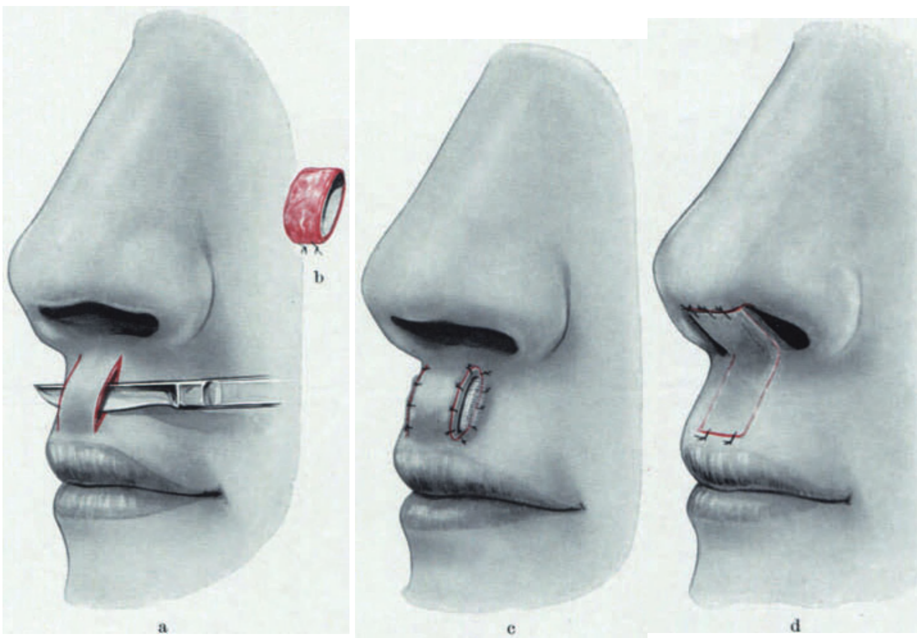
Figs. 379a—c. Reconstruction of the columella with skin from the philtrum according to Serre and Gillies. a Formation of the flap. b Covering the defect by pulling the lip upward. c The flap is severed at its base with a V-shaped cut. This allows the upper lip to return to its normal position. It is sutured and thus receives its original shape

the method is therefore not to be recommended. Dieffenbach, Szymanowski and Hueter even rotated a flap from the nasal tip, and v. Langenbeck one from the nasal dorsum in the region of the columella (quoted from Lexer).

A method of swinging replacement material down from the nose itself without creating any nasal deformity is the so-called "wing flap" of Gillies. Gillies swings a flap from the rim of each ala onto the columella and joins the two flaps there (Fig. 378).

Sheehan and Joseph described cutting and raising a flap in the upper lip while forming a small tubed pedicle flap. When making the suture on the tube one must be sure that the circular tension does not impair circulation even after the expected reactive swelling in the flap. In the region of the attachment of the former columella on the nasal tip, the skin is incised so that the end of the flap can be sutured in midline. The defect in the upper lip is covered with a triangular flap from the cheek or by means of approximation.

SERRE (1857) and later GILLIES devised a method of columella reconstruction from the upper lip in which a median, vertical flap pedicled at the vermilion border is used (Fig. 379a). Its upper end is lifted and sutured in the region of the nasal tip after the bed has been appropriately prepared (Fig. 379b). To relieve tension on the sutures in the region of the nasal tip an adhesive tape dressing



Figs. 380a—d. Reconstruction of the columella using a philtrum flap. a Formation of a bridge flap in the philtrum according to NEW and FIGI. b Muff-like full-thickness skin graft for lining the bridge flap. c The bridge is lined and packed loosely with gauze. d The flap is sutured in as the columella

is applied. In a second stage the pedicle at the lower end is severed and sutured at the base of the columella. The donor site in the region of the philtrum is closed by means of approximation (Fig. 379c).

In 1931 in his treatise on rhinoplasty, SANVENERO-ROSSELLI published an original method of reconstructing the columella. He cuts a vertical bridge flap in the region of the philtrum. THIERSCH grafts are applied to the raw surface under the bridge flap as well as to the donor site. The epidermis flaps are pressed in place with small rolls of gauze. After complete epithelization of the raw surface, the bridge flap is severed at its lower end and folded upward to the nasal tip and sutured there. According to SANVENERO-ROSSELLI a small amount of muscle tissue from the upper lip should also be raised, so that the flap contains more substance.

Of course this procedure is only possible with wide and long upper lips. NEW and FIGI have modified it by lining the bridge flap with a full-thickness skin flap rather than an epidermis flap (Fig. 380). Before inserting it they wrap it around a roll of stent.

A second method by SANVENERO-ROSSELLI is formation of the columella using cheek skin. The flap pedicled in the region of the nasolabial fold, swung onto the nasal tip and sutured there. One month later the pedicle is detached and sutured in the region of the philtrum and the columellar base.

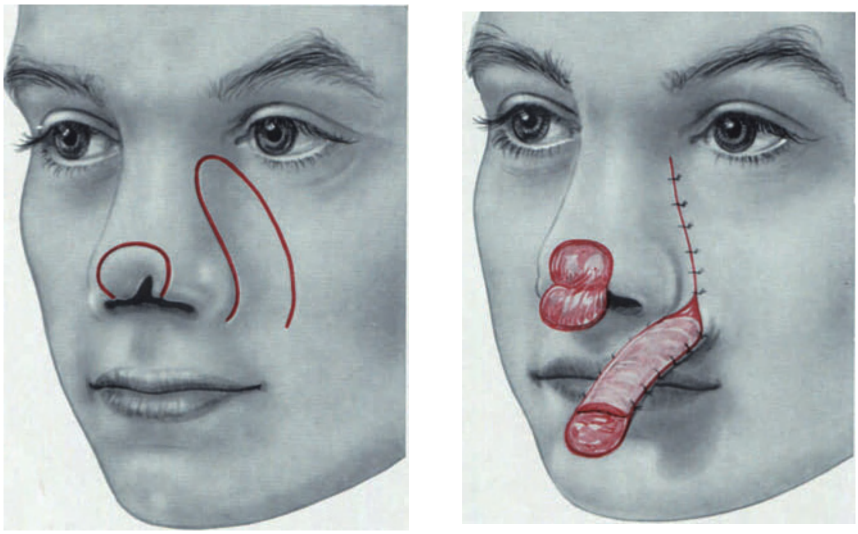
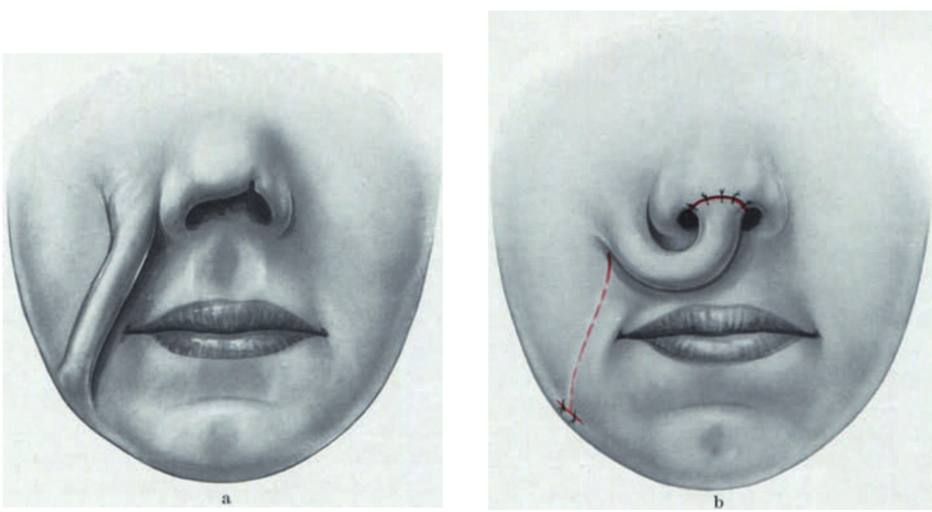


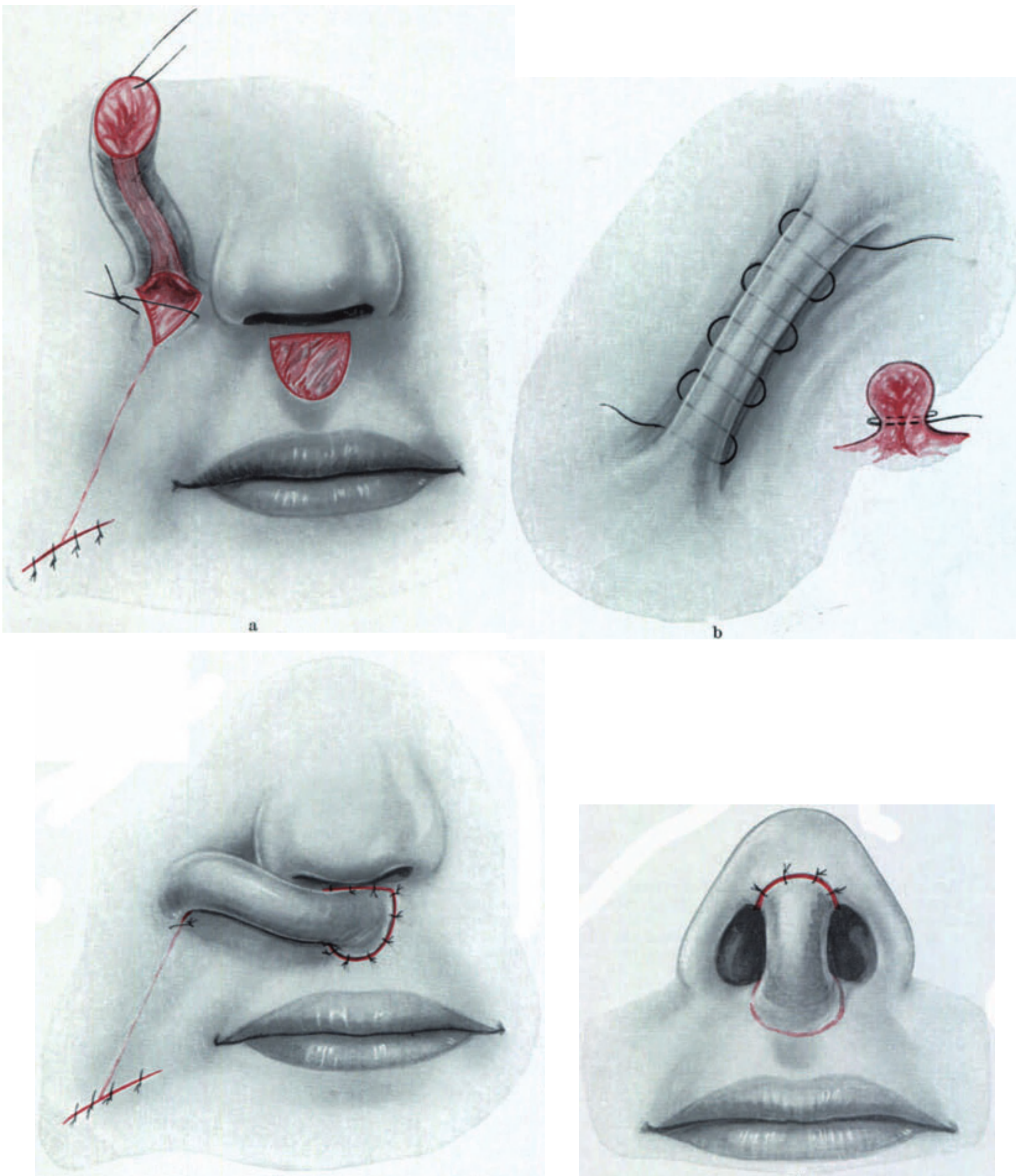
Fig. 381. Replacement of the columella using a flap from the nasolabial fold by SCHUCHARDT. The flap is partially lined with a THIERSCH graft. On the nasal tip a flap is formed which is used as the inner lining of the anterior part of the columella



a b

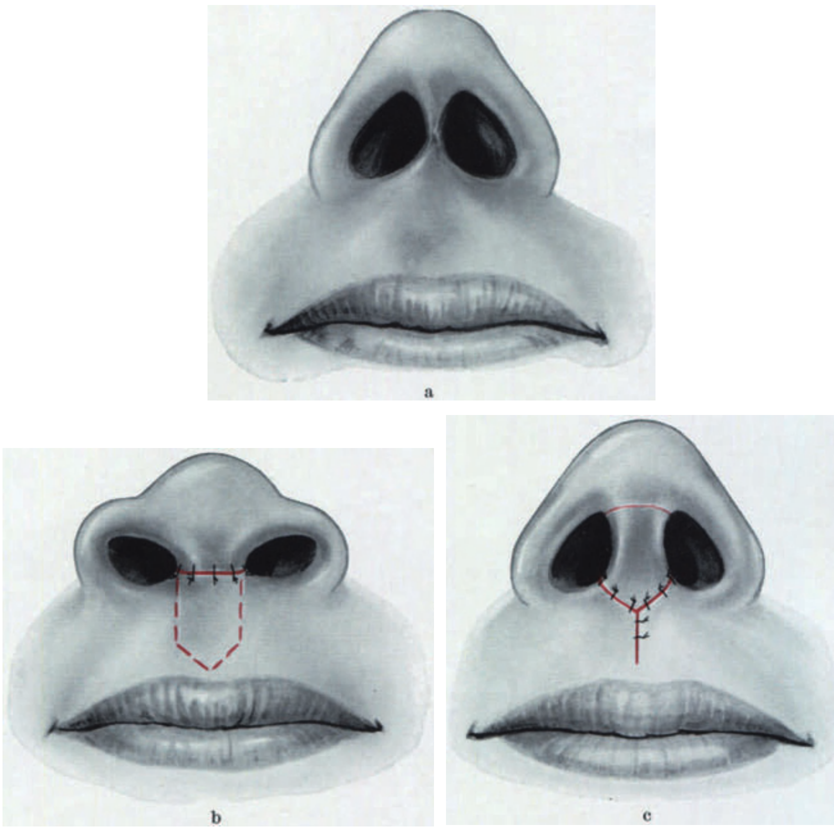
Figs. 382a and b. Reconstruction of the columella using a tubed pedicle flap from the nasolabial fold, according to MALBEC. a Formation of the tubed pedicle flap. b Suturing the tubed pedicle flap in the region of the nasal tip

The method of SCHUCHARDT is derived from this method. A longer flap is formed from the upper part of the nasolabial fold and the slope of the nose (Fig. 381a), in order to avoid a horizontal scar on the cheek. SCHUCHARDT recommends making the flap narrow but at the same time as deep as possible with much fat tissue so that no contraction of the ala occurs. The raw surface of this flap is covered with a THIERSCH graft as far as the end of the flap. The uncovered end is intended for the host area prepared on the nasal tip (Fig. 381 b). About 4 weeks later the pedicle of this fully epithelized flap is detached and sutured in the region of the columellar base. In this way the skin surface of the flap faces outward on the columella, and the surface covered with the THIERSCH graft faces the interior of the nose. A similar procedure was recently described



Figs. 383 a—d. Reconstruction of the columella by GILLIES using a tubed pedicle flap from the nasolabial fold. Pre-formed tubed pedicle flap is severed at the angle of the mouth; the base of the columella is prepared. (In this maneuver one can leave the skin flap with its base either above or below. In the illustration the skin has been removed.) b The tubed pedicle flap is formed by means of a continuous S-suture or several U-mattress sutures. The small sketch shows the flap in cross-section. c Tubed pedicle flap sutured at the base of the columella. d Situation after completion of operation; flap is sutured to the tip by Champion (1960). He cuts the same 5×1 cm flap paranasally and covers the raw surface with a Thiersch graft, but he attaches it first at the columellar base and then swings the flap to the nasal tip in the second stage. Ullik uses a flap from the nasolabial fold which is cut in exactly the same direction as the fold.

Malbec likewise obtains the skin from the nasolabial fold with the extension downward below the level of the mouth. He rolls it into a complete tubed pedicle flap. In the second stage he swings it to the nasal tip (Fig. 382) and in the third

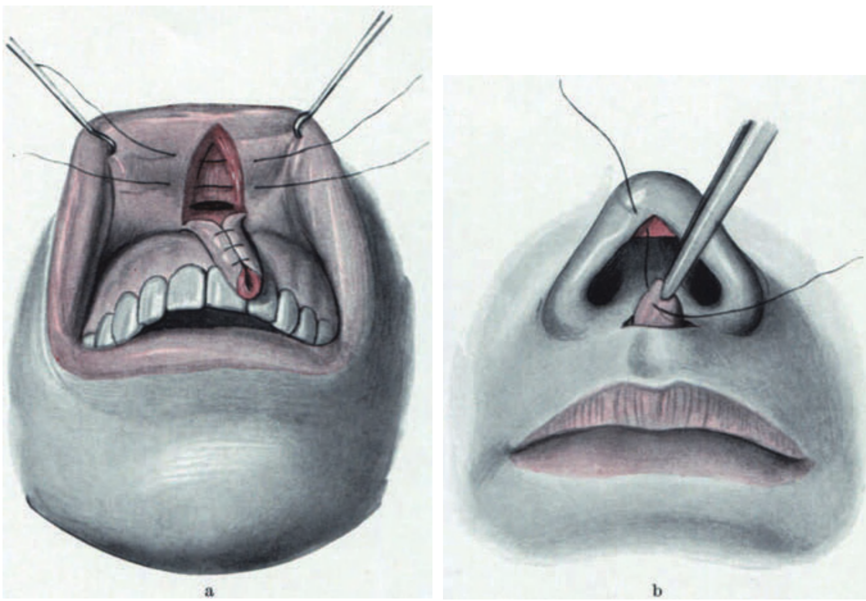


Figs. 384a—c. Reconstruction of an overly narrow cicatricious columella by Brown and McDowell. a Overly narrow columella. b Narrow cicatricious part of the columella removed and the tip is drawn downward to the columellar base. Dotted red line indicates the part of the philtrum which will be used for reconstruction of the columella. Nasal tip is raised and the donor site is sutured closed with consideration given to the length of the upper lip. The philtrum is advanced forward with the tip and covers the defect

stage detaches the upper pedicle next to the ala. In his opinion this flap should only be used on males. In our opinion, however, one should be careful that the flap intended for the columella contains no hair.

Gillies described a simple and certain procedure for obtaining a thin and delicate tubed pedicle flap from the neighboring area for the reconstruction of the columella. In that region one forms a fold from which the tubed pedicle flap is to be taken, e.g. in the nasolabial fold. He then makes a continuous S-suture or several U-mattress sutures at the base of the fold (Fig. 383b). The skin is pulled together firmly and then severed in this area after about 1 week. The tubed pedicle flap is sutured in place and the donor area closed. Gillies first sutures the tubed pedicle in the region of the base of the columella, and in the last stage he sutures it onto the nasal tip (Figs. 383c, d). Like MALBEC and GILLIES, FARINA, SANTOS, and BATISTA have also advocated the use of flaps from the nasolabial fold.

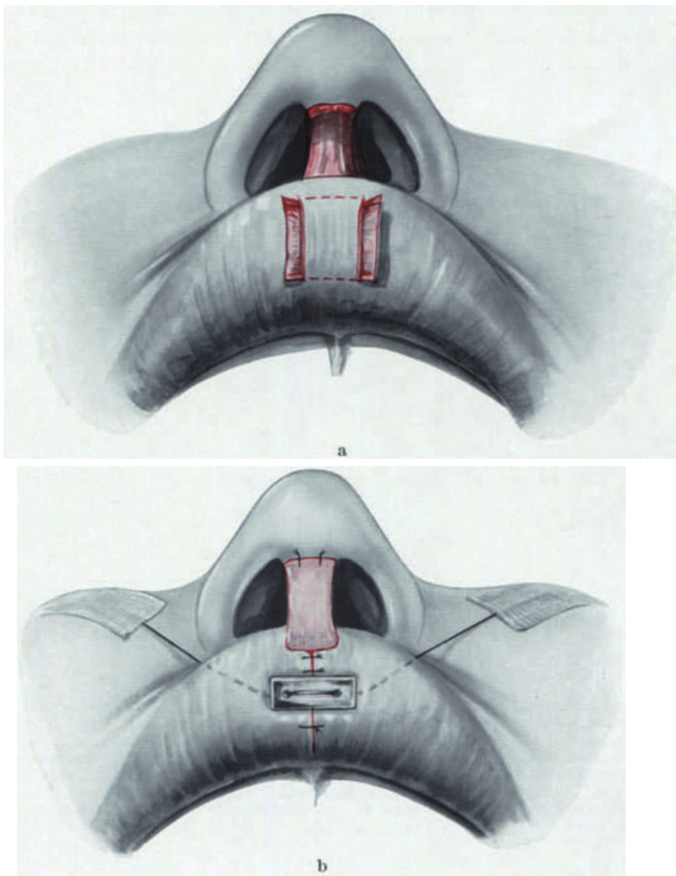
Another very simple method for replacement of the columella using philtrum skin comes from WURTZER (quoted from LEXER) and is described by BROWN and McDOWELL. In this method cicatricious skin is removed from the septum, and the skin of the nasal tip is sutured to the healthy skin in the region of the columellar base. Thus the nasal tip is pressed quite flat (Fig. 384b). Because the spring of the tip cartilage exerts a strong pull on the fresh sutures, this tension on the suture should be relieved by means of an adhesive tape dressing during



Figs. 385a and b. Replacement of the columella. Correction of the columella using mucosa from the lip, according to LEXER. a A mucosa flap shaped like a gothic arch and pedicled at the duplicative fold is cut from the upturned lip. The flap consists only of mucosa and submucous tissue. The lateral edges of the flap are sutured together. The mucosa is later carefully incised across at the base of the flap. Just below the nasal vestibule the tissue in the middle of the upper lip is incised crosswise for about $^1/_2$ to $^3/_4$ cm. b The rolled mucosa flap is drawn through the incision in the upper lip. A small wedge should be excised from the lower surface of the nose where the columella should be attached. The tip of the rolled mucosa flap is inserted into this area of excision. (From KLEINSCHMIDT)

the first week. After the suture has healed, a philtrum flap pedicled above is raised and drawn onto the columella, permitting the nasal tip to assume its normal position (Fig. 384c). This forward advancement of the philtrum flap, as already seen in correction of the columella (see p. 111) and of harelip nose after GENSOUL and LEXER (Fig. 311), can also be extended after the modification of BROWN (Fig. 310). For this purpose two lateral tabs of skin from the upper lip must be raised at the same time and advanced to the region of the columella, where they are sutured laterally in the membranous septum.

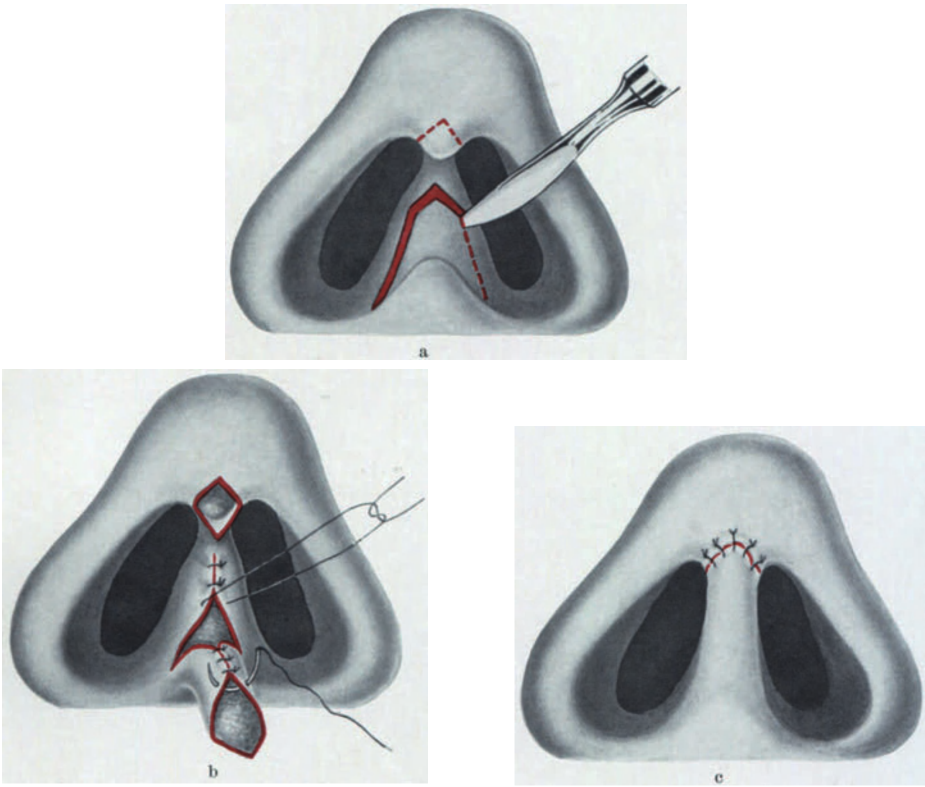
In some methods to be regarded as obsolete, labial mucosa (vermilion) is used for replacement of the columella. One such older method still used by MAY, but which has otherwise found little imitation, is the method of LEXER (Fig. 385). From the posterior of the upper lip one forms a mucosa flap pedicled below the maxillary spine. This is drawn outward toward the nose through a slit in the uppermost part of the lip. It is sutured with the formerly caudal end under the nasal tip. SHEEHAN shapes this flap into a small roll by means of sutures. The tunnel in the upper lip must be wide enough not to cut off the circulation in the originally 1.5 cm wide mucosa flap. — Another reconstruction with upper lip mucosa is by FERRIS SMITH (Fig. 386), which is like the method of SANVENERO-ROSSELLI. He forms a wide bridge flap in the mucosa of the everted upper lip. Muscular tissue should be included. The raw surfaces are covered with a THIERSCH graft. After healing, the flap is detached at the end more distant from the border



Figs. 386a and b. Reconstruction of the columella using vermilion, according to F. SMITH. a Formation of a bridge flap in the vermilion. The raw surface of the bridge flap is lined with a THIERSCH graft (dotted lines). b The vermilion surface of the flap is split in midline very slightly; the lined flap is swung upward from the lip to the nasal tip; the raw edges of the split in the vermilion surface are sutured bilaterally to the septal mucosa; the lip is immobilized with wire

of the lip and is swung upward like a trunk onto the prepared nasal tip. In this way the THIERSCH graft faces downward and outward in the region of the columella (Fig. 386b). The mucosa part is split lengthwise in midline so that it can be sutured onto the prepared surface of the defect in this manner. The donor site is undermined and sutured. To assure the healing of the flap on the nasal tip, the upper lip is immobilized by being pulled upward by means of a small metal plate and a mattress suture held with adhesive tape on the cheek.

In columella defects which show no cicatricious area in the region of the nasal vestibule and the remainder of the septum, the columella can be reconstructed from the skin in the nasal vestibule (Fig. 387). For this purpose one incises around the skin on the retracted remainder of the septum so that a tubed pedicle flap is formed with its base in the philtrum region (Fig. 387b). By appropriate preparation of the host site on the nasal tip a raw surface as large as possible is made with a small skin flap hanging down toward the interior of the nose. The short tubed pedicle flap can be sutured onto this freshly created raw surface (Fig. 387c). The method (DENECKE) has the advantage that it can be done



Figs. 387a—c. Replacement of the columella by means of a tubed pedicle flap from the nasal vestibule according to DENECKE. a Cutting the flap. b Formation of the tubed pedicle and closure of the donor site. c Suturing the flap to the nasal tip

unilaterally. Only a short stay in the hospital is required, and there is no facial deformity or deformity in the region of the upper lip. Narrowing of the nasal vestibule does not occur, as a rule, but if necessary it can be prevented by appropriate relief. This procedure is contraindicated if especially pronounced thick scars are present or if the nourishment of the skin in the vestibule has been disturbed by radiation therapy.

STAFFIERI has described a reconstruction of the columella by means of a two-stage advancement of a rectangular piece of the septum if the latter is not deformed by scars. The anterior border of the skin-covered cartilaginous septum is sutured to the nasal tip during the first stage and to the philtrum during the second stage to form the columella. The lateral septum skin and mucosa is drawn downward at the same time, so that a rectangular perforation is created behind the repositioned rectangle. It seems hardly possible that the columella reconstructed in this manner can have normal width and normal appearance.

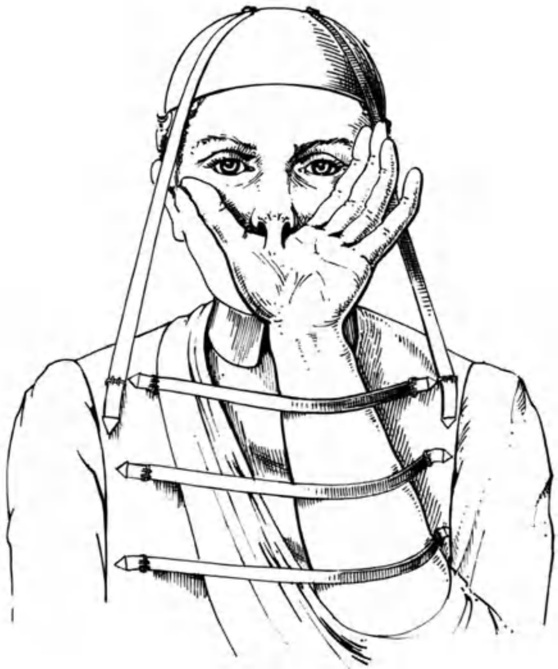


Fig. 388. Reconstruction of the columella using a flap from the inner surface of the hand, according to LABAT

Fig. 389. Reconstruction of the columella by means of small tubed pedicle flap which has migrated from other parts of the body by way of the "snuffbox" (according to SHAW and FELL). Fixation of the hand to the head by means of a device which resembles one used in management of jaw fractures

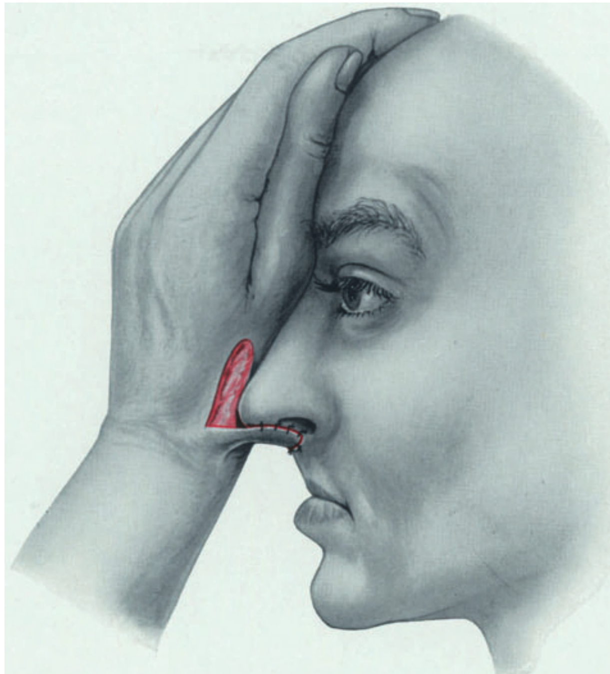


Fig. 390. Replacement of the columella using a skin flap from the "snuffbox" (F. YOUNG)

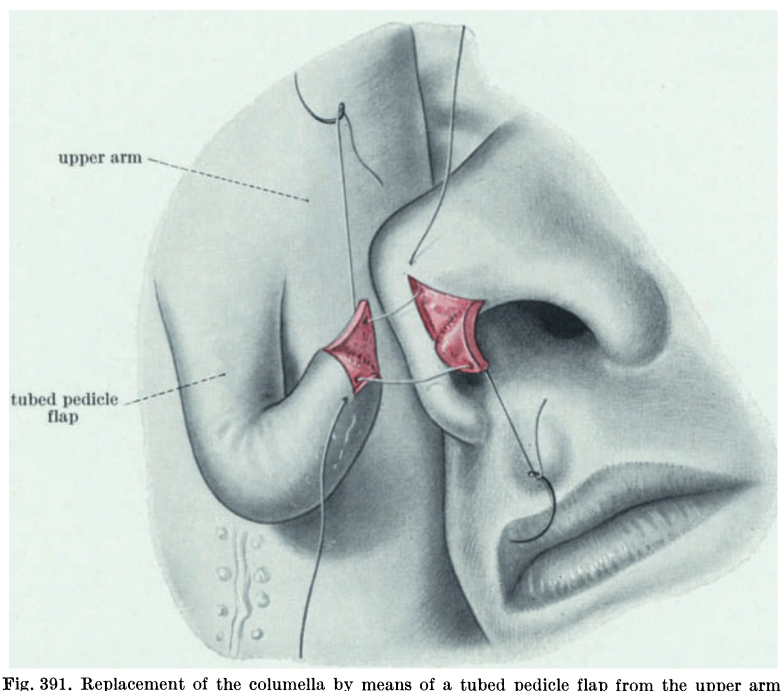


Fig. 391. Replacement of the columella by means of a tubed pedicle flap from the upper arm. The illustration shows the incision in the region of the nasal tip and on the end of the tubed pedicle flap as well as the suturing of the raw surfaces. The upper arm is immobilized in the position shown by means of a plaster cast. (From H. J. DENECKE)

2. Reconstruction of columella with distant flaps

Reconstruction of the columella is almost always successful with distant flaps in the most varied forms, even if it causes discomfort for the patient due to immobilization of the arm, which is usually used to transport the flap. The Italian method of LABAT (Fig. 388) with formation of the columella *from the ball of the thumb* demands fixation of the hand at the face for about 2—3 weeks. While the flap of LABAT was formed simply, i.e. without epithelization of the wound, SHAW and FELL made a tubed pedicle flap *from the "snuffbox"* ("tabatière"). The donor site on the hand was covered with a THIERSCH graft. Only after complete formation of the tubed pedicle flap was the pedicle detached at one end and sutured to the nose (Fig. 389). For immobilization of the hand at the face

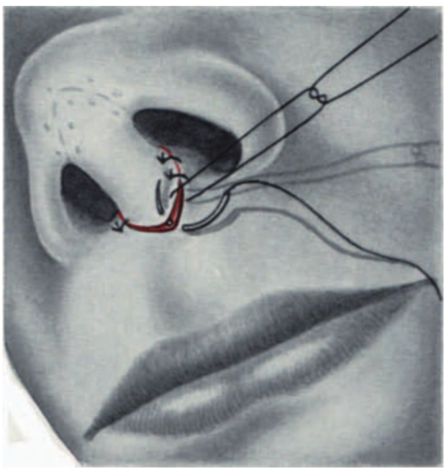


Fig. 392

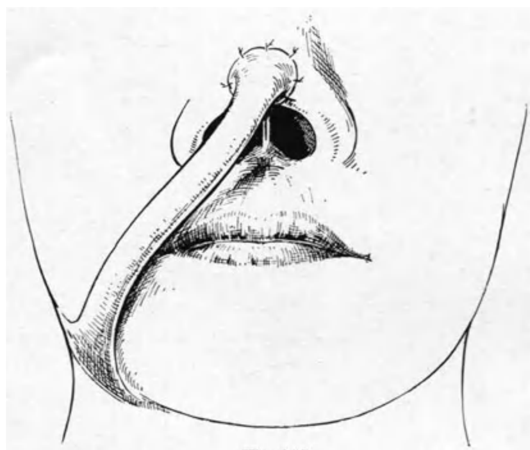


Fig. 393

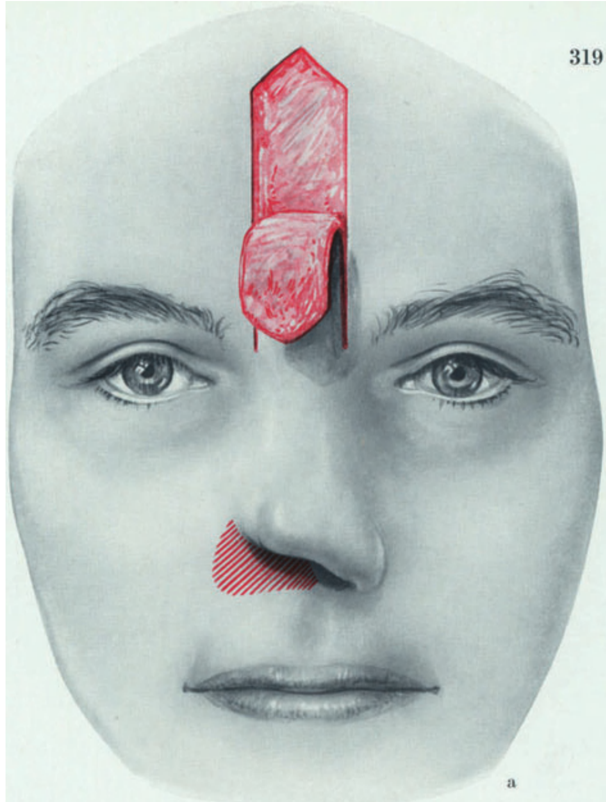
Fig. 392. The tubed pedicle is sutured to the columellar base after being severed from the upper arm

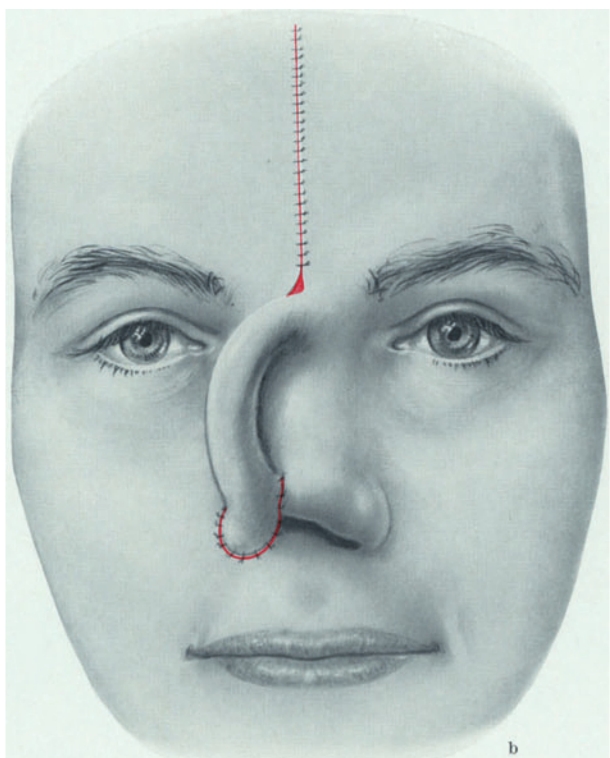
Fig. 393. Columellar reconstruction by means of a supraclavicular tubed pedicle flap which migrates across the edge of the lower mandible to the nasal tip. In the next stage the flap is fitted into the defect (according to F. SMITH)

the plaster cast around the wrist was attached to a forehead band by means of metal struts, much like the forehead band used in case of fractured jaw.

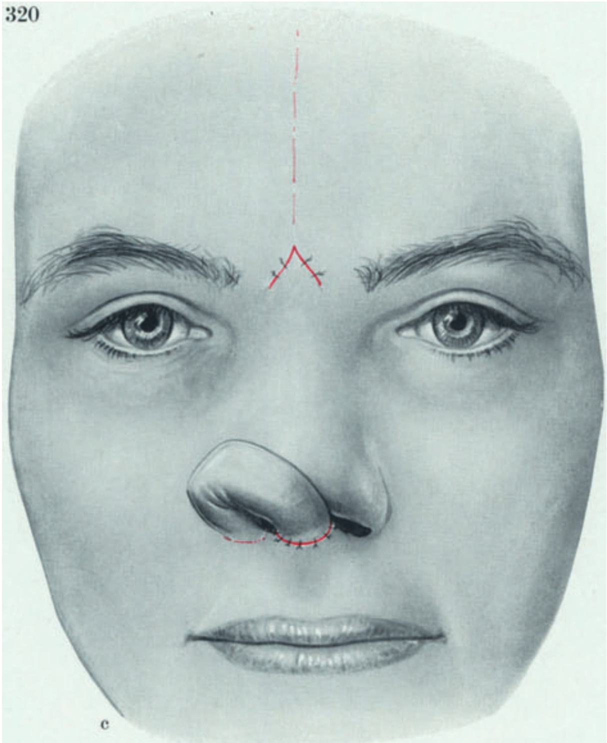
YOUNG sutures a pedicled flap (not tubed) from the "snuffbox" of the hand onto the base of the columella. In this procedure the hand is immobilized against the head by means of a plaster cast (Fig. 390) so that the hand is next to the nose and the fingers lie on the forehead. We consider the position of the arm very uncomfortable for the patient in the methods of LABAT, SHAW, FELL and YOUNG.

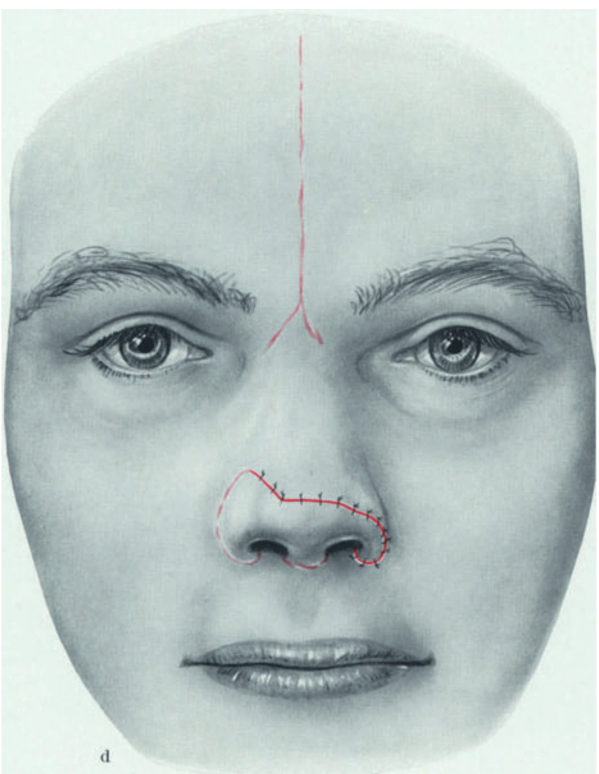
A good method applied successfully by us is to use a tubed pedicle flap about 5 cm long *from the inner surface of the upper arm* (Fig. 391). In order to determine the position of the flap, the upper arm of the patient is placed next to the nose and the suitable area for raising the flap is marked. When the flap has been formed and after some time, when one pedicle is sufficiently nourished, the flap is sutured to a small fresh wound surface on the middle of the interior surface of the nasal tip. The arm is immobilized against the head by means of a plaster cast so that the flap is under no tension. After 2 to 3 weeks, if the pedicle at the nasal tip permits sufficient blood supply, the flap is detached at the upper arm and sutured to the base of the columella (Fig. 392). If possible, the part of the flap facing the interior of the nose is also sutured to the lower





Figs. 394 a—d. Reconstruction of the columella and of small partial defects on the nasal tip and the alae using a median forehead flap by KAZANJIAN. a Formation of the medial forehead flap and mobilization of the forehead skin for closure of the donor site; parallel subcutaneous incisions. b Rolled flap attached to the base of the ala; donor site closed





Figs. 394 c and d. c Formation of the columella by suturing the flap at the columellar base. The nourishing base is extended by suturing it to the defect on the ala. d Flap is used for replacement of the remaining partial defects border of the still existing septum. To do this one must prepare the inner surface of the flap and the lower border of the septum by means of longitudinal incisions and spreading of the incision borders. From the start the flap should not be too short, since it almost always becomes considerably shorter due to contracture and thus would pull the nasal tip toward the base of the columella. If it should

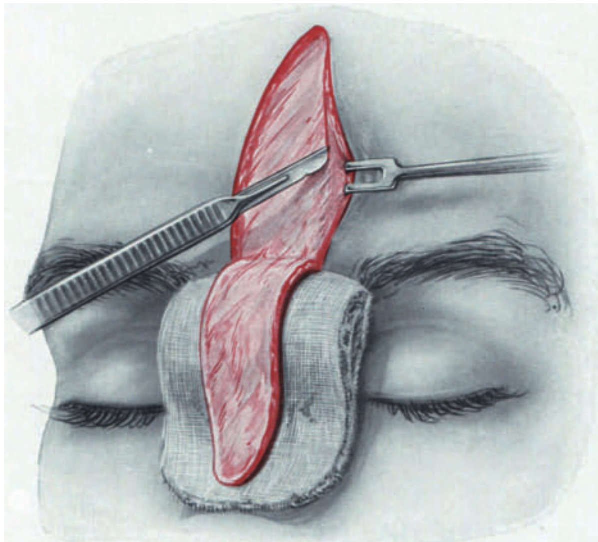


Fig. 395. Closure of the donor site of the KAZANJIAN forehead flap is facilitated by parallel subcutaneous incisions; the wound can then be closed by approximation

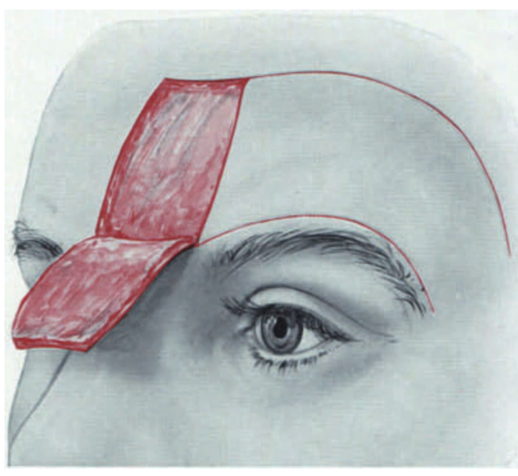
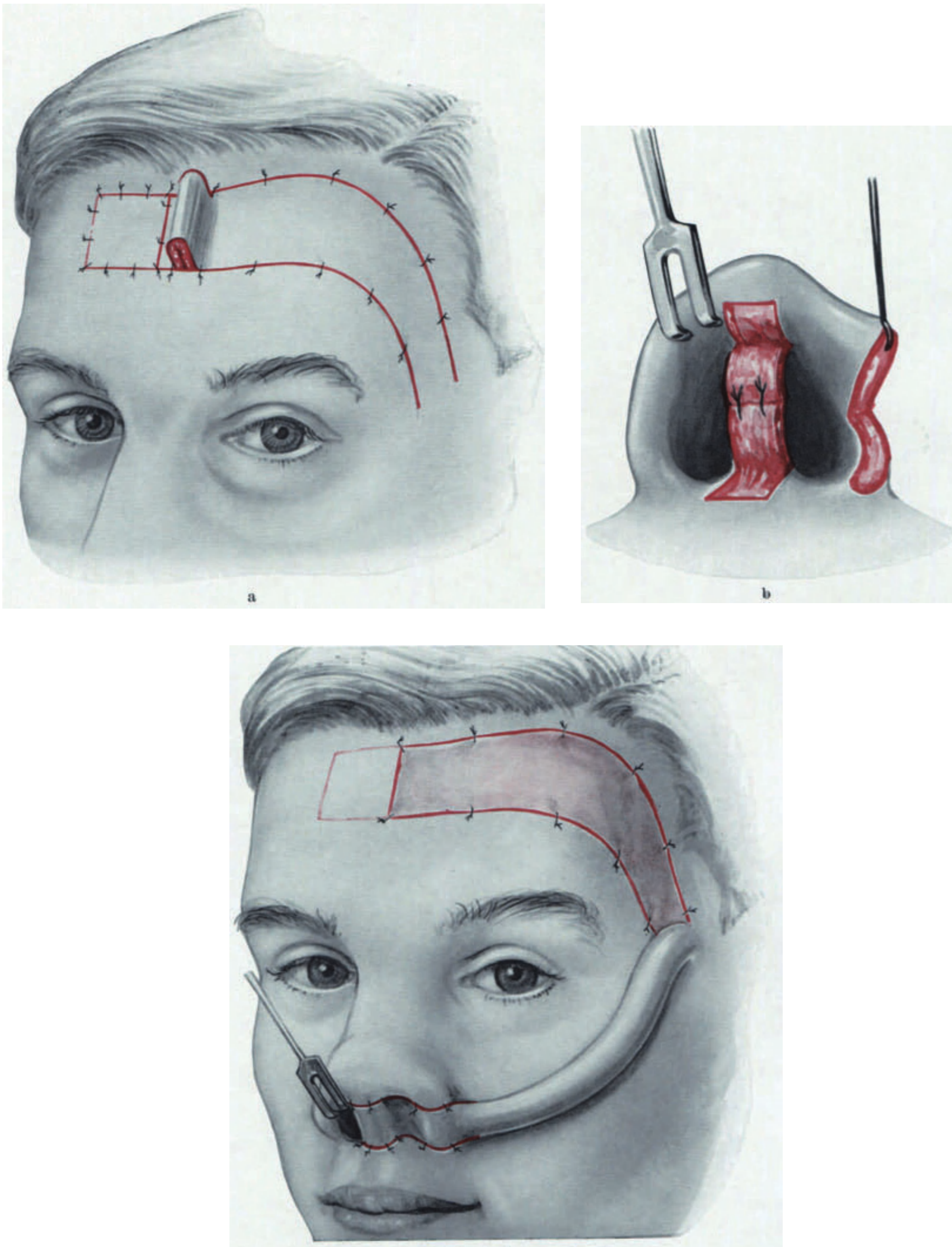


Fig. 396. Advancement of skin on the forehead in case the donor site can not be closed by the normal approximation procedure

happen to be too long and hang down, then it can be brought into the correct position by means of a small excision, whereby the profile angle can be corrected as well. Before doing this one should first wait, since it often shortens itself by means of cicatricious contraction. Grafting of stiffening material is not necessary if only the columella is missing (DENECKE).

MALBEC likewise forms the tubed pedicle flap on the upper arm. The distal end of the flap is above when the upper arm is raised to the head. He sutures



Figs. 397a—d. Reconstruction of the columella using a forehead flap according to GILLIES. a The columella is formed on the forehead by means of a skin duplication in the flap; the defect is covered with a THIERSCH graft. The donor site on the columella is prepared by suturing flaps from the tip and the base to form the posterior wall; the alar attachment is severed to facilitate migration of the flap from the forehead. c The end of the flap is sutured into the columella defect and is immobilized on the alar attachment which has been swung upward; the donor site is covered temporarily with a THIERSCH graft

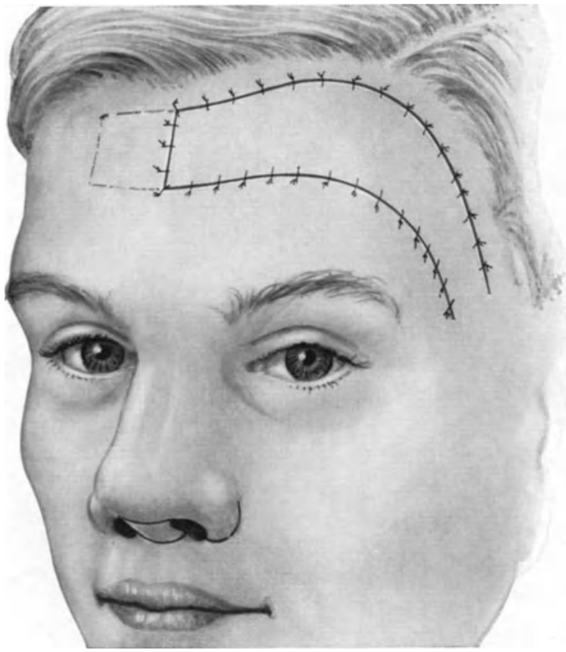
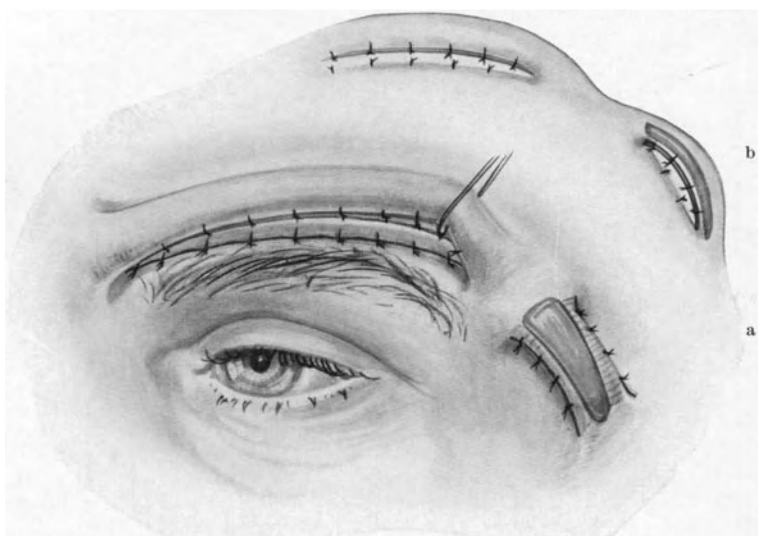
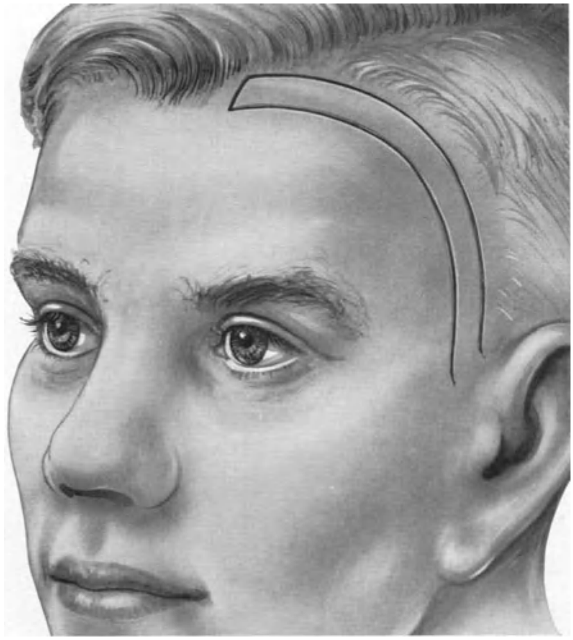


Fig. 397d. The pedicle of the flap and the ala are returned to their original position

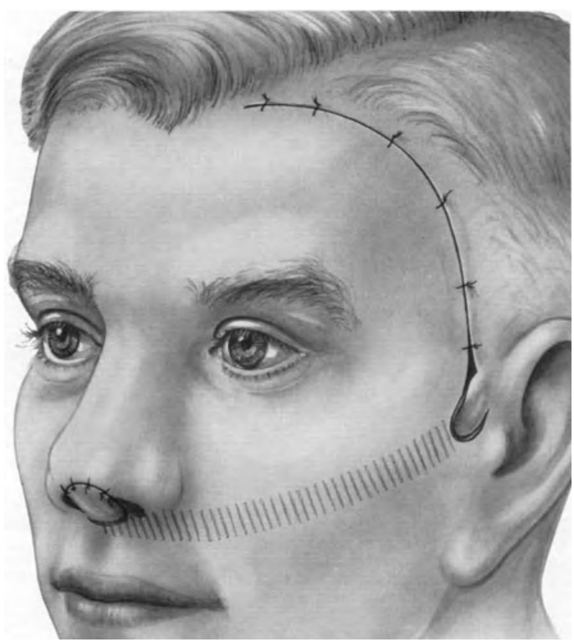


Figs. 398a and b. Reconstruction of the columella using a composite fronto-temporal flap according to R. MEYER. a Formation of the flap. In the temporal area a strip of auricular cartilage is implanted subcutaneously as superficially as possible; a bridge flap containing the graft is formed; the bridge flap is lined with a THIERSCH graft. A similar bridge flap is formed on the supraciliary arch (cartilage is shown in blue, THIERSCH graft shown by red hatching). b Both flaps viewed from below

the distal end to the nasal tip. With regard to the tension-free position, we consider our method of transferring the tubed pedicle flap better, as is shown in Fig. 391. Should the position of the arm and nose be changed slightly, the pedicle is not pulled so tight and thus there is less strain on the suture. — FERRIS SMITH

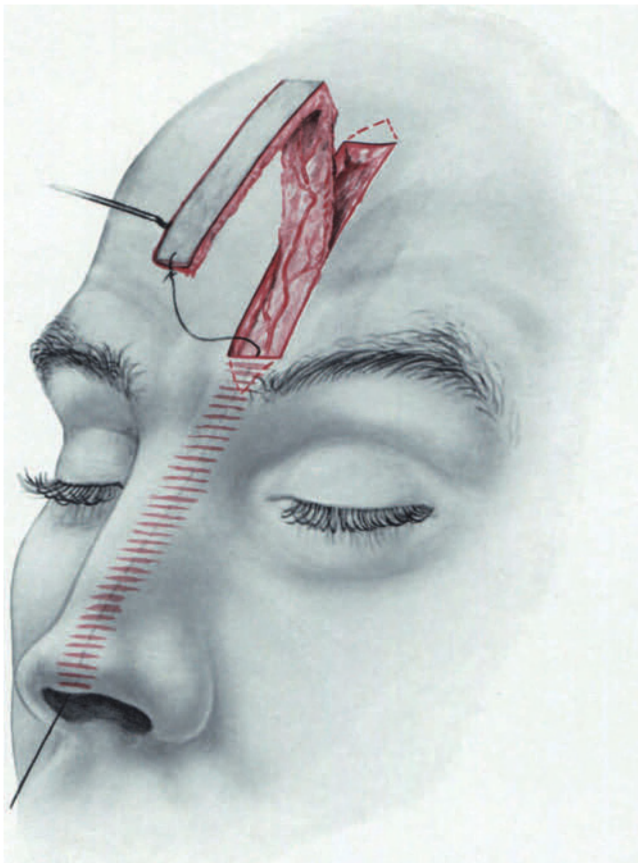


a



b

Figs. 399a and b. Reconstruction of the columella by HEANLEY. a Formation of a transposition flap from the temple and forehead. b Subcutaneous migration of the flap by means of tunneling under the cheek skin (red hatching) and suturing the end of the flap in the columellar defect. Donor site closed by approximation replaces the columella with a *supraclavicular tubed pedicle flap* which he transfers to the nose (Fig. 393). In the first stage he forms the almost horizontal tubed pedicle flap in the supraclavicular pit. In the second stage, about 3 weeks later, the lateral attachment of the tubed pedicle flap is severed and swung to the angle of the jaw, where it is sutured. In the third stage after another 3 weeks, the now lower end of the flap is severed and is sutured to the nasal tip. Then in a fourth stage the tubed pedicle flap can be shaped into a columella after being severed at the angle of the jaw.



a

Figs. 400a and b. Reconstruction of the columella by split and unfolded forehead flap which is migrated to the region of the defect through a tunnel under the dorsum (according to CARDOSO). a Mobilization of the flap and its extension as a connective tissue flap; a bridle suture is in place beneath the skin of the nasal dorsum. The artery remains intact in the pedicle.

HAVENS and SALINGER proceeded similarly. They transferred a tubed pedicle flap *from the acromio-pectoral region* on the lower edge of the jaw to the nose. There was one intermediate position in an area about 2 cm lateral to the angle of the mouth.

Even if one does not like to create additional new scars on the face, the construction of the columella *with forehead flaps* is also a rather widespread method today. The first columella operation with forehead flaps was described by HILDEBRAND (1911). In this a T-shaped flap was formed in the middle of the forehead and raised together with a bone graft from the underlying frontal bone and was then swung down onto the nose as a tubed pedicle flap. In 1946 KAZANJIAN presented a procedure for reconstruction of the columella and other small defects on the nasal tip and on the alae using a median forehead flap. A vertical flap about 2 cm wide from the middle of the forehead is pedicled at the glabella (Figs. 394a and b), swung downward and sutured at the columellar or alar base. Sometimes the middle part of it can be rolled closed by means of a few button sutures. The open surfaces on the upper and lower parts of the flap do not necessarily have to be covered with THIERSCH grafts, since the flap is in this bridge-

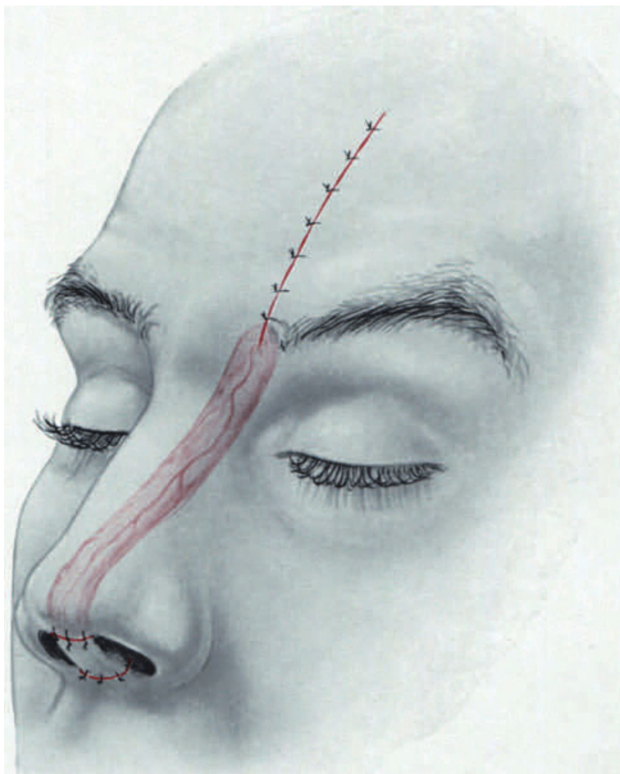


Fig. 400b. The epidermis part of the flap is sutured in as the columella; the donor site is closed

like position over the nasal dorsum for only 2 weeks and can hardly shrink very much during this time. The donor site on the forehead can be closed immediately by approximation after undermining, so that the median scar leaves no noticeable traces afterward. To make approximation of the borders of the defect possible, the subcutaneous tissue and sometimes the periosteum are mobilized from below by means of several incisions running parallel to the edge (Fig. 395). In case the flap is made somewhat wider and closure of the donor area is impossible by means of approximation, one entire half of the forehead must be raised as a flap and be advanced to midline (Fig. 396). Although this method has no cosmetic deformity as a result in the donor area of the flap, we consider it too radical just for reconstruction of the columella. On the other hand we have used it very successfully several times for reconstruction of the alae and columella. After only a few years one could hardly see the median scar on the forehead and the V-shaped scar at the glabella resulting from suturing the replaced base of the flap. This method is to be used primarily on males and is not to be considered for patients with a low forehead. It is also mentioned in the chapter on reconstruction of the alae (see p. 355).

An even more radical operation using forehead flaps comes from GILLIES. It represents the modification of the superficial temporal artery flap of SHEEHAN (see p. 369). A sickle-shaped flap about 3 cm wide is formed from the middle of the forehead along the hairline into the possibly hair-covered temporal area on one side. The 3 to 4 cm long end of the flap in the center of the forehead

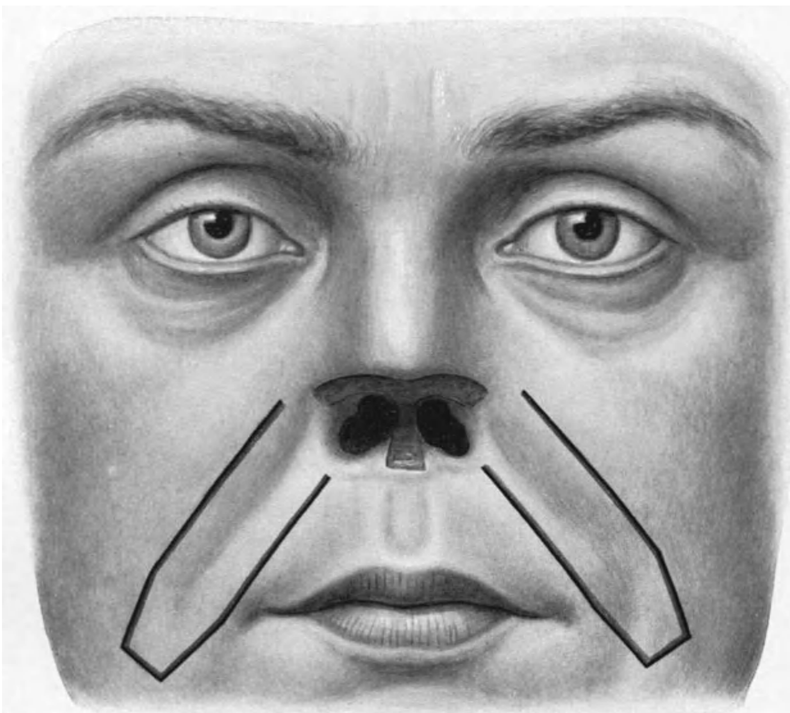
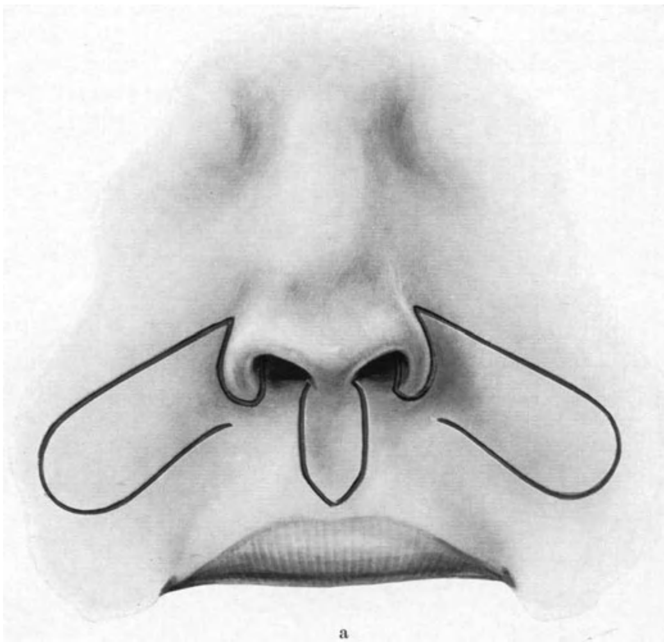


Fig. 401. Alar, columellar and tip replacement using skin from the nasolabial fold and from the forehead, according to THIERSCH and PAYR. The nasal stump is prepared to accept the flaps. Two flaps from the nasolabial fold are cut. (From KLEINSCHMIDT)

should slide back, like a caterpillar, into a fold (Fig. 397a). The defect caused by this is covered with a THIERSCH graft or a full thickness skin graft. After delaying the flap, i.e. after raising it from the underlying tissues and suturing it in the same position, the flap with the fold is raised definitively 10—12 days later and swung to the nose. The fold is sutured onto the nasal tip and columellar base as the new columella. To facilitate this the ala must be severed temporarily at its lateral attachment (Fig. 397b). The flap can be sutured into a tube in its middle section (Fig. 397c). After healing of the columella fold, i.e. after about 3 weeks, the pedicle of the flap can be detached at the nose and replaced on the temple and forehead. The ala is immediately sutured into its original position. The scars of the donor area are thus the quadrangular area in the middle of the forehead, which was covered with a THIERSCH graft or a full-thickness skin graft, and a curved scar on the upper border of the forehead toward the temple. The second scar running parallel to this lies in the hair-covered skin or at the edge of the same.

We (R. MEYER) have modified the method of the fronto-temporal flap of SCHMID (see p. 360) in that we pre-shape the columella with a cartilage graft on the temple (Fig. 398). The newly formed columella is swung into the defect by means of a supraciliary bridge flap. In principle this modification corresponds



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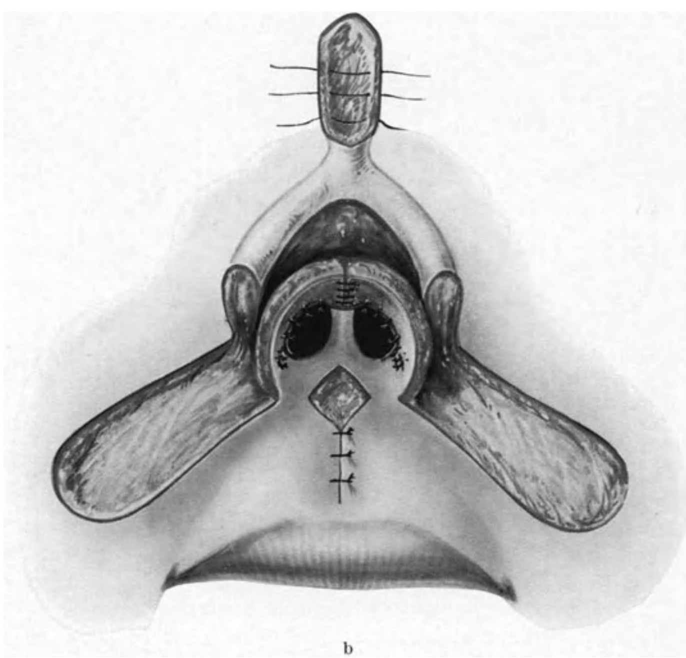
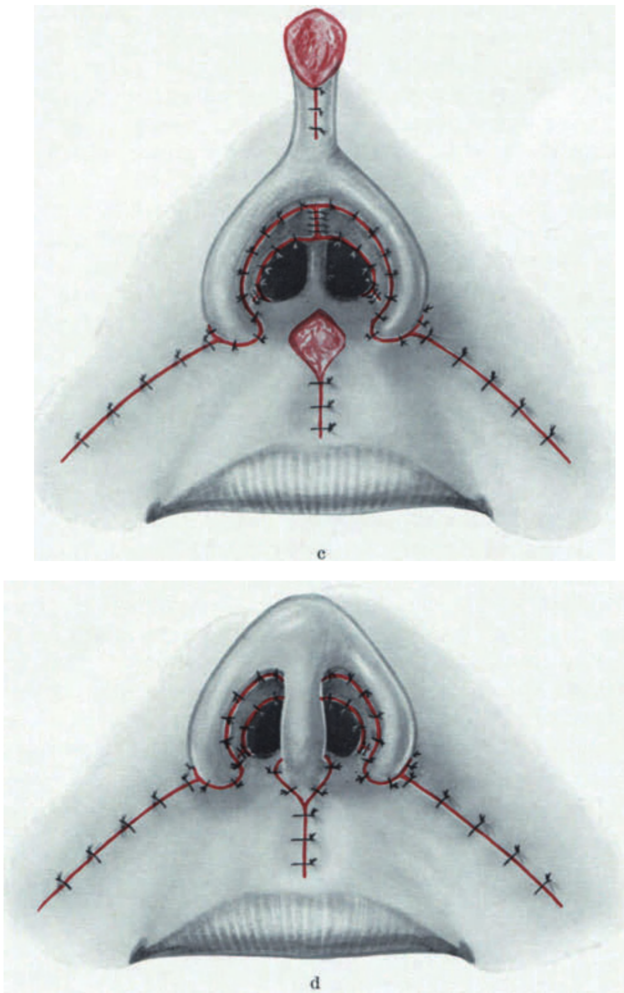


b

Figs. 402a—d. Correction of retruded soft structures of the nose with anterior septum perforation using philtrum and nasolabial flaps, according to FARINA. a Cutting the three flaps. b Columella-philtrum flap is raised and swung upward. The philtrum is sutured. A raw surface is made in the vestibule by means of an incision across it. This raw surface is covered by swinging the flaps from the nasolabial folds bilaterally onto it to the techniques described on pages 362 and 372 for the reconstruction of the ala and nasal tip.

For reconstruction of the columella HEANLEY also uses a fronto-temporal flap which follows the temporal artery like the flap of GILLIES but is not so long (Fig. 399a). The flap should be only 2 cm wide so that the donor area can be closed by approximation. The flap is transferred to the nose through a sub-



Figs. 402c and d. c Nasolabial flaps are sutured to the anterior border of the vestibular incision. The columella-philtrum flap is sutured into a tubed pedicle. d The columella-philtrum flat is sutured to the columellar base

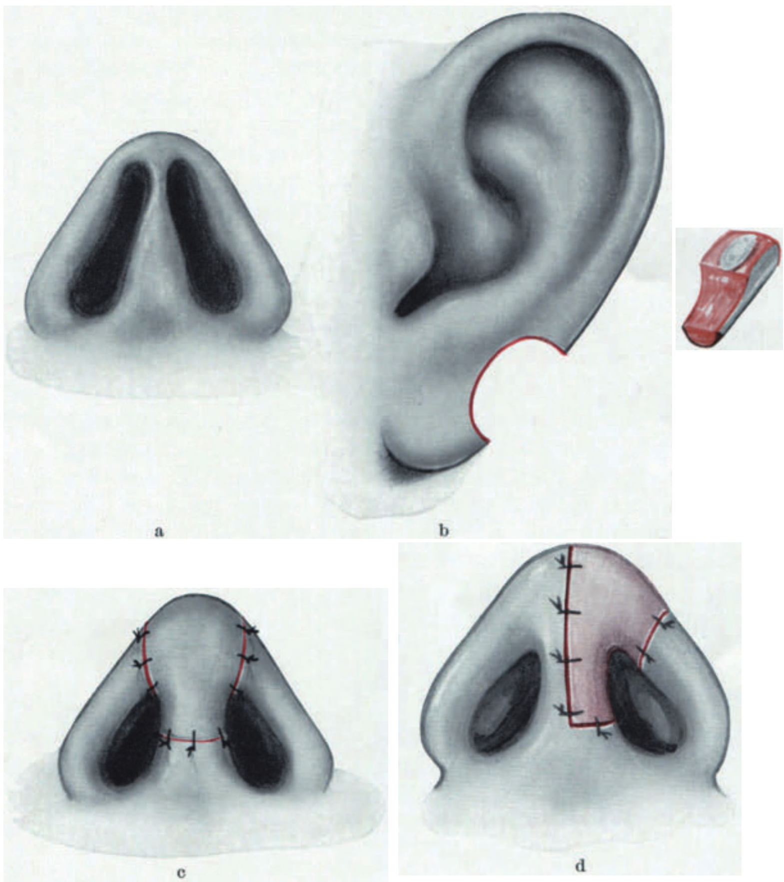
cutaneous tunnel from in front of the tragus near the pedicle to the base of the columella (Fig. 399b). It can be simple or double, if its raw surface is covered with a THIERSCH graft. This procedure leaves a less visible scar in the vicinity of the hair line on the temple. Unfortunately the author has not mentioned whether the uppermost layer of skin on the pedicle of the flap should be removed or not, since it is to remain in the tunnel. If not, then after the end has healed at the columella, the pedicle of the flap must be withdrawn from the tunnel and either be replaced on the forehead or removed. — A similar tunnel procedure was published by CARDOSO in 1958 (Fig. 400a). A 1 cm wide vertical paramedian skin flap is formed in the region of the forehead down to the periosteum. One raises this flap working from the glabellar area by separating the skin from the subcutaneous tissue and leaving the skin and subcutaneous tissue connected only at the upper end of the flap. In this way one obtains a flap almost twice as long. It is like an island flap and can be brought to the missing columella through a tunnel. The tunnel should lead from the inner end of the eyebrow on one side to the nasal tip underneath the nasal skin. There the end of the flap carrying the epithelium is sutured for reconstruction of the columella (Fig. 400 b). This method can be used only when the cartilaginous septum is still present. Like those of GILLIES and HEANLEY, this method seems somewhat complicated and uncertain. If the end of the skin flap forming the columella becomes necrotic following nutritive disturbance in the region of the pedicle, these methods can only end in failure, since it is impossible to lengthen the flap.

An interesting method which deserves mention is that of THIERSCH and PAYR. Not only is the columella reconstructed, but the vestibules can also be lined (Fig. 401). Flaps are formed bilaterally *in the nasolabial fold* and swung toward midline. The ends meet and are sutured at the base of the columella. The distal ends of the flaps are placed with their raw surfaces touching and are sutured together above and below. In this way they form the columella. The middle part of the two flaps is used for lining the nasal vestibule in cases in which the nasal tip and alae still are present or must be reconstructed by means of a forehead flap. In both cases auricular cartilage can be grafted onto the alae for bilateral reinforcement. The method of FARINA was derived from the method of THIERSCH and PAYR (Fig. 402). It is essentially a procedure for correction of retruded nasal tip. This was used by FARINA particularly on patients with Leishmanosis. The skin of the entire lower part of the nose is severed by means of incision around the alae and the columellar base. When making this incision one includes philtrum skin for lengthening the columella, depending on the extent of shortening. Then two wide nasolabial flaps are raised for the inner lining of the alae. The donor sites in the nasolabial folds and in the philtrum are closed by approximation. The lateral borders of the alae, which are pulled out over the base of the pedicles of the flaps swung into the nasal vestibule, can be sutured there. The short columella is lengthened by means of the philtrum flap.

II. Composite auricular grafts for replacement of columella and alae

Review of historical development of composite grafts. The use of composite auricular grafts of skin, cartilage and skin for replacement surgery is an old procedure. But only in the last 5 to 10 years has it become a part of the general procedures of plastic surgeons. The method comes from FRITZ KÖNIG who published it in 1902 in the "Berliner klinische Wochenschrift". In the same year BÜDINGER also reported in the "Wiener klinische Wochenschrift" on a method for replacement of lid defects with a free skin and cartilage graft from the ear. The procedure was almost forgotten in the subsequent years since it was not to be reconciled with the opinions on grafting held at that time. Medical literature shows that only a few surgeons, like MAKARA (1908), HABERER (1917), and LIMBERG (1935) used composite auricular grafts in nasal defects. LEXER and JOSEPH made little use of this possibility and reported that grafting was successful in only about half of the cases. In 1945, obviously without knowledge of the work by KOENIG, GILLIES published an original procedure. In this he transplanted composite auricular skin grafts under a forehead flap which was later transferred to the nose. In America the method was taken up again and publicized in 1946 by Brown and Cannon and by Dupertuis (Fig. 403). The authors had good experience especially in replacement of the ala, nasal tip, and columella. They had practically no failures. König reported healing in only 25 cases out of 47 and in 1935 Limberg reported healing in 40 of 47 cases.

Healing process of free composite auricular grafts. Since knowledge of the fate of free composite auricular grafts is important for indication and surgical



Figs. 403a—c. Replacement of an overly narrow columella and of the nasal tip using a composite graft from the lower edge of the auricle (König, Brown). a Defect before correction. b Donor site on the auricle with the graft. c Composite graft sutured in place

Fig. 403d. Reconstruction of the medial part of the lower lateral cartilage, nasal tip and columella using a composite graft according to Dupertuis

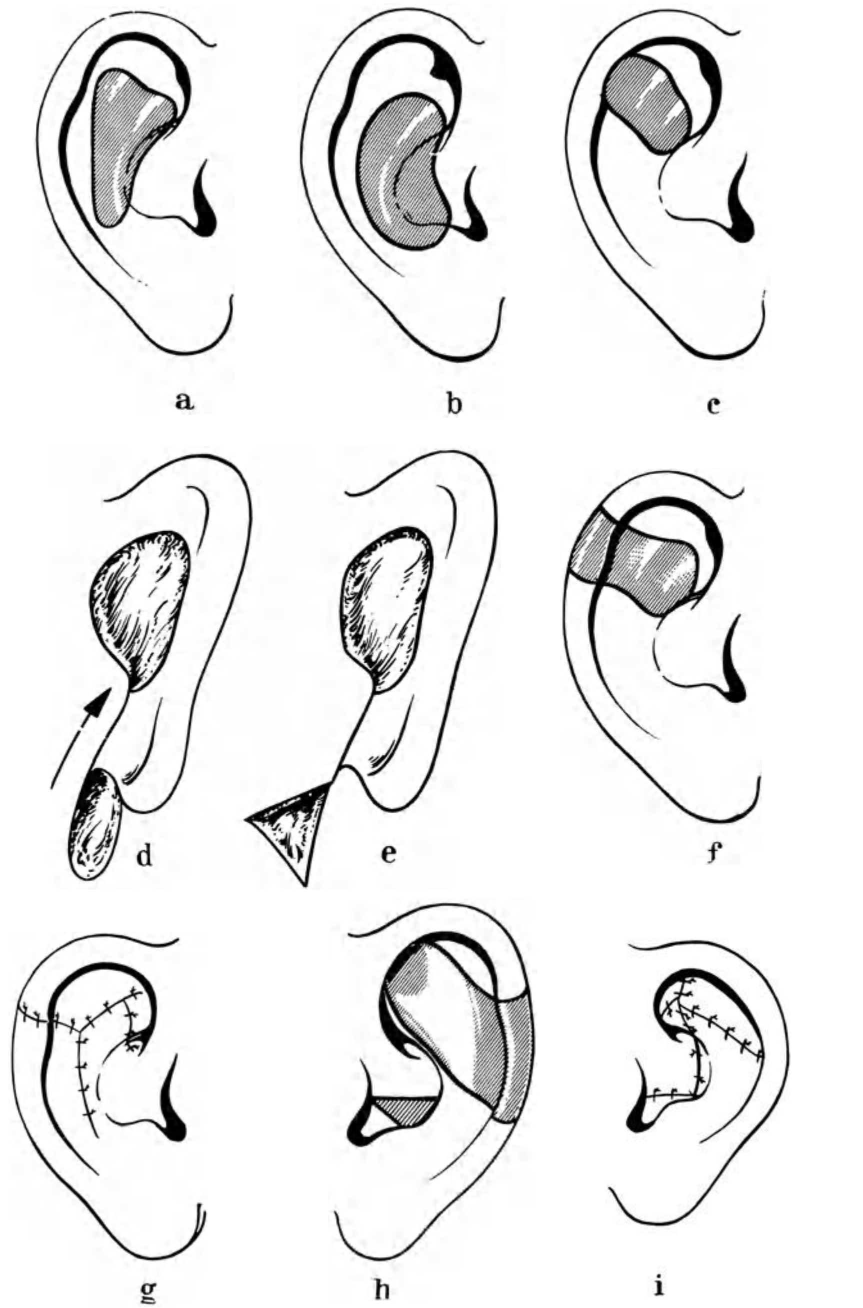
technique, a treatise by McLaughlin (1954) is discussed briefly here. In this the change of such grafts from the time of suture to complete healing is described in detail. The author observed that at the end of the operation the graft is pale. After 6 hours a reddish coloration begins, caused by the diffusion of erythrocytes in the extravascular spaces. Capillaries first grow into the flap after 12 hours. Capillary anastomoses occur after 22 hours. From the 12th to 24th hours the graft is bluish, often even discolored, due to delay in venous drainage. After 3 to 7 days the cyanosis disappears, and the skin of the graft gradually assumes normal color. In some cases we already expected partial necrosis of the graft.

However the endangered part gradually revived on the 7th day after removal of the dressing. — In a Russian treatise by Kravčuk (1958) one reads about the non-healing of a free skin graft from the upper arm for covering a nasal tip defect. 1 week after free grafting mummification and shrinkage of the skin graft began. At the end of the process only a crust remained. On the 20th postoperative day the skin graft fell off in crust form. At this time the nasal tip is said to have been covered with a thin epidermis, so that in spite of the failure the cosmetic effect was not bad. The author ascribes the role of a stimulator of the biological healing process (epidermization) to the mummified skin graft. — According to the experiments of Ballantyne and Converse, as well as by Dupuis, small free composite grafts have a better chance of healing if they are kept in amniotic fluid for 15 minutes before being grafted. — It may be that the chances of healing for a free composite or free skin graft improve with postoperative hypothermia of the graft as suggested by Conley and von Fraenkel. — In any case one must make sure that the nourishment of the entire graft begins as quickly as possible. This is aided if on one hand the raw surface for healing is as wide as possible, and on the other hand if the strip of grafted tissue is made rather narrow. This is described in more detail in the discussion of surgical technique. The length of the graft is not essentially important, according to the experience of Brown and Cannon. On the other hand the dressing technique is of great importance for the success of healing.

Indication. Naturally there are limits to the size of a composite graft. Among our cases published in 1955 there is one with a particularly extensive composite graft, the size of which can be considered maximum. The patient was a young woman whose nasal tip had been bitten off by her boy-friend during a quarrel. The defect was replaced in a single operation with a three-pointed star-shaped auricular graft from the region of the antihelix and its two crura. The center part of the antihelix of the left auricle covered the larger alar defect on the right side, and the anterior crus of the antihelix was used to cover the columellar defect. The posterior crus replaced the smaller alar defect on the left side. In this case the antihelical folds of the auricle could be used to shape the composite graft. Of course one must match the donor site individually with the extent and position of the defect as well as with the shape of the desired replacement. Therefore not all auricles are suitable for such replacement surgery. Especially thin auricles with thin skin which can easily be pushed aside over the cartilage can hardly be used. In addition one can hardly use sometimes strongly pigmented auricular skin to cover nasal defects.

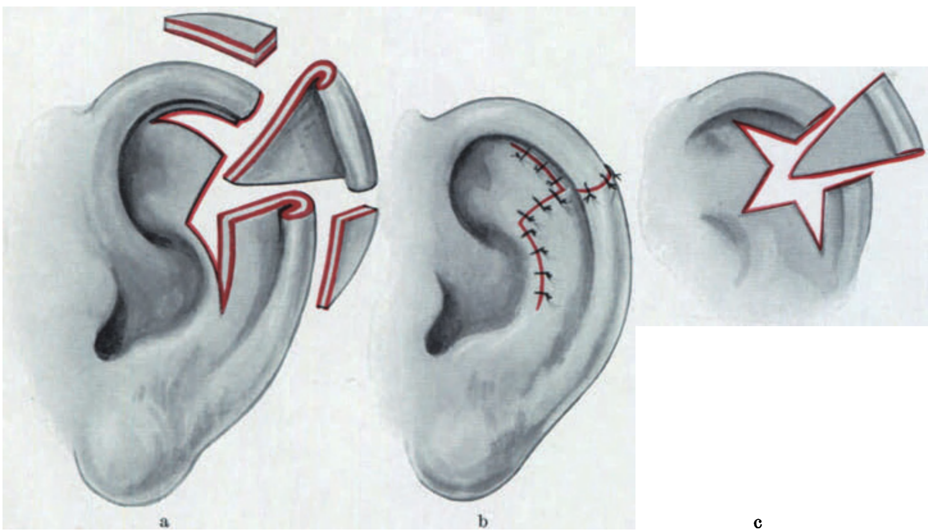
In extensive burns of the face, if areas of the nose, such as columella, alae, and tip, have been burned along with the auricle, one can hardly consider the composite graft. But in a few cases we have tried it with good results. In one case "take" of composite grafts from both somewhat burned auricles was achieved in the injured alae. Since the burned area of the nose had good vascularization this method could be used. In cases of X-ray burns after tumor radiation use of this procedure is definitely not advised.

Technical procedure in removal of composite grafts and treatment of donor area. When removing composite grafts from the auricle one must know while cutting in the individual tissue layers what suture technique will be used in suturing the properly prepared defect. That is, one must know whether one wants to let the inner or outer tissue layer overlap the cartilage (see p. 336). In addition one has to take into consideration the tendency of the skin to contract as it is being severed over the cartilage. One must also make adequate consideration for postoperative shrinkage when forming the graft. The choice of the site on the ear from which one takes the graft depends on the shape dictated by the defect (Fig. 404).



Figs. 404a—i. Ways to obtain composite grafts and correction of the donor sites. a—c Possible donor sites. d and e Covering the skin defect on the posterior surface of the auricle. The anterior surface must be covered by means of approximation of the borders of the wound, advancement of the skin, or with free skin grafts. f—i Helix-scapha excision and respective closure of the donor site by means of suturing

The auricle is hardly deformed by the graft excision. In each of our cases the remaining parts of the auricle were be joined to give a satisfactory cosmetic result in the first stage. Pelliciari plans a later correction in cases of larger removal. Sometimes patient trial is necessary before the edges of the wound are adapted precisely. Therefore a few examples of auricular excisions and subsequent closure of the donor sites are illustrated here (Fig. 404). The posterior surface of the auricle can be covered with large advancement flaps from the postauricular area, possibly also with excision of Burow triangles (Figs. 404d and e). Transposition flaps can also be used for covering (Berson). — The border defects of the donor site on the helix can also be covered with a wide flap from



a b c

Figs. 405a—c. Obtaining wedge-shaped composite grafts with two possibilities for correcting the donor sites. a Wedge-shaped composite graft and two smaller additional excisions for subsequent management of the donor site. b Situation after suturing the donor site resulting from a. c Variations in the additional excisions

the skin of the postauricular region. If possible this skin can also be folded to correspond to the shape of the helix. This is the procedure used by Brown and McDowell.

On the basis of present experience one can not support the objection of Joseph to the method of Koenig that a deformity of the auricle is unavoidable in ears of normal size. Joseph considered the "auricular method", indicated only when the ears of the patient were too large and could stand reduction.

Technique of suturing composite grafts. Since one must count on postoperative shrinkage, as mentioned above, the graft must be 1 mm thicker, wider and longer than the size of the defect. In columellar reconstruction the length of the columella should be exceeded by the graft. In replacement of the ala the graft should extend somewhat over the rim. It is also important that the cartilage forming the middle layer is not separated from the skin layer. The union of cartilage and skin must be protected most carefully. Particular care is required when suturing the graft to the nose. No catgut should be used to suture the subcutaneous tissue or the cartilage; only fine skin sutures of silk and nylon should be made. We use 6/0 Dermalone. The sutures must be placed close together, not only when suturing the external skin but also when suturing the interior of the nose in the region of the vestibule.

In order to make the contact surface of the composite graft and the freshened border of the defect wider. LEXER recommended folding the upper defect border inward after it has been incised along a curve. The skin flap of the three-layer graft which is intended for the inner lining of the ala at the rim must then be cut appropriately smaller than the outer flap which is brought into contact with the external defect border (Fig. 407). GÖCKE has modified this procedure by cutting a narrow flap through the entire thickness of the ala along the rim of the defect. The flap is pedicled posteriorly at the alar base, repositioned downward and sutured to the nasal tip at the level of the normal alar rim. In this way the rim defect has been transformed into a central alar defect which can be filled with an auricular graft of good adaptation possibility to all sides. The concha of the auricle is best as a donor site because it is curved like the shape of the ala (Fig. 408).

When suturing the graft one should make sure that the skin-borders of the three-layer graft extend beyond the edge of the cartilage. With respect to this, one must also make sure that the edges of the external skin and the vestibular skin on the border of the defect are placed farther back than the layer of connective tissue, muscle, or cartilage between them. This way one not only obtains congruence of the wound borders which must be sutured together, but also a larger contact surface. On the other hand the cartilage layer of the composite graft can extend beyond the edges of the skin if the edges of the skin along the borders of the nasal defect are undermined appropriately, likewise increasing the contact surface. We have had the best results with the second method, while DAVENPORT and BERNARD recommended the first. In many cases the three layers are sutured step-like: the external skin extends beyond the edge of the cartilage, which in turn extends beyond the edge of the inner lining, as already described in the method of LEXER.

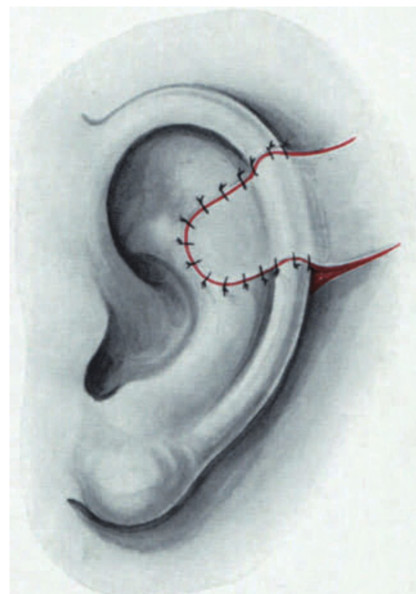
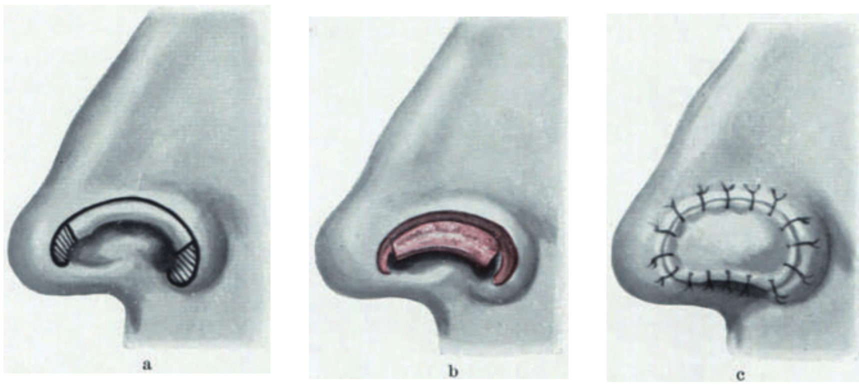
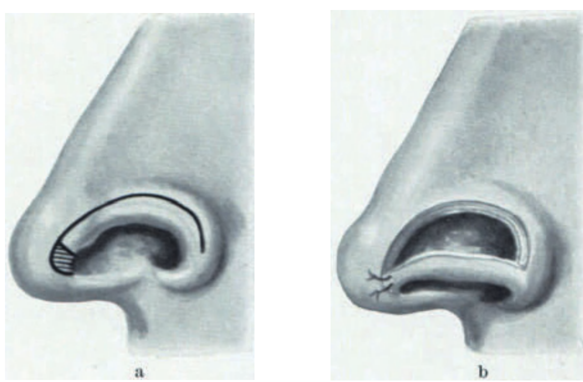


Fig. 406. Treatment of the donor site of a large composite graft by means of two-stage suturing of a retroauricular skin flap. The anterior surface is covered by the distal end of the flap. In a second stage the base of the flap is detached and the remaining part of the flap is used to cover the posterior surface of the auricle

DAVENPORT and BERNARD emphasize the importance of sutures which are close to each other but which do not extend deeply into the skin so that vascularization is not impaired. The sutures should affect only the most superficial skin layer. A suture including the cartilage should never be applied. In order not to crush the vessels one grasps the tissue along the border of the wound, especially on the graft, with fine dermal hooks and not with a forceps. If possible, the operation should not be done under local anesthesia. We do not strictly reject local anesthesia as DAVENPORT and BERNARD do, since we have never had bad experience with it. One must only make sure that the local anesthetic does not come close to the freshened edges of the defect. Injection at least 1.5 cm distant from the borders of the wound area, or else nerve-block anesthesia should be given. Is it recommended not to use adrenalin with the anesthetic. Hypotony due to the lytic cocktail should also be avoided. No ligatures may be applied for hemostasis in the border of the defect. Nor should one coagulate bleeding vessels. Small mosquito clamps can be used and be left in place until suturing. To improve the chances of healing CONLEY and VON FRAENKEL have tried to reduce the biological requirements of the composite graft by means of cooling until it has adapted to the new surroundings and its survival seems assured. The speed of many biological processes like cell division, metabolism and the



Figs. 407a—c. Reconstruction of the ala by means of folding over the border of the defect for partial interior lining thus forming at the same time a larger contact surface as a host site for the composite graft, according to LEXER. a Incision. Black hatching shows surplus tissue. b Defect border folded down. c Composite graft sutured. The sutures on the rim of the ala are only made if the inner lining reaches the border. If this is not the case, the composite graft must be chosen from the edge of the auricle; then this suture line lies in the vestibule



Figs. 408a and b. Partial replacement of the ala according to KÖNIG, GÖCKE. a Incision. Black hatching shows surplus tissue. This tissue is excised to assure a smooth rim. b The rim of the ala is sutured. The defect is no longer on the rim and is prepared as a host site for the composite graft. (From KLEINSCHMIDT)

biological activity of all body tissues is directly dependent on body temperature. Cooling also has a bacteriostatic effect. Cooling is obtained by application of ice or compresses on the dressing for 14 days. It begins with the first dressing. The dressing is first changed on the 10th or 12th day. After this local hypothermia, hyperemia and edema of the graft occur. These conditions subside gradually over several months.

Dressing technique. Many composite grafts have been lost because of too much pressure from the dressing. Therefore the dressing must be very loose and yet protective. We cover the graft and the suture area with aureomycin tape, ointment tape. Gauze soaked with perubalsam or with penicillin ointment is also used. One must take care in covering the graft without folds. We pack the vestibules loosely with some petrolatum gauze. A carefully trimmed layer of gauze is placed on the nasal tip, columella or ala, and finally an adhesive tape dressing is applied, if the surgery was only for replacement of the columella. A protective plaster cap without pressure is used if the surgery was for replacement of the nasal tip or ala. BURIAN and ZOLTAN recommend covering the graft with cellophane rather than with a dressing.

Like BROWN and PELLICIARI we feel that the dressing should not be changed after a few days, but that it should be left intact for 7 days. One should follow this principle even if the graft begins to smell on about the 5th day. At this time there is danger of a necrosis. But in general the graft recovers during the next days. DAVENPORT and BERNARD remove the dressing and sutures on the 5th day.

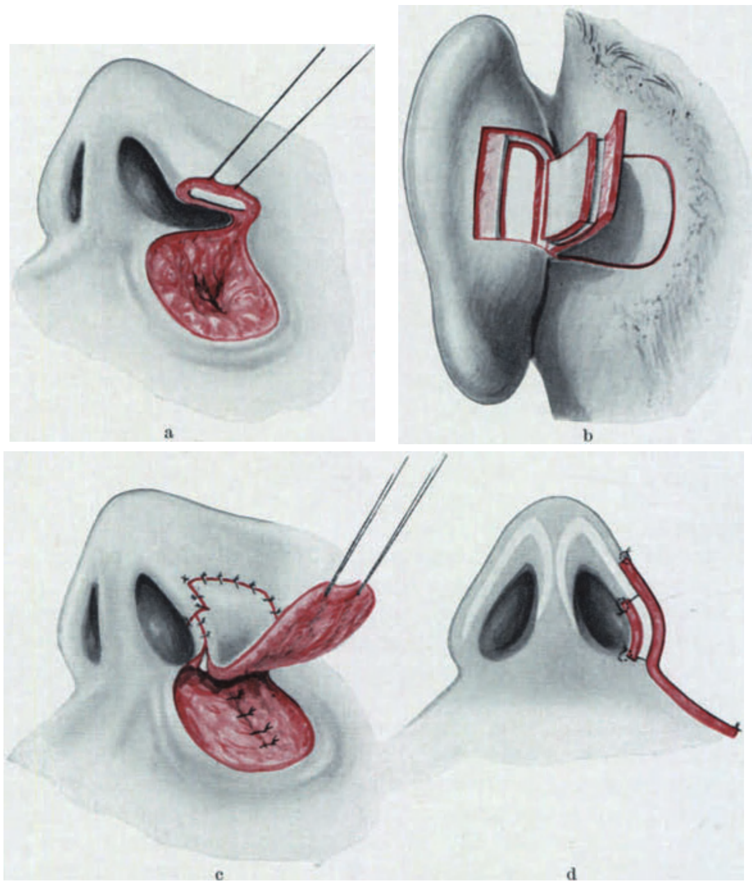
Results. With free auricular grafts the results are better than with many others. In the alar replacement technique the appearance of the inner alar lining is very natural. In addition, the curvature of the ala or the delicate shape of the columella can hardly be worked out so well with other techniques. There is no tissue in the body other than the auricle in which a curved cartilaginous plate is covered on both sides with skin like that of the cartilaginous nose. — The changes in shape of the auricle are relatively slight when one observes the general instructions mentioned above. — A considerable advantage of the procedure is that the patient's stay in the hospital is short and that, with the exception of possible slight postoperative corrections, surgery is necessary only once. If the graft fails to "take", there is no damage to the patient other than the slight change in shape of the auricle. One must make him aware of the possibility of failure.

Other possibilities. In addition to the 3-layered skin-cartilage-skin grafts described above, one can also use free grafts of tissue from the lobe *without cartilage*, as described by ZENO and HIRSCHBERG. DUPERTUIS also grafted parts of the ear lobe without cartilage. In suitable cases we use free grafts from the posterior border of the ear lobe for the columella, as CONVERSE and MCLAUGHLIN also have recommended.

Two-layer skin-cartilage grafts are used in cases where the defect does not affect the entire thickness of the ala, columella, or nasal tip. A patient's nasal breathing may be almost completely obstructed on one side due to cicatricious contraction of the ala after trauma. In such a case we were able to bring the originally concave, inwardly curved lower lateral cartilage to an outwardly convex position by using a 2-layer graft from the curved auricular concha. In such cases the grafts include the posterior layer of skin of the concha together with cartilage, while the anterior layer of skin remains intact. The retroauricular defect is covered by means of advancement flaps.

The partial reconstruction of the columella by means of free grafting of a wedge *from the base of one ala* after PEGRAM should be mentioned here. This was also discussed in the chapter on bilateral harelip nose (see p. 248). We have likewise had good results with this procedure. — An unusual case of composite graft was described by DAVIS. He extended a cicatriciously shortened ala with a wedge-shaped composite skin-cartilage-skin graft from the normal ala.

In 1950 CONVERSE described an extended composite graft method. For the replacement of the alar attachment together with the adjoining part of the cheek he used a three-layer skin-cartilage-skin graft from the auricular concha with an attached, much larger external *layer of skin from the mastoid*. When removing the graft one had to cut around the skin on the posterior surface of the auricle and much beyond the fold of the auricle into the postauricular region. This skin flap attached to the much smaller piece of cartilage was used to cover the adjoining cheek defect. The other part of skin which came from the anterior wall of the auricle was used to line the nasal vestibule and was about as large as the piece of cartilage or a little smaller. The donor site on the posterior surface of the auricle and on the retroauricular area was covered by advancement flaps. The defect in the concha was closed with a full-thickness skin graft (Fig. 409).



Figs. 409a—d. Extended modification of the composite graft method of CONVERSE for alar defects which extend into the skin of the cheek. a Defect. b Obtaining a three-layer graft from the auricle with a retroauricular skin flap. c Suturing the graft. d Situation after providing the internal and external epithelization with cartilage reinforcement

SCHUCHARDT recommended closing the donor site on the back of the auricle with a bridge flap.

In 1956 ROBINSON reported on a reconstruction of the nasal tip and both alae with an 8 cm long, strip-shaped composite graft. The instructions of BROWN, CANNON and PELLICIARI not to exceed 1 to 1.5 cm in width were observed. ROBINSON obtained the graft from the helix and did without a dressing after surgery as MCLAUGHLIN does.

ŠERCER combines the composite graft technique with a pedicled flap. He does not transplant the auricular graft as a free graft but transports it to the ala *by means of a long pedicled flap.* This flap runs inside the hair line and above and parallel to the forehead and is pedicled parietally.

III. Reconstruction of alae

Isolated defects of the alae are relatively rare and are usually combined with destruction of the nasal tip, columella, dorsum, or the lateral walls. It is primarily a matter of bite wounds, lacerations, gunshot wounds, burns, or condition after excision of lupus or tumor tissue, lues, etc.

The methods for reconstruction of the alae are the following:
1. local procedures;
2. reconstruction with flaps from neighboring area;
3. reconstruction with septal flap;
4. reconstruction with distant flaps;
5. free graft methods, which are described in the preceding chapter (see p. 330).

1. Local reconstruction procedures

One of the local procedures of reconstruction is the use of tissue adjacent to the defect.

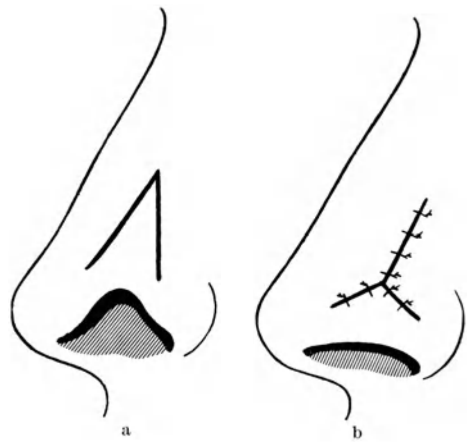
Among the older methods of correction of pinched-in alae are those by KRAUSE and DIEFFENBACH (Fig. 410) as an inverted V-Y advancement, and the BOCKENHEIMER method. In the latter an angled incision is pulled out to a rhombus, which is drawn strongly in the direction of the defect and approximated to a line (Fig. 411). Both methods are obsolete.

The method of DENONVILLIERS is a *Z-plasty in the alar region*. In this a flap pedicled anteriorly is moved distally and sutured (Fig. 412) so that the alar border lies at the proper level. This procedure can also be used to cover marginal alar defects and can be enlarged by means of a free skin graft in the upper part of the ala after KAZANJIAN (Fig. 413). In a modification of the procedure by DENONVILLIERS, KAZANJIAN mobilizes the mucosa lining of the nose above the alar defect to advance it downward. This way it is positioned against the inside of the defect resulting over the ala and no perforation occurs. Then one does not need to close the external defect with a free graft which replaces the entire wall.

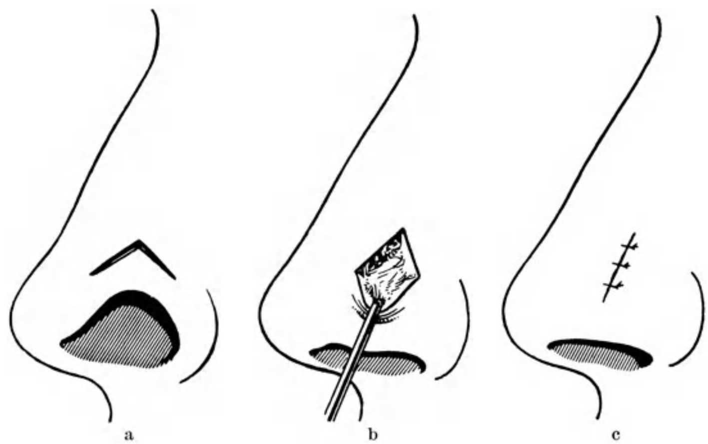
Another variation of the method by DENONVILLIERS was described by JOSEPH. By cutting around the base of the ala one can mobilize the ala so that the border is placed at the normal level. The entire mobilized ala is pedicled at the nasal tip. TENNISON, WALLER and GRIFFITH correct congenital lateral nasal cleft, i.e. a wedge-shaped alar defect (see p. 292), with similar small local flaps. In the smallest defects or retractions of the alar rim a marginal Z-plasty is sufficient (Fig. 414). A flap pedicled above from the region of the alar attachment is swung into the defect and sutured. Another simple procedure by JOSEPH consists of a vertical wedge excision on the retracted and cicatricious ala with downward repositioning of the mobilized lateral part of the ala (Fig. 415). However this method can seldom be used. It is suitable for wide, not very high nasal defects, or for retracted alae. The rim must be long enough, and no deep scars should be present on the base of the alae and in the region of the adjoining cheek, so that nourishment is not endangered.

A more extensive procedure was originated by us, which can be used in larger alar defects (R. MEYER). The ala is severed anteriorly through its entire thickness. A narrow wedge is excised by means of a second incision at a very acute angle to the first. The skin of one half of the nose is mobilized to the level of the eyes so that the resulting skin flap, can be rotated and sutured in at the proper level. In order to facilitate this rotation and *advancement of the entire lateral nasal skin*, we extend the paramedian incision in a curve under the eyebrow.

Just in front of the end of the eyebrow on the glabella we excise a Burow triangle. (Fig. 416). Undermining is extended to the upper lid and to the superciliary arch. At the piriform aperture the mobilization of the mucosa is continued upward beyond the agger nasi while forming a wide flap. This can be advanced with the entire skin rotation. — In case of cicatriciously contracted ala Kazanjian likewise mobilizes an adequate flap on the lateral slope of the nose and pulls



Figs. 410a and b. Correction of pinched-in ala using V-Y advancement by Krause, Dieffenbach. Incision through the entire thickness of the soft structures. b Ala advanced, incision sutured

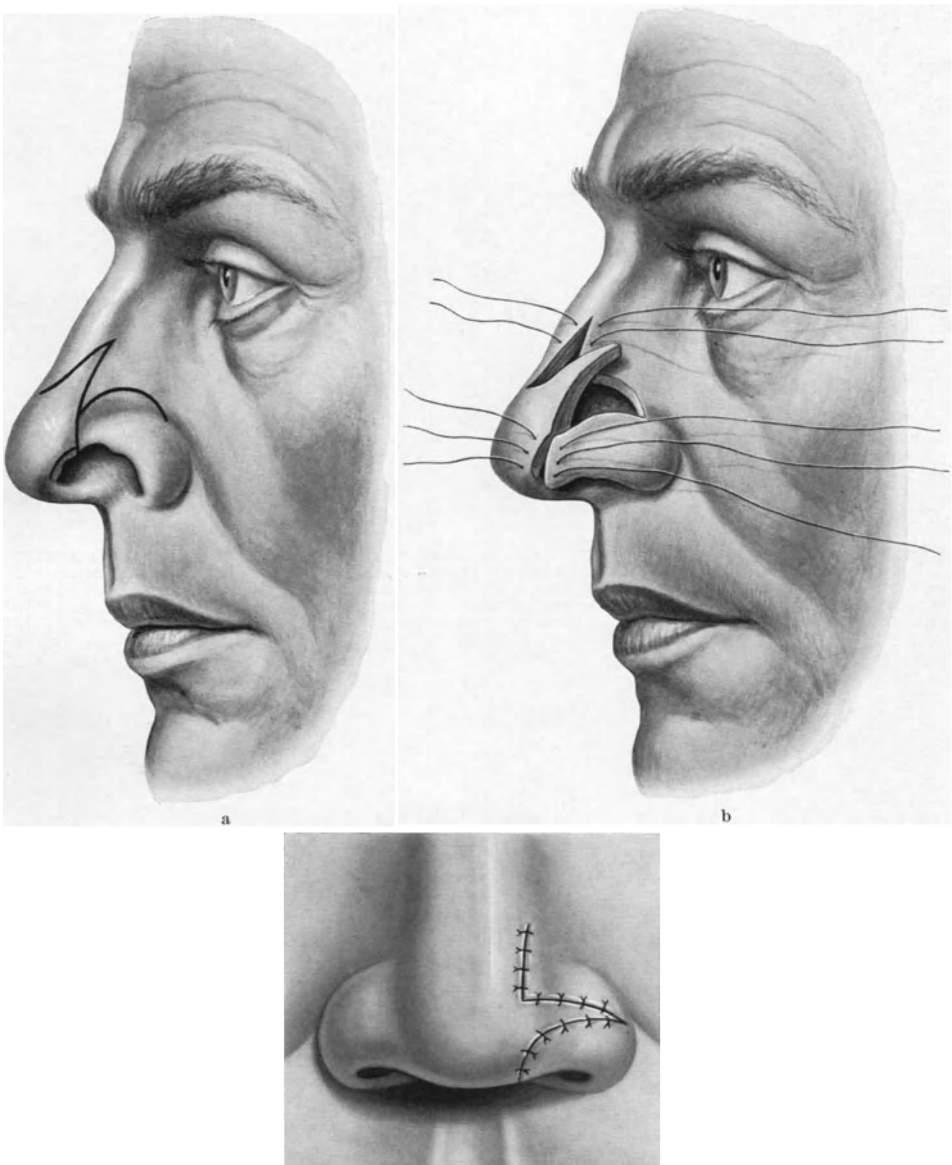


Figs. 411a—c. Correction of pinched-in ala by Bockenheimer. a Incision through the entire thickness of the ala. b Alar rim is drawn downward to the normal level. c Suture line runs longitudinally

it downward. In this way an improved position of the alar rim is obtained. The upper defect in the region of the bony nose is covered with a transposition flap from the glabella. — In case of congenital notch in the anterior part of the ala, a rotation maneuver of this kind can also be combined with a marginal Z-plasty after Griffith.

With an ala retracted by scars on the lateral slope of the nose, the correction by Kazanjian can be made using an extensive Z-plasty. Both triangular flaps of the Z-plasty must be mobilized beyond their base so that they can be transposed easily (Fig. 418).

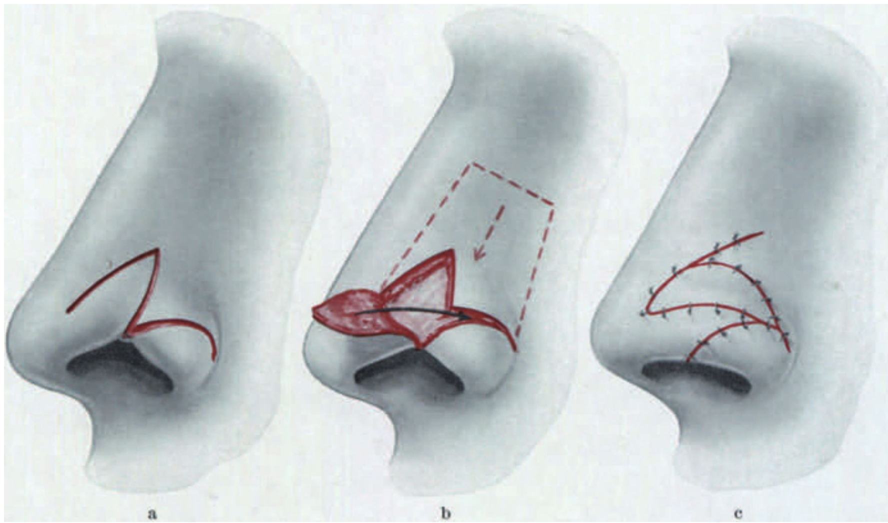
These methods by JOSEPH, R. MEYER and KAZANJIAN for correcting retracted alae achieve symmetry of the nose. They should only be used if the nose is long, because they lead to a certain shortening of the nose, i.e. to a lifting of the nasal



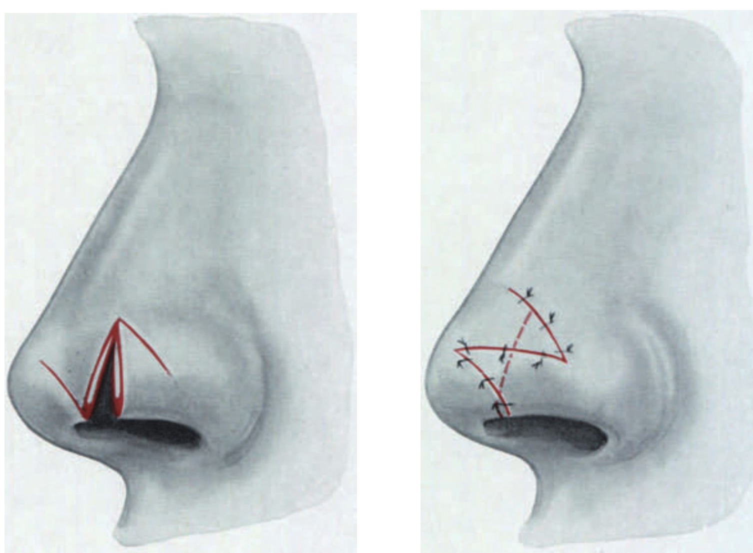
a b c

Figs. 412a—c. Alar surgery by DENONVILLIERS, JOSEPH. a The black lines show the incisions needed for the flap exchange. b The partially applied sutures show the future position of the flaps. c Situation after suturing. (From KLEINSCHMIDT)

tip. In several cases with our method we obtained a very good result with regard to symmetry of the nose, but in a second stage a few months later, the nose had to be lengthened by mobilization of the entire dorsal skin, by implantation of a graft, or by an inverted V-Y advancement at the glabella. Of course fine suture technique is necessary here so that the external scars are hardly visible later. We use 6/0 Dermalone exclusively.

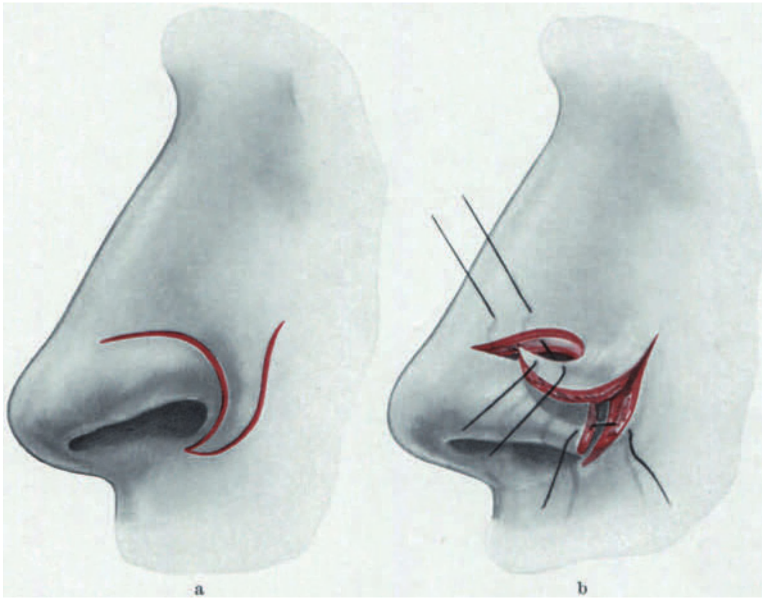


Figs. 413a—c. Correction of pinched-in alar rim using combination of methods of DENONVILLIERS and KAZANJIAN. a Incision according to DENONVILLIERS. b Mobilization of the flap according to DENONVILLIERS and preparation of the host site for this flap (black arrow). Dotted red line outlines the flap in the vestibule and nasal cavity. Red arrow indicates direction of advancement. c Flap of DENONVILLIERS sutured in place, remaining defect covered with a full-thickness skin graft (KAZANJIAN)

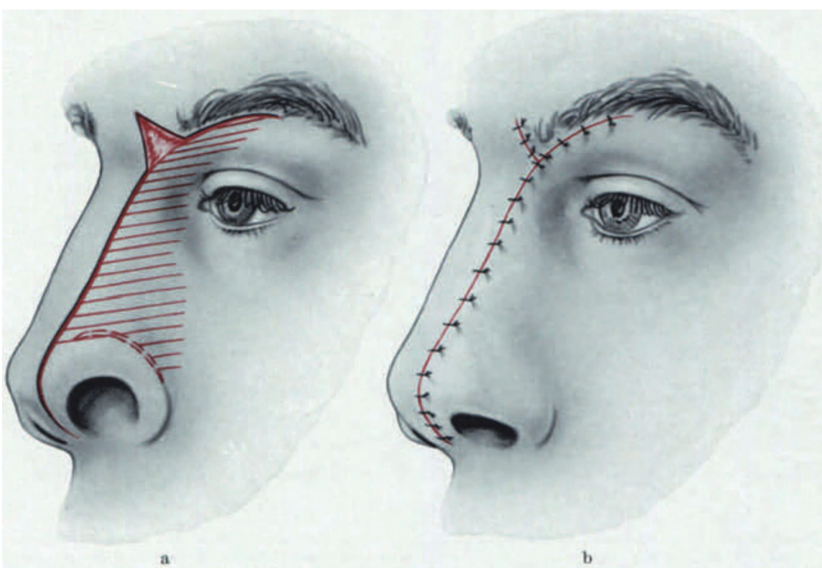


Figs. 414a and b. Correction of an alar defect or a pinched-in ala using a Z-plasty. a Incision. b Transposed flaps are sutured

A two-stage procedure for correction of retracted alae has been developed by BARSKY. A large *rectangular advancement* flap is formed by means of incision on the caudal border of the nasal bone paramedially forward to the border of the alar defect. The flap is repositioned downward and is sutured at the proper level (Figs. 419a and b). In this way a triangular defect results above the ala.

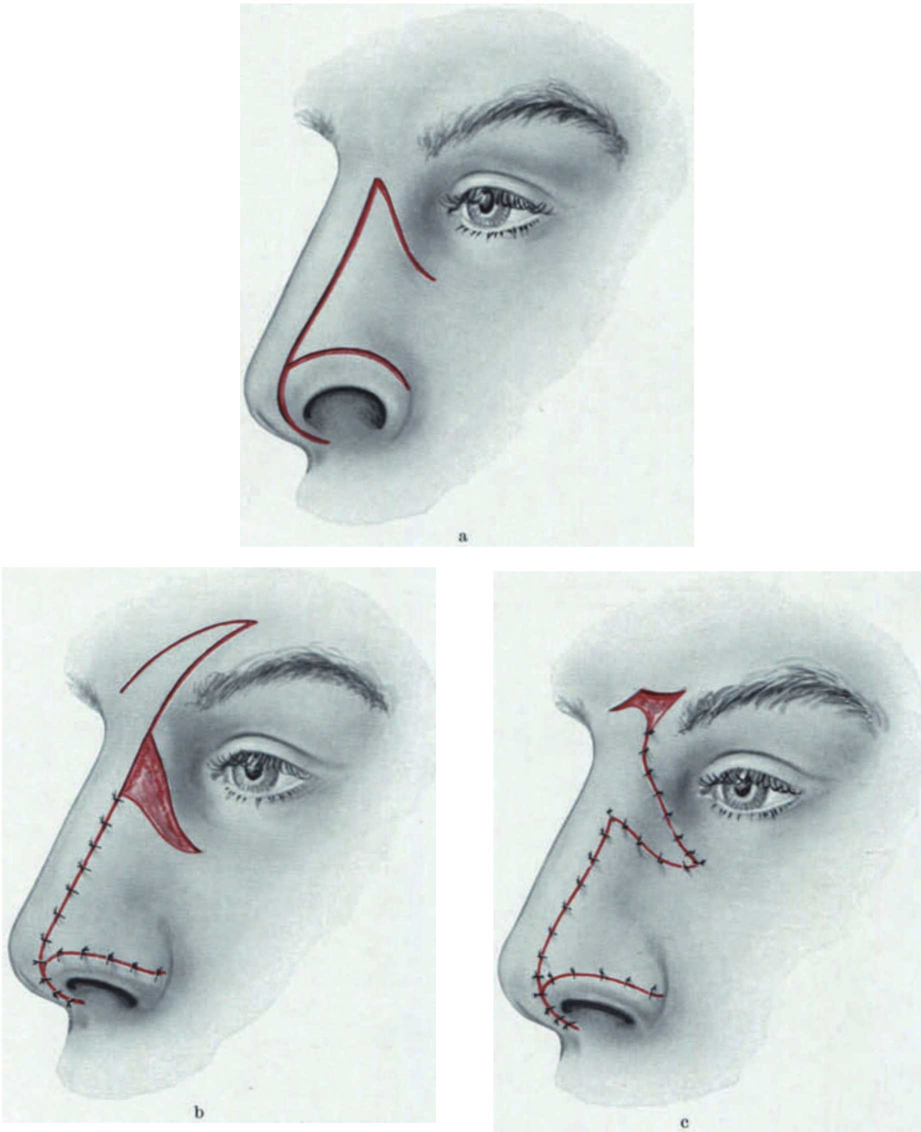


Figs. 415a and b. Management of pinched-in alar base by DENONVILLIERS, JOSEPH. a Incision. b Transposition of a flap consisting of the entire thickness of the ala including epithelium for the inner lining



Figs. 416a and b. Correction of pinched-in ala by means of skin advancement on the entire side of the nose, according to R. MEYER. a Red hatching shows mobilized skin. Excision of a BUROW triangle at the glabella to release tension. Dotted red line shows the intercartilaginous incision for release of the inner retraction. b Suturing the skin after advancement

In the second stage operation this must be closed (Fig. 419b). In the first stage the nasal mucosa and the skin on the upper defect border are sutured together. After a few weeks a triangular skin flap is formed with its base on the upper defect border. This is swung inward for the internal lining and is sutured (Fig. 419c). When doing this one must be sure that the nourishing base is not folded too sharply or stretched too tightly. In addition the flap must be made



Figs. 417a—c. Correction of pinched-in ala using an advancement flap from the lateral nasal wall and a transposition flap from the glabella, according to KAZANJIAN. a Incision in the region of the columella, on the lateral part of the nasal dorsum, on the nasal wall, and in the region of the alar rim. b Formation of a transposition flap on the glabella; advancement flap sutured with repositioning of the alar border. Skin defect on the lateral nasal wall covered with the glabellar flap

adequately large. The external defect is covered with a free skin graft (Fig. 419d). Covering by means of a pedicled flap from the upper arm is also possible.

In slighter retraction of the ala an incision as by KAZANJIAN 1 cm above the retracted ala can be made down to the inner lining of the nose. From here the nasal mucosa can be undermined (décollement) extensively upward. A trapezoidal flap with its base at the ala is formed from this mobilized mucosa. It is advanced distally with the repositioned alar border. In the region of the agger nasi a mucosa defect results which must granulate closed (Fig. 420). After

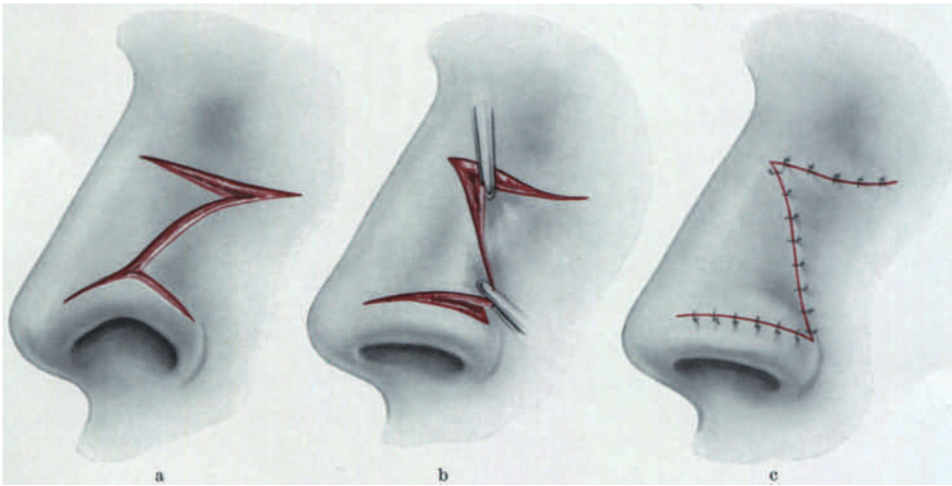
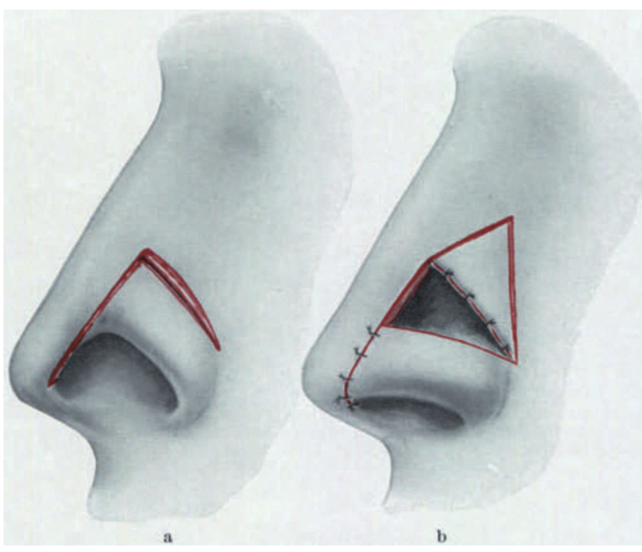


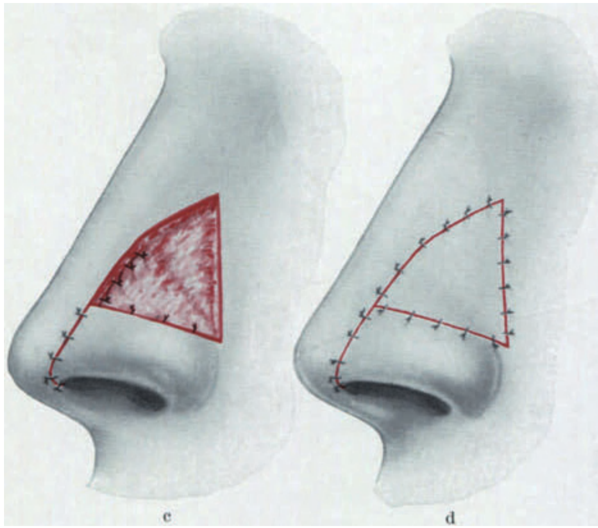
Fig. 418. Z-plasty in pinched-in alae according to DENONVILLIERS, KAZANJIAN. The skin flaps must be mobilized even beyond their bases



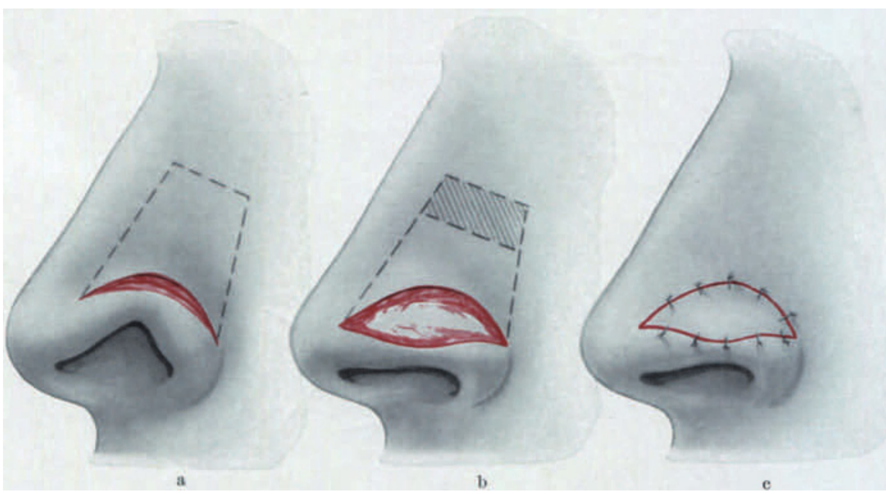
Figs. 419a—d. Correction of an alar rim defect by BARSKY. a Incision through the entire thickness of the soft structures to form an advancement flap. b Advancement flap placed at the proper level and sutured. The limit of the skin flap which is later to be transposed for inner lining is shown. The skin and mucosa are sutured along the upper border of the perforation

repositioning the alar border an external defect remains at the extended horizontal incision. This is covered with a free full-thickness graft (WOLFE-KRAUSE flap).

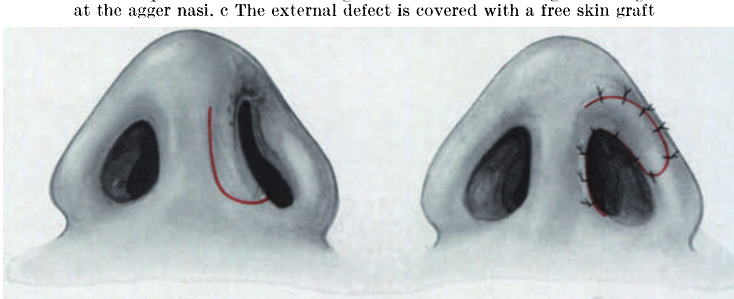
Sometimes it is also possible to cover small anterior border defects on the ala laterally by means of a *transposition flap from the columella* (R. MEYER,



Figs. 419c and d. c Inner lining formed by folding over the triangular flap. d External defect is covered with a full-thickness skin graft



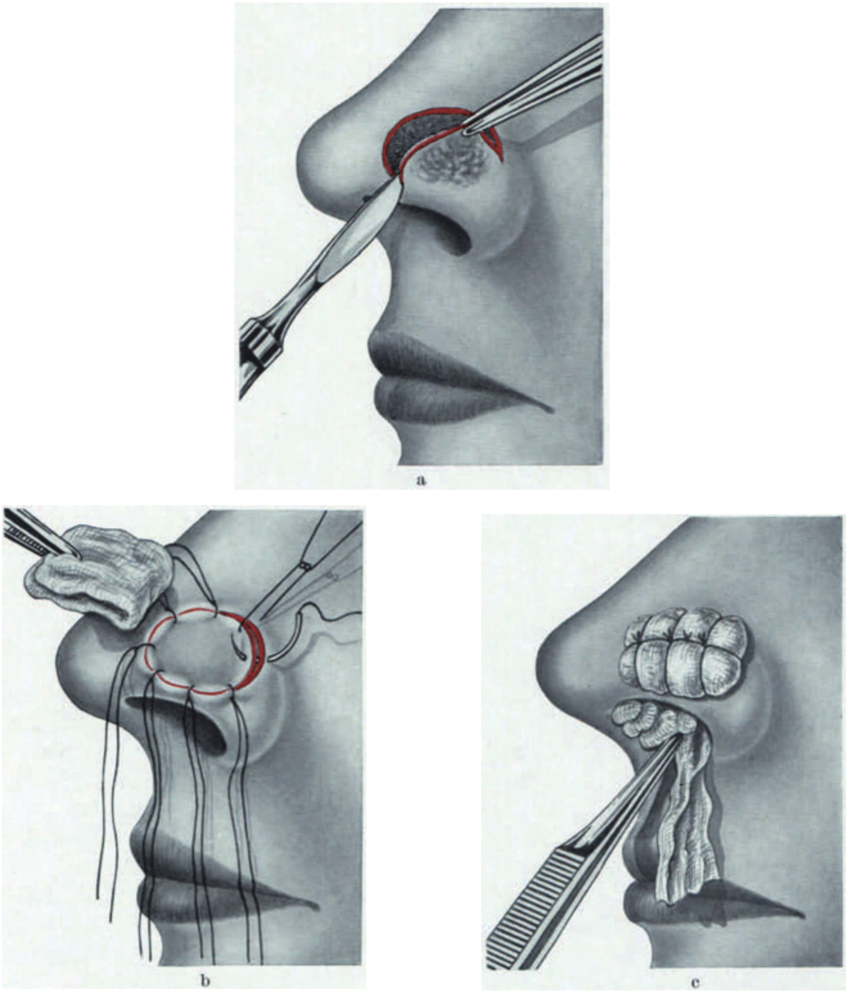
Figs. 420a—c. Correction of slightly pinched-in alar rim by KAZANJIAN. a An incision is made through the ala, but only as far as the inner lining, 1 cm above the rim of the pinched ala. Dotted line shows the mucosa to be mobilized. b The alar rim is repositioned downward together with the inner lining. Hatching shows the raw surface at the agger nasi. c The external defect is covered with a free skin graft



Figs. 421a and b. Elimination of an anterior alar defect using material from the columella, by R. MEYER. a Cutting the flap laterally on the columella. b Suturing the transposed flap

Fig. 421). But the columella must be adequately large for this. In addition the skin of the membranous septum can be used to cover the donor site on the columella.

If a perforating defect does not remain after excision of nevi and other tumors, covering is done by rotating skin from the neighboring area onto the defect or



Figs. 422a—c. a Excision of a nevus from the ala; the inner lining is retained. b The defect is covered with a full-thickness skin graft. c The sutures are tied over a fixation and compression dressing. Loose nasal packing aids fixation and keeps the ala motionless

by using *free skin grafts*. Treatment with free skin grafts (Wolfe-Krause) (Fig. 422) is done in the following manner. The sutures which immobilize the skin graft are tied around a pressure dressing so that the dressing presses gently against the grafted area. The pressure should not be too strong. Otherwise the sutures tear and healing is not guaranteed, which can result in a retraction of the alar rim. The best donor sites for smaller Wolfe-Krause skin grafts are the retroauricular region or the supraclavicular pit.

The local methods described here for elimination of alar defects are applicable today only if the defects are relatively small. In general one must say that free grafts and composite auricular grafts have for the most part superseded local methods. — Alar defect surgery using free grafting of a wedge-shaped piece from the normal ala to the defect after JOSEPH has proved to be good. Failure of the grafting is possible and one might have to resort to removal from the auricle after all. This can happen in the case of narrow alar defects without an ugly retrusion of the tip resulting.

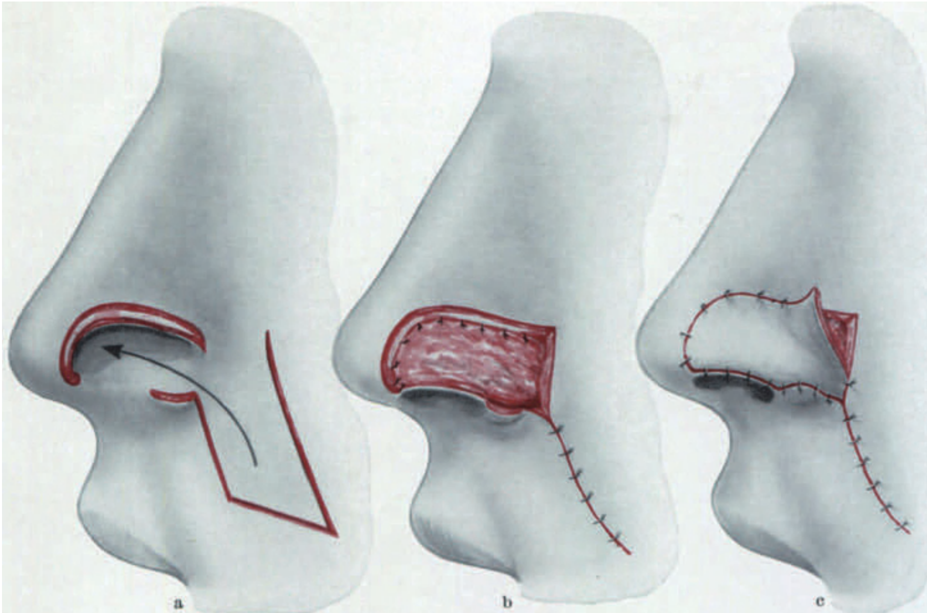
2. Reconstruction with flaps from neighboring areas

First a few older methods should be mentioned. DIEFFENBACH and DUPUYTREN swung a flap *from the nasolabial fold* forward into the defect (Fig. 425a). In the same manner SÉDILLOT used a horizontal flap from the cheek (Figs. 425b, c).

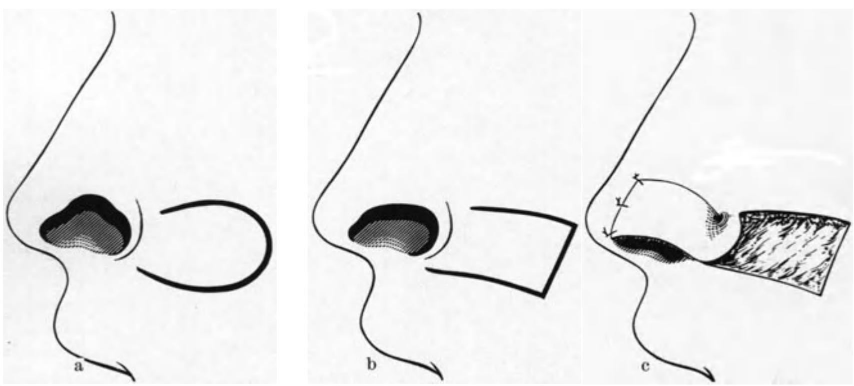
Figs. 423a—c. Replacement of the ala by SANVENERO-ROSSELLI. a Skin flap with its base on the rim of the defect is swung downward for inner lining (wedge excision aids formation of a better rim). b External covering with a transposition from the lateral part of the nose and cheek. c Situation after covering the defect and suturing the donor site

Such one-layered flaps which affect the entire ala are to be rejected. On the other hand flaps used in this manner can be successful if they are lined with a THIERSCH graft during a first stage and then, a week later, swung onto the defect and sutured, as MAY advises. One can also use the often cicatricious skin in the region of the defect border for inner lining of the defect. It must be separated carefully and be turned inward toward the vestibule. SANVENERO-ROSSELLI described such a procedure. Once the inner lining has been formed by suturing the border skin which has been turned inward, one covers the external defect with a transposition flap from the region of the frontal process of the maxilla (Fig. 423). A procedure by L. OMBRÉDANNE and KAZANJIAN is much like the one described above. In this procedure a skin flap is formed in the nasolabial fold and swung with its raw surface outward into the defect to become the inner lining. The external raw surface is covered with a full-thickness skin graft (Fig. 424).

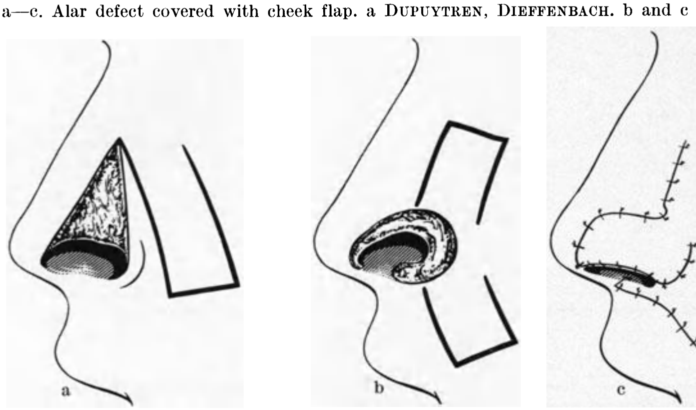
Another procedure with transposition of a flap *from the cheek* to the alar defect comes from NÉLATON (Fig. 426a), but it is outmoded. In this the end of the pedicled flap is turned inward for partial inner lining. The method after ZUCKERKANDL uses an advancement or transposition flap from the cheek area. In the modification by JOSEPH a little tab from the nasolabial fold is also advanced and used for inner lining of the ala. These two methods are also obsolete. For these methods ŠERCER described covering the donor site on the cheek by rotation of cheek skin. The procedure of VON LANGENBECK and its modification by VON



Figs. 424a—c. Alar replacement by OMBRÉDANNE, KAZANJIAN. a Flap for inner lining is formed in the naso-labial fold. b Suturing the inner lining and the donor site. c The raw surface is covered with a full-thickness skin graft

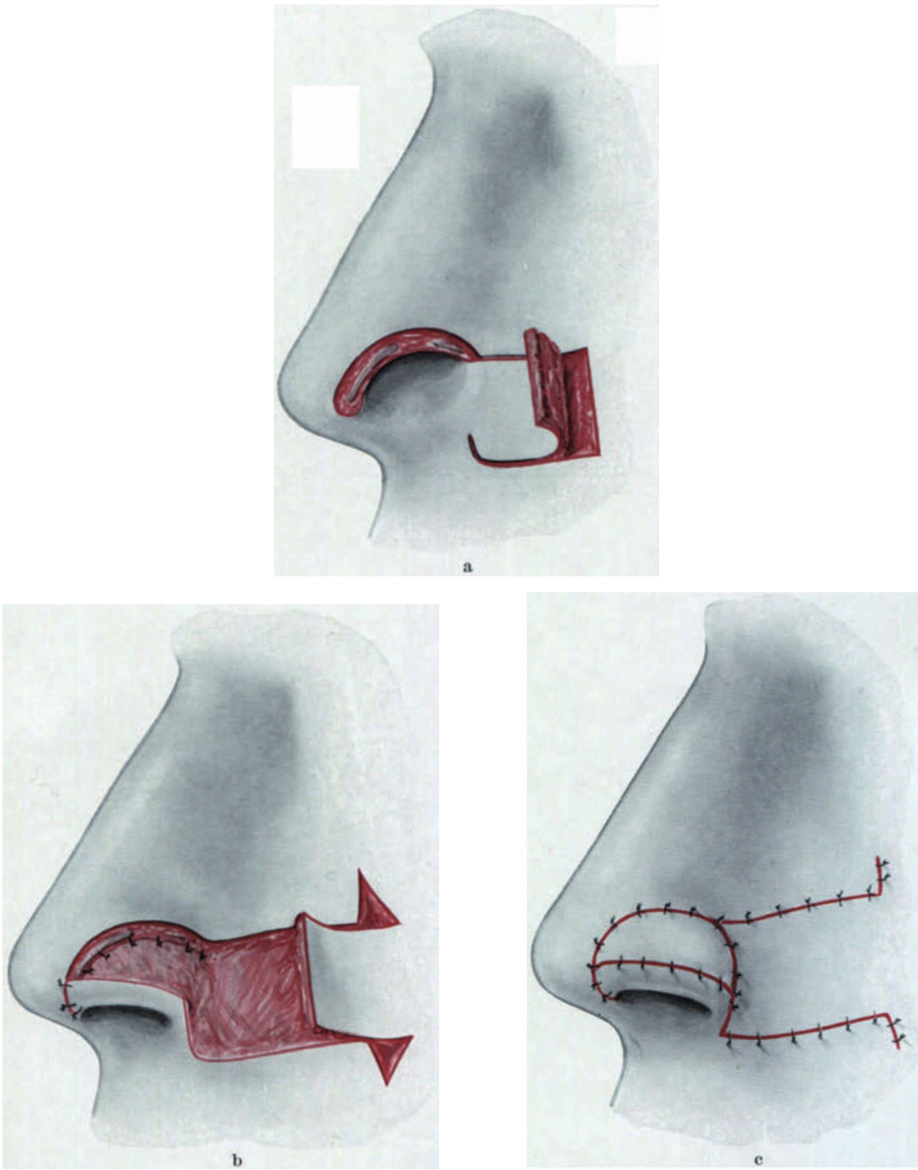


Figs. 425a—c. Alar defect covered with cheek flap. a DUPUYTREN, DIEFFENBACH. b and c SÉDILLOT



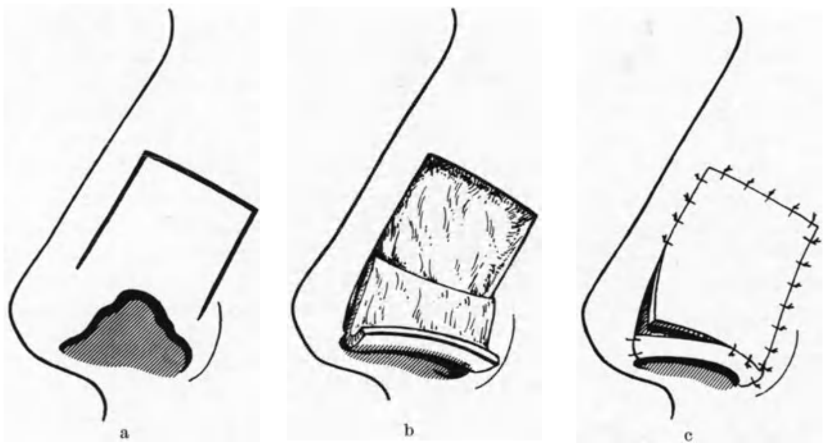
Figs. 426a—c. Alar defect covered with cheek flaps. a Alar replacement using a transposition flap from the cheek pedicled above (NÉLATON). b and c Alar replacement using a double flap from the neighboring area. Naso-labial flap is used for inner lining of the nose; the flap from the lateral nasal wall is used for external covering (DIEFFENBACH)

HACKER also probably have no adherents today. In this method a rectangular, pedicled flap from the normal side of the nose is swung onto the defect and as by VON HACKER the inner lining is formed by swinging a flap from the naso-



Figs. 427 a—c. Alar reconstruction by F. SMITH. a The rim the defect is prepared and a cheek flap is swung over for inner lining. b The cheek flap is sutured and the alar rim is formed by folding over the edge of the flap. c The donor site is covered with a straight advancement flap. The remaining external alar defect is covered with a free full-thickness skin graft

labial fold. In another method of DIEFFENBACH a nasolabial flap is swung inward for the inner lining and a transposition flap is used for the external covering. This method has likewise not become popular due to the narrow base of the two flaps (Figs. 426 b and c).



Figs. 428a—c. Alar replacement by F. SMITH. a Incision of a skin flap for inner lining. b Flap swung down. The end of the flap is folded over to form the alar rim. c The defect is covered with a full-thickness skin graft

SCHUCHARDT published a simple procedure for correction of the ala which is retracted only in the anterior part. The ala is severed from the nasal tip by means of a curved incision and is rotated distally to the proper rim level. Then the inner lining is advanced and covered as by KAZANJIAN (see p. 344) with a mucosa flap which is drawn downward from the region of the agger nasi. On the cephalic border of the curved incision one mobilizes a triangular skin flap which is first advanced laterally and then sutured. — An interesting method was described by FERRIS SMITH. We have tried it with good success. Just behind the alar defect a pedicled cheek flap is swung into the defect as the inner lining. The lower part of the flap which is now at the alar rim is folded outward so that a duplication is formed on the rim. The donor area of the flap is covered with a direct advancement flap from the cheek. The raw surface remaining over the upper part of the alar defect is covered with a full-thickness skin graft (WOLFE-KRAUSE graft) (Fig. 427). If the original alar defect is not too large, one can close the donor area of the nasolabial flap by approximation as described by WYNN and NORDSTROM, Jr. In this procedure of turning a cheek flap for inner lining of the alar defect one must make sure that fat remains on the base of the flap so that the blood supply is assured. Because of this the flaps are somewhat too thick. However the ala can be thinned in a later operation by means of opening it and excising fat and connective tissue.

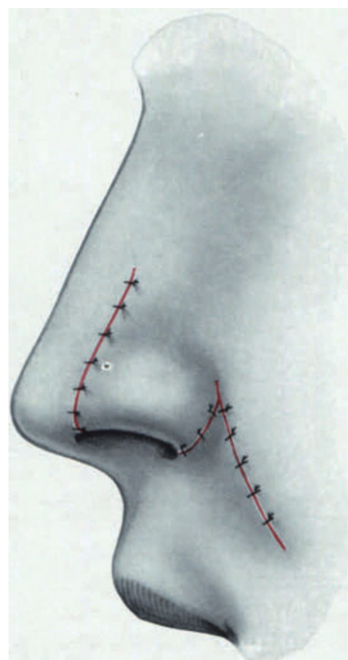
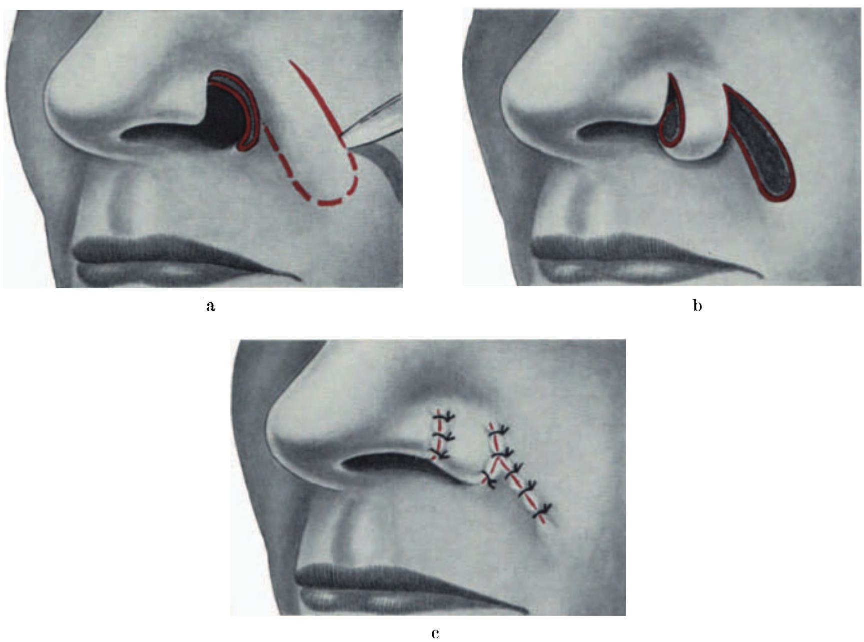


Fig. 429. Alar replacement by DE CHOLNOCKY (NÉLATON). Defect covered with a flap from the nasolabial fold; the base of the flap is on the lateral nasal wall; inner lining formed by folding the end of the flap into the nostril

F. SMITH derived another method of replacement (Fig. 428) from one by JOSEPH. He swings a rectangular flap with the underlying muscle fibers downward from the lateral slope above the alar for inner lining of the ala. Here again the overlapping part of the flap is folded outward, thus forming the alar rim duplication as in the method last described. The remaining external defect is again covered a free full-thickness skin graft. JOSEPH made this external covering with a diagonal, forehead flap pedicled at the glabella. Today, in the age of free grafting, the modification by FERRIS SMITH is to be preferred to the original method by JOSEPH because it makes no additional scars on the face. One must then deal with a double skin surgery, i.e. with the combination of a flap from the neighboring area and with a free skin graft, as has often been mentioned above. CONVERSE and ROBIN recommend this double skin surgery especially for replacement after excision for superficial carcinomas. They use advancement



Figs. 430a—c. Closure of a defect in the region of the alar base. a Formation of a flap in the nasolabial fold with its base at the level of the defect. b The flap is swung into the defect. c The donor site and flap are sutured

and transposition flaps from the neighboring area and cover the donor area with WOLFE-KRAUSE skin grafts. The use of pedicled flaps from the upper arm for covering the resulting defect should be mentioned because of the great assurance of healing.

Like E. SCHMID we have had the experience that flaps turned for inner lining (Figs. 426—428) are better vascularized and more solid if they are previously reinforced. One does this by lining the flap with a slightly convex piece of cartilage from the auricular concha.

DE CHOLNOCKY described plastic covering of alar defects using a flap from the nasolabial fold pedicled at the nasal dorsum. By means of careful mobilization of the cheek skin the donor site can be closed so that no contraction of the upper lip results and the scar in the nasolabial fold is practically invisible (Fig. 429). To strengthen the flap it is sometimes recommended that one reinforce the flap with cartilage from the auricle. This can be done after the flap has been transposed, but it is better to do it beforehand, i.e. by grafting it into the prepared flap.

We have used flaps from the nasolabial region with good success. We cut a flap so that its base is lateral at the level of the defective ala and its tip near the angle of the mouth, similar to the methods of HAGERTY and SMITH and of DE CHOLNOCKY which are modified from that of NÉLATON. The tip of the flap is turned inward for inner lining of the nasal vestibule (Fig. 430). In this procedure it becomes apparent that a postoperative correction on the lateral rim of the ala is necessary to smooth the pedicle. Contrary to McLAREN we have abandoned this procedure for treatment of larger defects. One advantage is the good blood circulation of the flap due to the angular and facial arteries which anastomize in this region.

Following the technique of POLYA, ZOLTAN makes a similar nasolabial flap pedicled farther laterally on the cheek. He sutures the end of the flap at the upper, inner border of the defect so that the surface of the flap faces toward the nasal vestibule. He leaves the pedicled flap doubled this way for 3 weeks. In a second stage the pedicle of the flap is detached at the base and the middle part of the flap is sutured as external covering so that the suture line forms the upper alar depression.

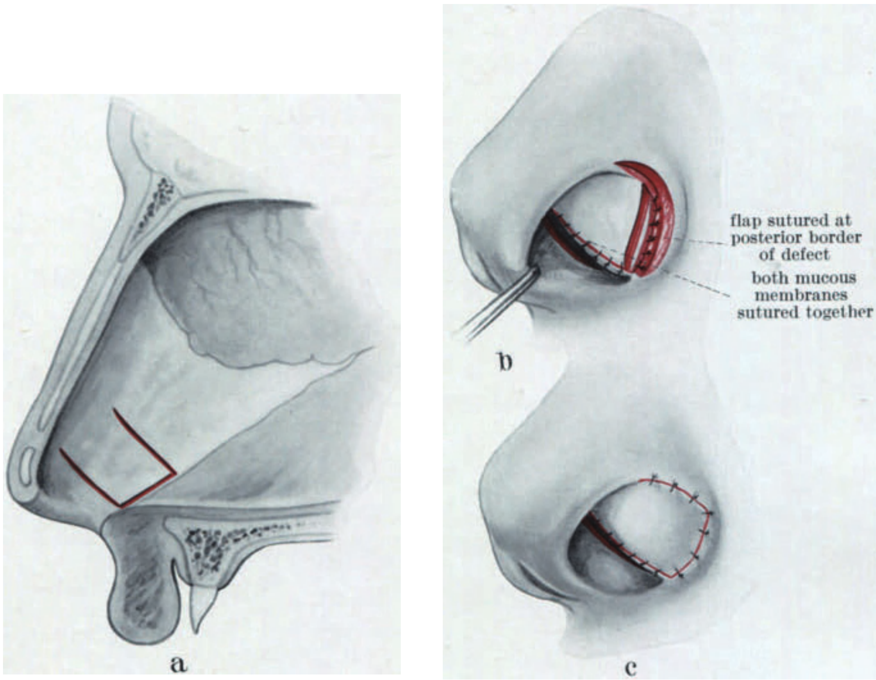
For replacement of larger alar defects BROWN and McDOWELL use a cheek-nasolabial flap pedicled above and lined with a THIERSCH graft. It seems hardly possible that the donor area can be closed in a cosmetically satisfactory way.

The two-pointed flap described by ESSER in 1918 and taken up again in 1953 by ZIMANY should be mentioned here. This method seems somewhat complicated, but it certainly must have its use in cases where the skin of the area surrounding the nose is thick and under tension. Two flaps are cut which form the shape of a three-leaf clover with the defect to be covered. This way one oval flap is in the nasolabial fold, and the other is on the nasal wall (Fig. 431). When the upper flap is swung onto the defect, the lower, somewhat smaller flap is rotated at the same time and covers the donor site of the first flap. This flap transposition is intended for covering non-perforating defects on the ala.

Fig. 431. Covering non-perforating alar defects using the two-pointed flap of ESSER and ZIMANY. The flap from the lateral nasal wall closes the alar defect, and the nasolabial flap is used to cover the donor site of the first flap

3. Reconstruction with septal flap

An interesting procedure, with which KAZANJIAN has obtained amazing results, is to cover the alar defect with a cartilage-mucosa flap from the septum. This is a variation of the older method of DE QUERVAIN from 1902, which was intended for defects of the lateral nasal wall. DE QUERVAIN cut a flap pedicled above or anteriorly on the nasal dorsum in the entire thickness of the septum. This was pressed onto the defect from the other nasal cavity and was sutured there after removal of the mucosa facing the defect. In this way the perforation was closed from the inside. Externally a pedicled skin flap was rotated onto the raw area. KAZANJIAN transferred this method to replacement surgery of the ala. A three-stage operation is necessary for this. In the first stage one cuts the septum flap which is pedicled anteriorly on the nasal dorsum: one severs the septum by means of an incision just behind the caudal border of the septal cartilage, then along the upper edge of the vomer and parallel to the anterior incision (Fig. 432). This movable part of the septum is sutured to the posterior border of the alar defect. On the anterior edge of the flap the mucous membrane



Figs. 432a—c. Alar replacement using a septum flap by DE QUERVAIN and KAZANJIAN. a Incision of the flap on the septum. b The flap is partially sutured on the posterior rim of the defect; the two mucous membranes are sutured along the lower border. c The external covering of the flap is also sutured posteriorly. In a second stage the base of the flap is detached at the septum and is sutured anteriorly in the nasal defect. In a third stage the external mucous membrane is replaced with skin (see Fig. 433)

Fig. 433. Situation after completion, cross-section. Additional covering by HOLMES. After removal of the external epithelium on the septum flap the raw surface is covered with a transposition flap fromth e nasolabial fold

of one side is sutured to that of the other. In the second stage the flap is detached at its base parallel to the nasal dorsum and is sutured entirely into the alar defect. In the third stage the mucous membrane on the flap which faces outward is removed and the external defect is covered with a pedicled skin flap possibly from the nasolabial fold or with a free skin graft. HOLMES used the technique of KAZANJIAN with success in a very large alar defect. In the third stage he rotated a nasolabial flap, as described above (Fig. 429), to cover the external raw surface on the defect (Fig. 433). Because of its complexity the method has not become popular. We prefer other newer methods to this one because we regard the large perforation remaining in the septum and the resulting functional disturbances as too great a disadvantage.

ROBIN described a flap from the septum consisting only of mucosa for the inner lining of alar defects. The flap is rectangular and is cut on the opposite side of the septum with its base at the membranous septum. It is passed through a transfixion incision to the side with the alar defect and is sutured into the defect as the inner lining. A transposition flap from the nasolabial fold is used for the external covering. In a second stage the flap which has been passed through the gap in the septum is detached at its base and is sutured completely into the ala. Here one must be sure that the base of the flap is not constricted in the region of the transseptal passage, a condition which would jeopardize circulation.

4. Reconstruction with distant flaps

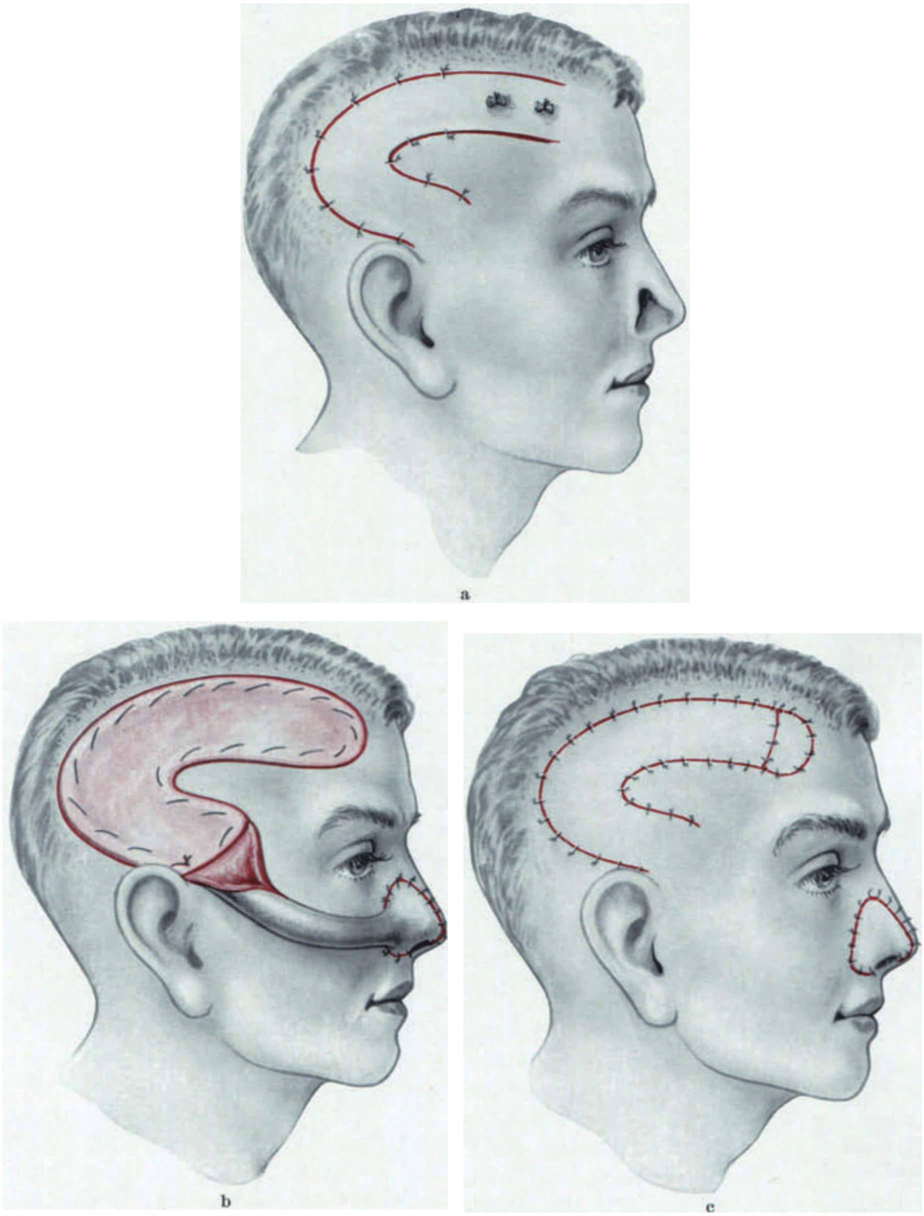
a) Forehead flaps

In the preceding section the method of Joseph was mentioned in which a skin flap from the lateral slope of the nose is swung downward for the inner lining of the alar defect with covering of the external defect using a diagonal forehead flap. This technique was described in a similar manner by Dieffenbach as early as 1845. Dieffenbach turned a trap-door flap inward for the inner lining and covered the external defect with a diagonal forehead flap. But Labat was the first to use a forehead flap for partial reconstruction of the nose. Before that, larger flaps from the forehead (Indian method) for total reconstruction of the nose were known. Szymanowsky described the use of a horizontal forehead flap in 1870. Similar flaps were originated by Roux, Verhaege, Mutter, Bonnet, Weber, Blandin, Thomson, Preidlsberger, Bouisson, etc. In 1931 Sanvenero-Rosselli described a horizontal forehead flap with its base on the temple. This flap was closed to a tubed pedicle flap and was then used to cover a large perforating alar defect. For inner lining the respective area at the end of the flap was lined with a Thiersch graft.

In 1946 Kazanjian took up the method of Labat and improved it. It has already been mentioned in the discussion of replacement of the columella (see p. 326). In our experience this method is very useful in cases in which the defect extends over the nasal tip, the alae, and the columella, as encountered primarily in destruction due to lupus. In such cases we have used it with good success. In this procedure the alae, tip, and columella can be lined later with auricular cartilage grafts to prevent contracture of the grafted soft tissues. One female patient was very satisfied with the primary result and would not permit any further surgery on her nose. In this case we had the bad experience of shrinkage and collapse of the soft tissues on the nasal tip and alae. — A median forehead flap can also be combined with the flap swung inward for inner lining after F. Smith (Figs. 427 and 428) as exclusively external covering, as described by Brown and McDowell.

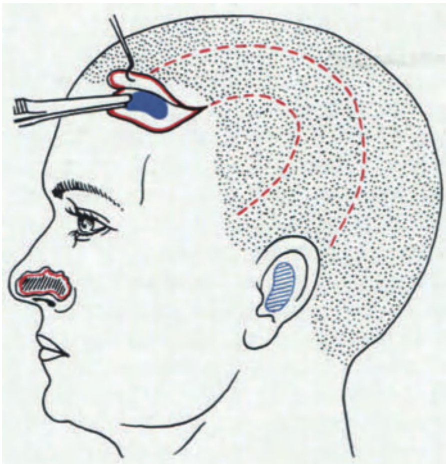
Forehead skin for alar reconstruction is also obtained by means of the fronto-temporal sickle-flap after New. The flap runs in an arc from the temple into the parietal area. The distal part on the forehead intended for the reconstruction is lined with a Thiersch graft. During the second stage the flap is sutured into the nasal defect. At this time the flap is sutured to form a tubed flap in its middle part. Until the pedicle is replaced in its original position the donor site is covered with a Thiersch graft. The donor site of the distal end of the flap used for covering the alar defect can be resurfaced with a full-thickness skin graft.

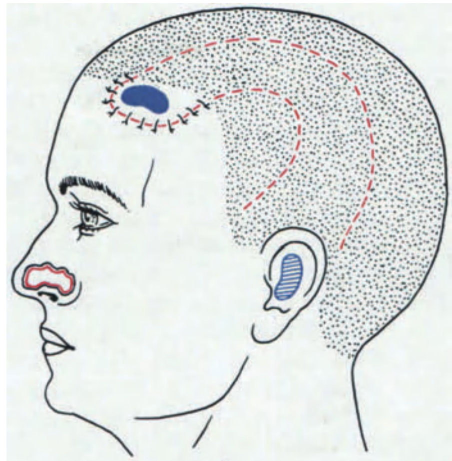
May also recommends using the sickle flap after New for replacement of the ala. He lines the flap (Figs. 435a and b) with a two-layer composite auricular graft whose epithelium is placed facing the frontal bone. This lining with a composite graft originally comes from Gillies who used it in the forehead flap described by him. This lining is done in the first stage operation, in which the flap is also formed for delayed migration. In the second stage the sickle-flap bridges the cheek. The end is sutured in the defect so that the skin surface of



Figs. 434a—c. Sickle flap by NEW. a Delay of the flap and lining with a THIERSCH graft. b Suturing the distal end of the sickle flap. The flap is gradually rolled and sutured into a tubed pedicle flap. c The flap is detached at the nose and is replaced on the forehead after removal of the THIERSCH graft. The donor site of the distal end of the flap is covered with a full-thickness skin graft

the composite graft is in the nasal vestibule as inner lining. After the end of the flap has healed to the ala, i.e. after about another 3 weeks, the flap can be detached here in the third stage and be brought back to its original position.





Figs. 435a and b. Alar replacement using a sickle flap, the end of which is reinforced with a composite graft (according to MAY). a Four-fifths of the flap is situated in the scalp; the two-layer composite graft is inserted with its epithelium flush against the bone. b The end of the flap with the underlying composite graft is sutured. Blue hatching shows the donor site on the auricle (delay of the flap)

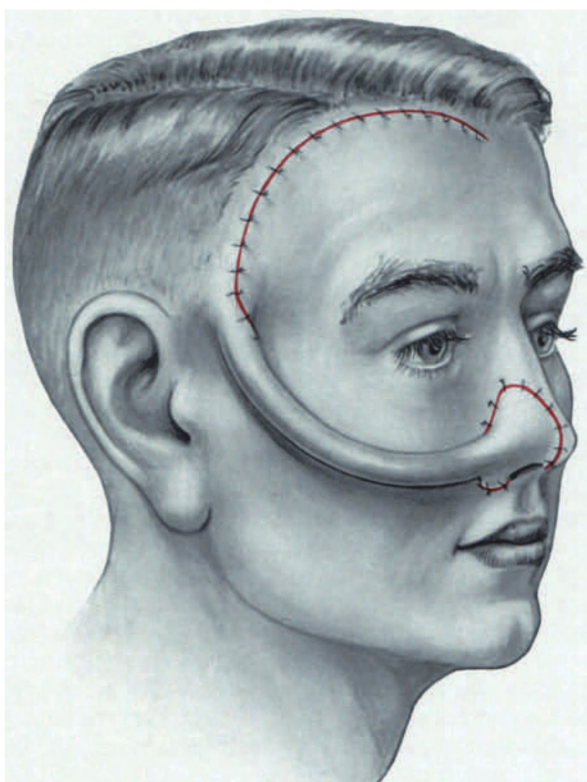


Fig. 436. Closure of a partial defect on the nasal wall using a tubed pedicle flap from the forehead, according to F. SMITH. The end of the flap can be turned inward or lined with a THIERSCH graft to form the inner lining

The secondary defect on the forehead is covered with a THIERSCH graft or a full-thickness skin graft during the second stage. In the same manner the donor site of the composite graft on the auricular concha is covered with a free skin graft.

In the procedures of alar reconstruction mentioned to this point three types of inner lining have been described: local use of a skin flap from the neighboring area, turning under the distal end of the transposition flap intended for external covering, andTHIERSCH grafts or free full-thickness skin grafts, or composite grafts.

In case of complete loss of the ala, which also affects the nasal tip and columella, one can sometimes resort to tubed pedicle flaps for covering. A type of tubed pedicle flap by SANVENERO-ROSSELLI has already been mentioned above. — F. SMITH recommends forming a tubed pedicle flap behind the hair line on the temple and forehead. An area of the skin flap is turned under for inner lining (Fig. 436). The tubed pedicle flap on the temple includes the temporal artery. After this delay the flap is swung into the defect. After another 3 weeks, i.e. after healing of the end of the flap, the pedicle is detached at the nose, with possible consideration of the material for inner lining, and the remainder of the flap is sutured into its original position. The donor area which still is not covered must be provided with a THIERSCH graft or with a free full-thickness skin graft, as in another procedures. During the period between the second and third stage operation, the raw area on the forehead and temple should be treated with boric acid ointment gauze.

If one wants to avoid additional visible scars on the face, one also uses a pedicled flap from the upper arm or a tubed pedicle flap from the trunk for the replacement of larger alar defects. Experience shows that the difference in skin coloring equalizes itself relatively soon and is considered less disturbing than scars in the region of the forehead by many patients, especially by women.

b) Neck flaps

BARSKY uses a transverse tubed pedicle flap from the submental skin of the neck (Fig. 437). The removal of the flap from this region has the advantage that the scars lie in the same direction as the folds of the skin and therefore are less obvious after a while. With such defects we only rarely use a tubed pedicle flap. But as DE CHOLNOCKY does here we recommend choosing a pedicle flap large enough that the free end can be turned inward into the nasal vestibule. In such an alar replacement, if not enough mucosa or skin is available, then it can be provided by means of free grafts of cheek mucosa or by THIERSCH grafts. YOUNG forms a tubed pedicle flap at the neck with the base lateral to the hyoid bone and the end in the retroauricular skin (Fig. 438). Sometimes this end can be reinforced with a cartilage plate from the auricle. The end of the flap is sutured accordingly. To form the inner lining a part of the tubed pedicle flap is necessary, which must be taken into consideration when one detaches the pedicle after about 3 weeks. After adequate removal of subcutaneous fat tissue the thinned part of the flap which extends beyond the alar rim, is folded and packed into position into the interior of the nose (Figs. 438 and 439). The removal of skin from the retroauricular area has the advantage of having the desired pigmentation and a complete lack of hair. However sometimes too little material is available for filling large defects. But this can be obtained from the pedicle in additional operations.

In order to transport the possibly cartilage-reinforced retroauricular skin to the nasal defect, MAGGIORE and ŠERCER use a tubed pedicle flap based at the parietal region and formed on the scalp. This transport flap has the advantage that it leaves practically no visible scars. —We use the same transport flap in cases of defects of the ala and nasal tip to obtain composite grafts from the auricle.

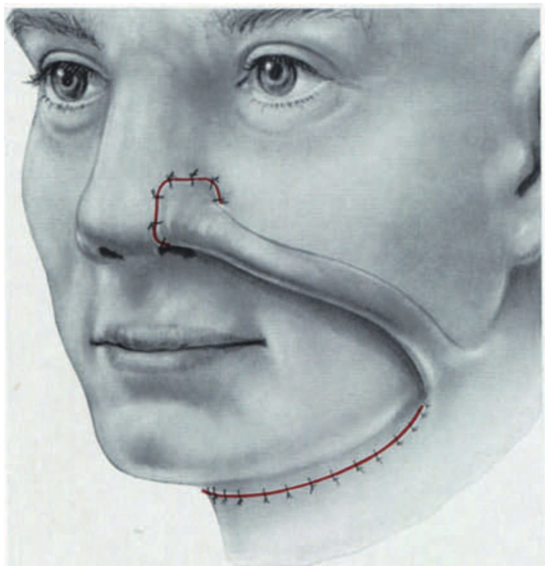


Fig. 437. Covering an alar defect using a transverse tubed pedicle flap from the submental region, according to BARSKY

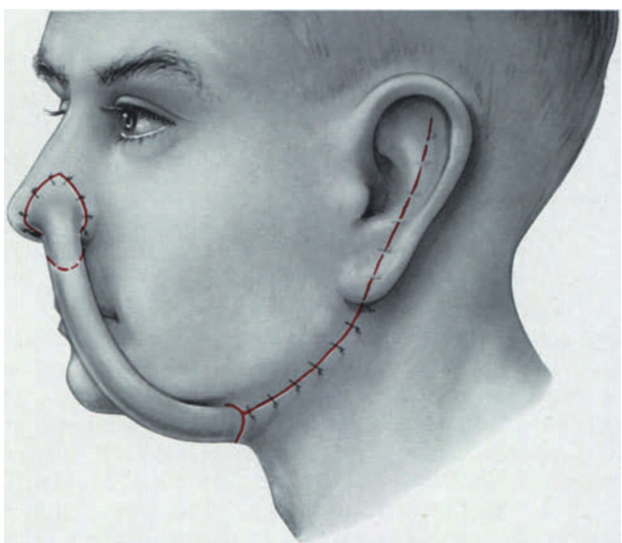
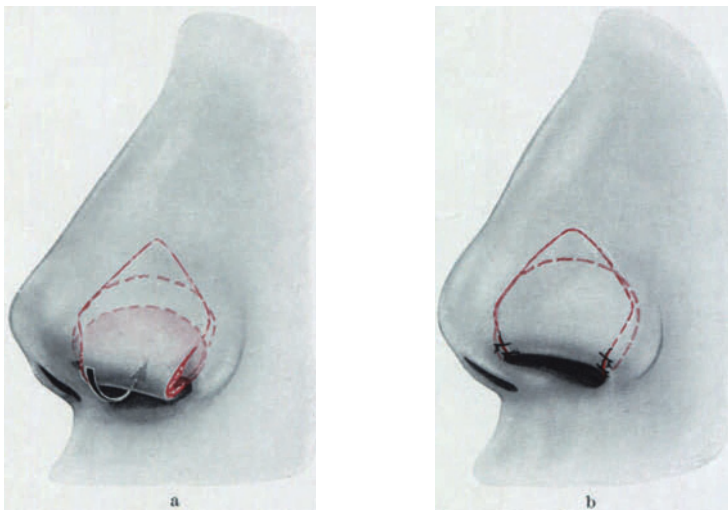


Fig. 438. Alar replacement using retroauricular skin transferred on a tubed pedicle flap based in the submandibular region (by YOUNG); the flap is sutured in the region of the alar defect. The dotted red line shows the incision when the flap is detached; consideration is given to the skin necessary for inner lining

c) Fronto-temporal flaps

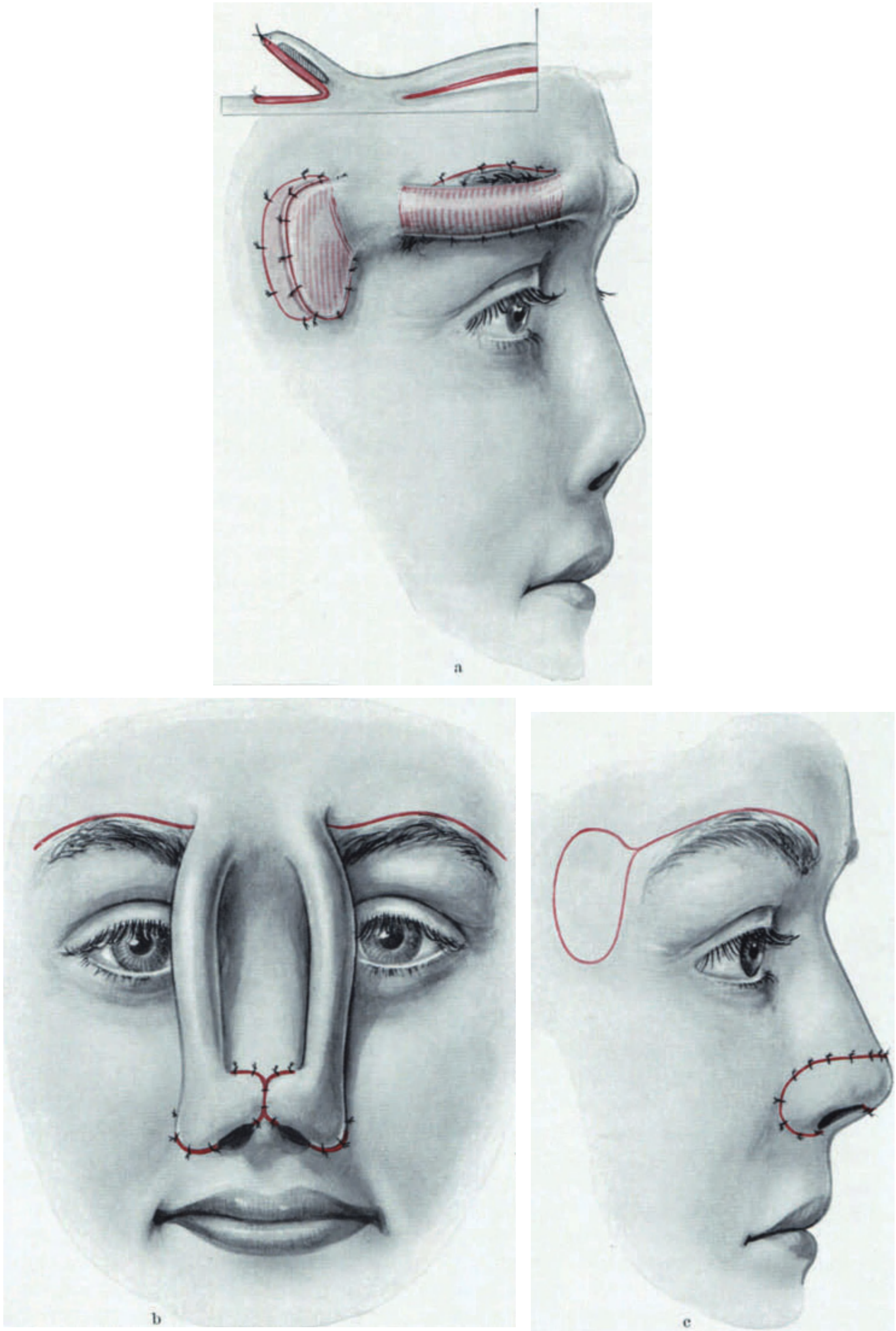
A very original method was described in 1952 by SCHMID. It combines the Indian method with a type of tubed pedicle flap. A horizontal supraciliary bridge flap is formed with a shoe-shaped extension on the temple (Fig. 440).

It is not rolled to a tubed flap, but is cut as a band, and its lower surface is covered with THIERSCH grafts. It is 5 to 10 mm wide; SCHMID suggests 16 to 20 mm. The defect due to removal can be closed by drawing the mobilized forehead skin downward. Here, too, as in the method of KAZANJIAN (see p. 326) it is recommended to make multiple incisions in the forehead fascia and subcutaneous tissue. The incisions run parallel to the skin incision and make approximation easier. Subperiosteal sutures at the orbital border prevent pulling of the eyebrow upward. The thin split-thickness graft which covers the raw surface of the bridge flap must be sutured carefully. It is advisable to pass the suture first through the THIERSCH graft and then through the thicker skin of the bridge flap so that the THIERSCH graft is not torn. In the same, first stage operation, an approximately 3 cm long and 1 cm wide piece of cartilage from the auricular concha



Figs. 439a and b. Tubed pedicle flap has been detached; after the flap has been thinned, it is turned inward as inner lining. b Inner lining sutured in the region of the dotted red line

is implanted subcutaneously at the temple through a fine incision at the hairline. After 3 weeks a shoe-shaped flap pedicled medially is cut from the skin of the temple which is lined with auricular cartilage (Fig. 440). This is raised together with the cartilage and the connective tissue capsule. The raw surface on the shoe-shaped flap is also covered with a THIERSCH graft. While the flap at the temple protrudes like a small ear, a 1 cm wide area of skin between this and the lateral end of the bridge flap exists. This area has not yet been raised from the underlying tissue. Raising the intermediate section and thus the entire, now boot-shaped fronto-temporal flap takes place after another 3 weeks. Then the flap can be swung down onto the freshened alar defect. The shoe-shaped piece of the flap is carefully sutured in two layers with the tip of the shoe forward. Here one observes the same precautionary measures as in suturing composite grafts. The surface covered with the THIERSCH graft becomes the inner lining of the ala. Naturally the flap can not be sutured at the posterior part where the pedicle is attached. This is done after another 3 weeks when the pedicle is detached below at the ala. If there are additional nasal defects, the pedicle is not detached at the alar rim but in the region of the glabella and is used to fill the defects. The stumps of the flap are carefully flattened and sutured. In defects of the entire lower part of the nose, i.e. of both alae and of the tip, such boot-like flaps



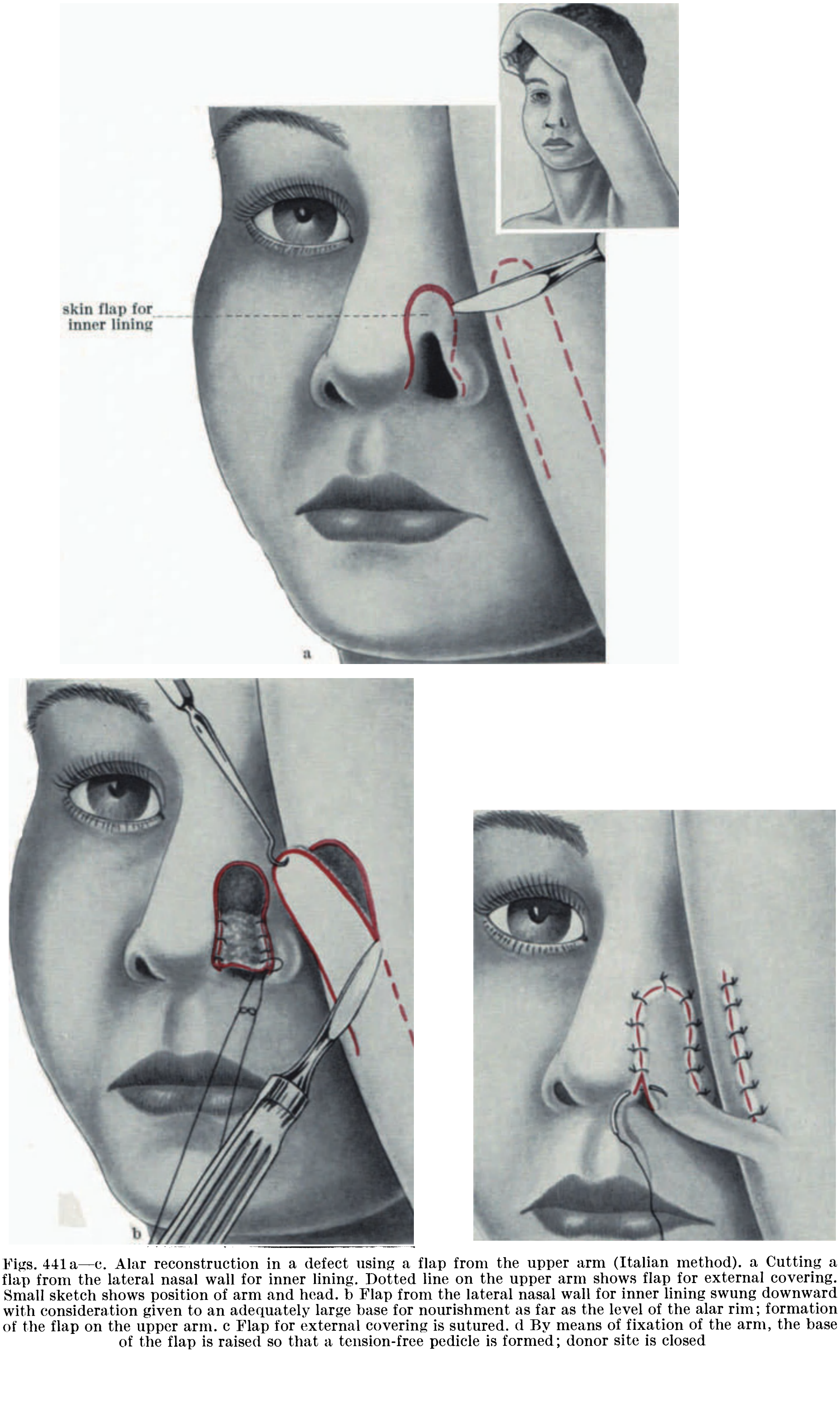
Figs. 440a—c. Alar reconstruction using the fronto-temporal flap of SCHMID. a Formation of the flap above the eyebrow. In a previous stage the shoe-shaped skin flap on the temple is reinforced with auricular cartilage; when the flap is raised, it is lined with a THIERSCH graft (see small sketch). The red hatching shows the parts of the flap which are lined with THIERSCH grafts. b The flaps are rotated downward bilaterally from the forehead for replacement of the alae and nasal tip. c Elimination of the defect. The red line on the forehead and the temple shows the donor site

are made on both sides. The pedicle of one flap can be used as medial filling material. In larger defects this method is extended in the manner mentioned in the chapter on partial and complete replacement surgery (see p. 419). On p. 328 an original (R. MEYER) modification of the SCHMID method for reconstruction of the columella is described. We have also modified a procedure for replacement of the nasal tip and septum from the SCHMID flap technique described above (see p. 327). — The fronto-temporal flap of CONWAY and a treatise by him and his colleagues should be mentioned here. By means of injection experiments it was shown that the pedicled flap from the temple has the best circulation of any pedicled flap on the face.

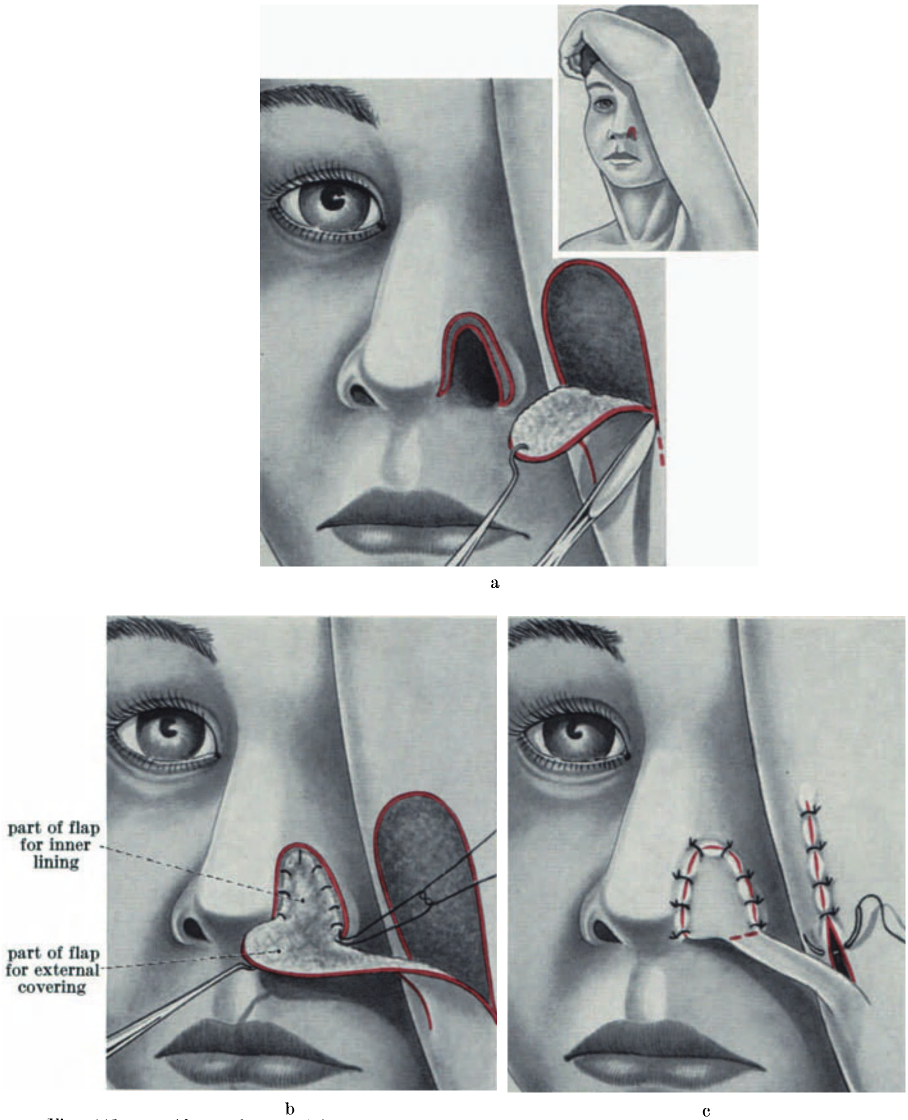
The advantage of the fronto-temporal flap is the natural appearance. The color generally is the same as that of the facial skin in the area. The material has been through all shrinking and changing processes before it is used for reconstruction. With careful surgical technique the thickness and consistency of the ala appears natural. The scar at the border of the eyebrow is hardly visible, and the contraction of the eyebrow is minimal. The donor area on the temple covered with a rotation flap or with free full-thickness skin grafts likewise causes no deformity. The method is to be recommended especially for older patients and those who have loose skin. In younger patients, if one should decide upon it, temporary relief of tension in the scalp is advantageous for better, tension-free closure of the donor area. Visible scars can occur in spite of this where the skin is tight, especially on a high forehead. This should be avoided in women, especially in cases with a tendency toward keloid formation. With a low forehead unsightly contractions result in the region of the eyebrow. Damage to the frontal branch of the facial nerve can always be avoided with superficial dissection in the region of the donor site. As observed, the grafted flap can appear somewhat darker than the surrounding skin as a result of shrinkage, especially in a dark complexion. — Thus in case of tight skin, strongly arched or low forehead, tendency to keloid formation or with dark complexion, one does better to use other methods such as replacement with skin from the upper arm or with a tubed pedicle flap from the trunk, if one wants to avoid these disadvantages.

d) Flaps from upper arm (Italian method)

A very advantageous method for reconstruction of alar defects is the removal of the skin from the upper arm by means of pedicled flaps (LABAT, 1833; DIEFFENBACH, 1845; JOSEPH, 1912). It is suitable for superficial and deep defects. The procedure differs according to the type of the defect. While the superficial defect is covered by spreading the end of a pedicled flap from the arm on top of it, one can proceed in various ways in case of extensive substance loss. By cutting a skin flap on the lateral nasal wall with the base at the upper border of the defect, one can form the inner lining so that the alar rim is at the proper level (Figs. 441 a and b). The donor site and the flap turned inward for the inner lining are covered by the peripheral end of the flap from the upper arm (Fig. 441 c). After healing, the pedicle is detached in the region of the alar rim and the inner lining is sutured to the external covering at the alar rim. One must make sure that the base of the inner lining is not too narrow, so that no necrosis occurs at the alar rim. If it should happen after all, then this is taken into consideration when the pedicle is detached at the upper arm, and the remaining portion of skin from the flap is swung into the interior of the nose. If insufficient available skin is insufficient for making the inner lining in the region of the nasal wall and the lateral part of the nose, or if for some other reason the raw surface on the nasal



Figs. 441 a—c. Alar reconstruction in a defect using a flap from the upper arm (Italian method). a Cutting a flap from the lateral nasal wall for inner lining. Dotted line on the upper arm shows flap for external covering. Small sketch shows position of arm and head. b Flap from the lateral nasal wall for inner lining swung downward with consideration given to an adequately large base for nourishment as far as the level of the alar rim; formation of the flap on the upper arm. c Flap for external covering is sutured. d By means of fixation of the arm, the base of the flap is raised so that a tension-free pedicle is formed; donor site is closed wall should not be enlarged, then the inner lining is obtained from the upper arm flap after the defect border has been dissected (Figs. 442a and b). To do this it is necessary to turn the flap slightly. Since the skin is very mobile with



Figs. 442a—c. Alar replacement in a defect using skin from the upper arm (Italian method). a Formation of the flap on the upper arm; prepared alar defect. Small sketch shows fixation of head and arm. b The end of the flap from the upper arm is sutured into the defect for inner lining. c The flap is turned for external covering; donor site on the upper arm is closed. Dotted red line shows where the pedicle is detached; the base of the flap is raised to leave the sutures without tension

a generous flap, the external covering can be obtained from the adjoining part of the flap. With proper formation of the flap and tension-free fixation of the pedicle (Fig. 442c), the pedicle can be detached in the region of the alar rim after a short time. The site of detachment is to be sutured accordingly. Since one must count on a certain contracture one should leave a slight overhang compared with the normal side. Immobilization of the arm against the head is described in nasal tip reconstruction from the upper arm (see p. 378). The disadvantage of this method lies in the different types of pigmentation of the skin which has healed together. But in the course of time, especially in the region of the alae, an equalization of the color of the grafted skin to that of the facial skin takes place. Cartilage grafts can be inserted afterward for stiffening the ala, or they can be implanted beforehand on the arm. Naturally one can roll the pedicled flap into a tube when forming it, as described by F. BURIAN, LIMBERG and PESKOVÁ.

ERCZY uses the tubed pedicle flap from the upper arm only for the external covering. BOGORAZ uses the tubed pedicle flap on the upper arm to transport auricular tissue to the nasal defect in order to obtain certain healing. Thus in this way one can transplant a larger composite graft.

IV. Reconstruction of nasal tip

The causes of nasal tip defects are like those of alar defects: Gunshot and laceration injuries, burns, effects of surgery, conditions remaining after lupus, lues, tumors, etc. Bite injuries, especially by dogs and humans, are much more common here than on the ala.

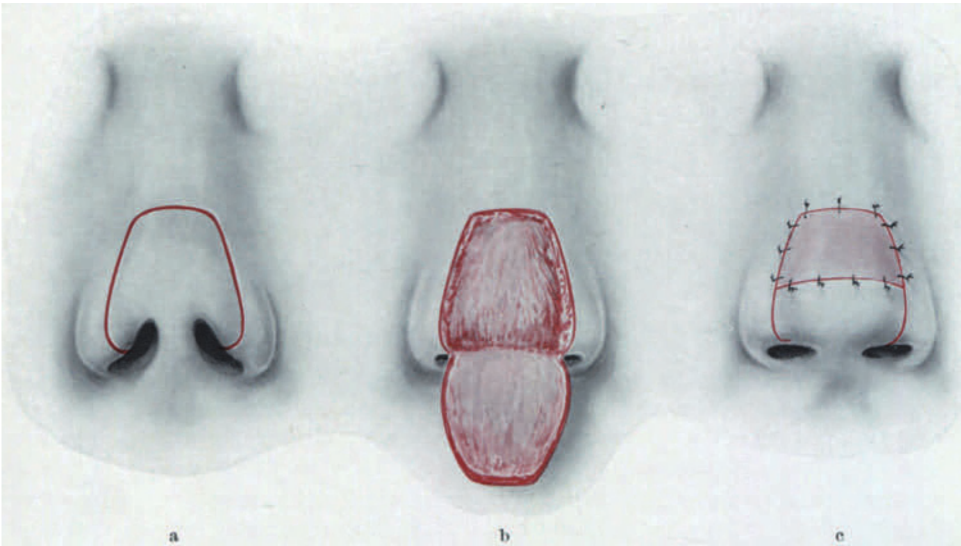
For reconstruction of the tip one uses practically the same methods as for the ala, i.e. flaps from neighboring areas, flaps from more distant parts of the body, and free grafts.

1. Reconstruction with flaps from neighboring area

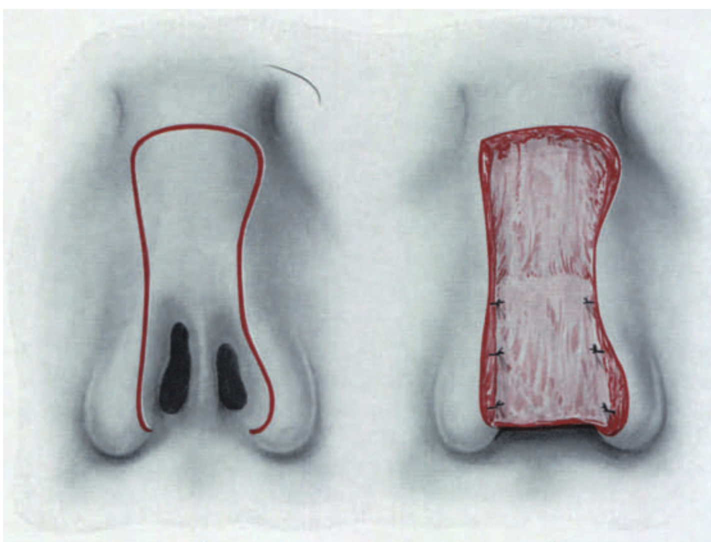
Small defects can be covered with flaps from the immediate surroundings. After FERRIS SMITH one raises a tongue-shaped flap with the base at the defect and sutures the flap in again for delayed migration. After a few weeks the flap is raised, mobilized somewhat distally, migrated into a fold in the region of the nasal tip and sutured precisely laterally. The defect resulting above the new nasal tip is covered with a full-thickness skin graft (WOLFE-KRAUSE flap) (Fig. 443) This method can sometimes be combined with a composite graft for reconstruction of the columella.

In larger defects of the nasal tip a skin flap from the nasal dorsum after F. SMITH is swung downward into the defect for the inner lining. The dorsum as well as the tip are formed using a forehead flap. The base of the flap can lie directly above the upper border of the defect. If the anterior part of the columella must be formed, the flap from the dorsum can be made so generous that it extends beyond the nasal tip. The roll thus formed is narrowed somewhat in the middle by approximation and can be covered by means of a full-thickness graft from the posterior surface of the ear. It is advantageous first to delay the dorsal flap which is to be swung downward. From this method CRONIN developed the "caterpillar-flap" technique. In the latter method a triangular flap on the nasal dorsum is mobilized so that it is sutured to the tip after migrating downward (Fig. 314). The newly created defect on the dorsum is not closed with a skin graft but rather by means of an inverted V-Y advancement as by DIEFFENBACH (Fig. 313). At the base of the triangular flap a fold is made. 3 to 6 weeks later the caudal edge of this fold is cut and forms a small flap which is moved to the columella and is sutured there (Fig. 314d). In 1956 MOREL FATIO confirmed the good results of this method which he performed in a one-stage operation.

Joseph also originated the replacement of the nasal tip with a flap from the lateral half of the cheek. He calls it the "buccal lateral rhinoneoplasty". The flap is cut diagonally upward toward the temple from the nasolabial fold,

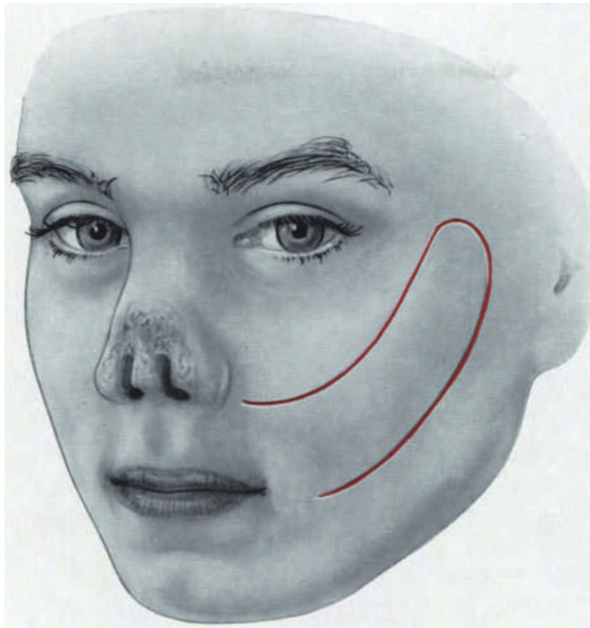


Figs. 443 a—c. Reconstruction of the nasal tip using flap advancement from the nasal dorsum according to F. Smith. a Incision. b Mobilization of the advancement flap. c Flap sutured in the region of the tip and the medial parts of the alae; remaining defect is covered with a full-thickness skin graft



Figs. 444 a and b. Reconstruction of the nasal tip in larger defects by F. Smith. a Incision. b Flap folded over from the nasal dorsum for inner lining without formation of the columella. A forehead flap is used for external covering

where it has its base. It is swung onto the nasal tip, is not rolled, and can be used for larger nasal defects as well which primarily affect the dorsum. Formerly it was used by Sanvenero-Rosselli but has also been abandoned by him today (Fig. 445). We do not consider this method very favorable since it leaves de-



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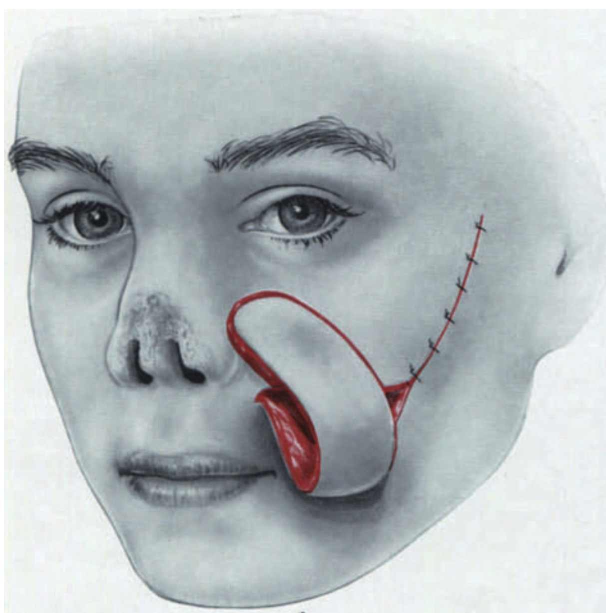


b

Figs. 445a—c. Reconstruction of nasal tip using skin from the cheek by JOSEPH and SANVENERO-ROSSELLI. a Cutting the cheek flap. b Flap is raised and the donor site is closed

forming scars. On the other hand more recent reconstruction techniques by SANVENERO-ROSSELLI and by PALETTA and VAN NORMAN are good. A rather wide flap from the nasolabial fold pedicled at the cheek is cut in a curve down to the chin and is swung onto the extensive defect on the tip, dorsum and columella.

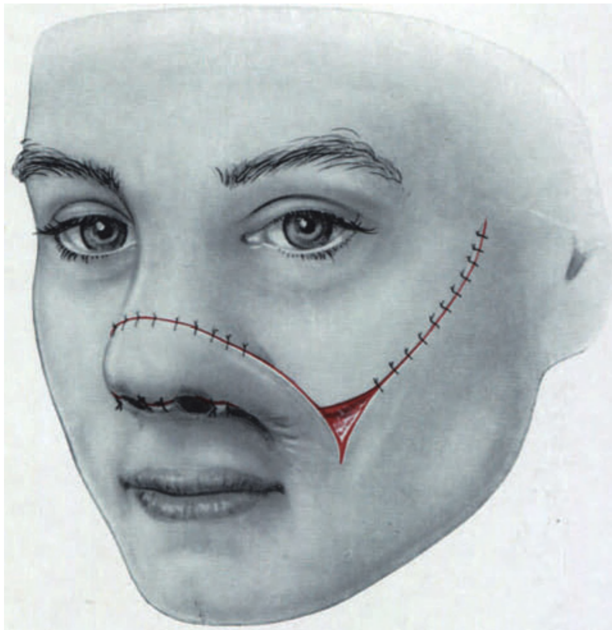


Fig. 445c. Flap sutured into the defect

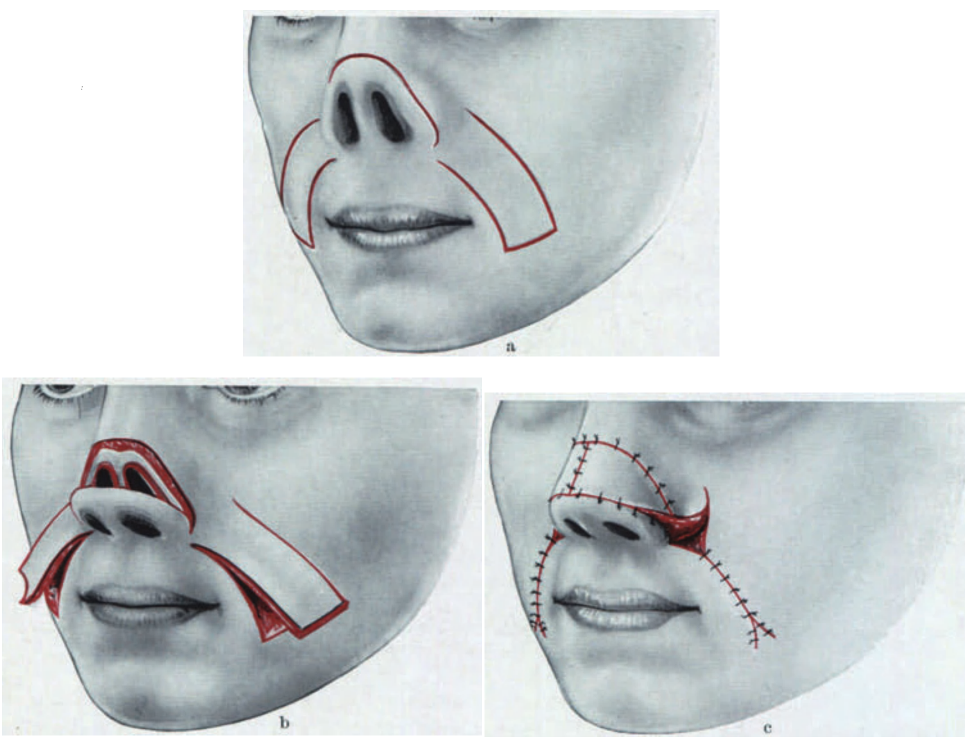


Fig. 446a—c. "Quick method" without inner lining(!) for reconstruction of amputated soft strutures by LAGROT and GRECO. a Incisions at the piriform aperture and for the nasolabial flaps. b The cicatricious slice of skin at the piriform aperture is swung downward; formation of the flaps. c Suturing the rotated flaps and the donor sites

One procedure was developed during a recent war. It does not follow the principles of plastic surgery and must be rejected. During the Algerian war LAGROT and GRECO developed a *quick method* for reconstruction of amputated nose. A number of Arabs who had fought on the side of the French were punished with amputation of the nose. Many of them then had opportunity to have their noses repaired. The quick method of LAGROT and GRECO is a replacement operation from the nasolabial fold. One must not expect very much with regard to function and cosmetic appearance since the method does not include inner lining. It can cause narrowing and pinching-in on the dorsum. LAGROT and GRECO justify their method by stating that with the great number of amputees this one-stage procedure was the only possible way for the conditions at that time and place. In these cases usually the soft tissues in the lower part of the nose had been completely removed. The cicatricious edge of the piriform aperture and of the septum stump are severed like a slice from the rest of the nose down to the base at the lateral alar attachment and at the maxillary spine. This slice is swung forward and downward. The resulting wedge-shaped defect is covered only on lateral parts of the wall on either side with a pedicled flap from the nasolabial fold. The pedicled flaps have to be turned at their base near the defective ala for this (Fig. 446). — Another method by A. RÉTHI has not become popular: bilateral nasolabial flaps are used to construct a retruded tip and a shrunken columella. Understandably the tendency in reconstructive surgery of the nose is more and more to avoid additional visible scars on the face when possible.

2. Reconstruction with distant flaps

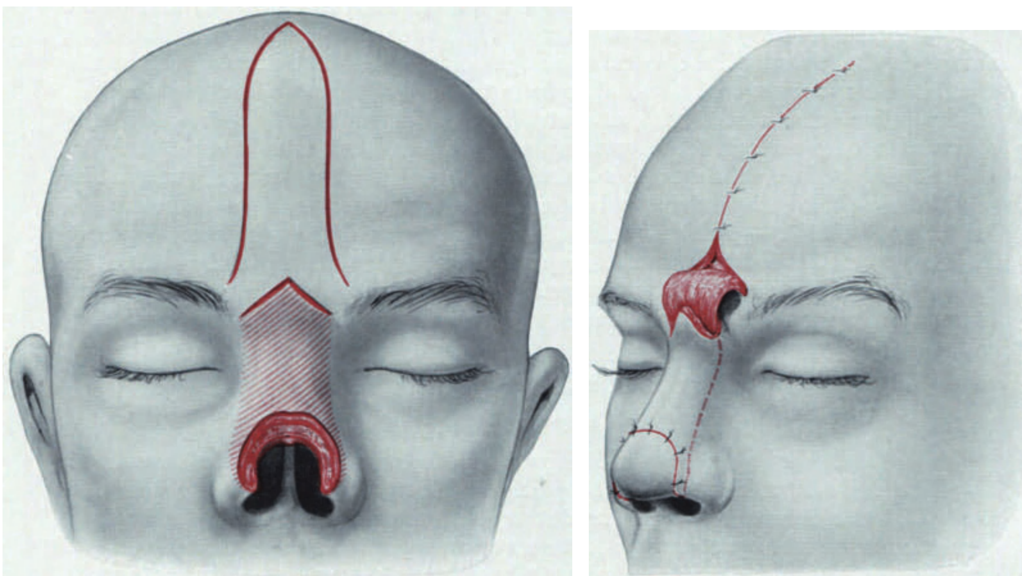
a) Forehead flaps

Tip replacement surgery with flaps from the forehead was first described by LABAT. He formed a diagonal pedicle and a wider end near the hair line shaped like an inverted shovel. The donor area on the forehead was undermined and sutured. The flap was only used to cover an external, non-perforating defect. JOSEPH also chose a diagonal forehead flap. SCHUCHARDT uses a wide diagonal flap whose donor site can not be closed by approximation. The donor site must be covered with a THIERSCH graft. The part of the pedicle which is not used is later replaced, so that a small part remains covered with the THIERSCH graft on the upper part of the forehead. — Because of the relatively pronounced deformity on the forehead we avoid this kind of flap in cases of small nasal tip defects.

A forehead flap which leaves less scarring on the forehead is the lateral flap of SHEEHAN. This follows the course of the temporal artery (superficial temporal artery flap) and corresponds essentially to the flap of GILLIES described in the chapter on columellar reconstruction (see p. 327). But for reconstruction of the tip no fold is made, contrary to the GILLIES flap. The flap of SHEEHAN has such good circulation that it does not have to be delayed. Only in case of poor general circulation should one delay migration.

In *delaying* the flap it is cut and carefully separated from the underlying tissue. On the forehead the fascia is not included. One can now check whether the flap is long enough and whether its end is shaped so that it can cover the defect. At the same time the circulation in the base can be checked by means of rotating the flap. After resuturing the flap into the donor site one should wait 2 to 3 weeks before rotating the flap onto the nasal defect.

When rotating the delayed flap onto the nasal defect the pedicle can be rolled to a tube in the middle section. However this is not absolutely necessary, since during the weeks needed for the end of the flap to heal shrinkage is not very great. The flap should not be closed to a tube by means of tight sutures in the immediate vicinity of the base where it has a slight crease or bend and cuts off the blood supply. After the end of the flap has healed in the defect the rest of the flap which is not needed can be replaced in its original position. Some authors cover the donor site temporarily with a THIERSCH graft. Like F. SMITH we cover the area with dressing tape. A free full-thickness skin graft from the retroauricular region is used to cover the donor area of the end of the flap taken for correcting the defect. In temporary treatment of the entire donor area with split skin grafts, the region of the end of the flap is covered afterward with a



a b

Figs. 447a and b. Reconstruction of the nasal tip and the medial parts of the alae using a forehead flap by LOEB (SANVENERO-ROSSELLI). a Formation of the forehead flap as far as the hairline and incision of the glabella for the purpose of tunneling under the dorsal skin as far as the prepared defect. Red hatching shows undermined area of skin. b Forehead flap is swung downward and drawn through the glabellar incision and the tunnel to the region of the defect. The end of the flap has been turned and the skin sutured in the region of the tip and the medial parts of the alae

full-thickness skin graft for a better cosmetic result. — SKOOG uses a flap which is made near the forehead-hairline and for the most part is in the hair. This is similar to the "scalping flap" of CONVERSE (see p. 411).

A much wider and therefore cosmetically less favorable forehead flap with its base on the temple and a small side flap in the middle of the forehead for simultaneous treatment of columellar defects was described by STRAITH, Sr. The sickle flap after NEW can also be used here. It is discussed in the section on alar reconstruction (Fig. 434).

For treatment of defects on the nasal tip, forehead flaps which are pulled down to the tip by means of *tunnelling the skin of the nasal dorsum* have also proved useful. After "take" of the flap on the tip the pedicle can be detached at the tip, be drawn back through the tunnel in the dorsum and returned to the forehead. SANVENERO-ROSSELLI likes this method for the correction of compound saddle nose. It was taken up in 1956 by MOREL FATIO for substance loss at the tip.

In 1960 Loeb described an interesting procedure for reconstruction of cicatricious nasal tip which is contracted at its transition to the alae. This defect can occur after inflammatory diseases, after lupus and Leishmaniosis or also after poor nasal tip surgery. Loeb cuts a median forehead flap pedicled at the glabella. The flap extends to the hair line above the forehead. Since the flap is to be brought to the nasal tip and alae by means of a tunnel under the dorsal skin, the base of the flap at the glabella is split like a swallow-tail. One must be sure that the base bilaterally is adequate for nourishment so that blood supply along the nasal dorsum is not cut off too much as a result of torsion when the forehead flap is drawn through the tunnel. The region of the medial part of the ala must be prepared accordingly (Fig. 447), so that the end of the forehead flap drawn through the tunnel can be sutured. Since the forehead flap lies with its epithelium toward the nasal cavity, the end of the flap must be turned upward to permit the epithelization of the medial part of the ala and the nasal tip. After "take" of the flap in the region of the nasal vestibule, the pedicle is detached through the glabellar incision under the dorsal skin at an adequate depth and the base of the flap is returned to the forehead. The point of detachment on the flap corresponds to the edge of the epithelium in the nasal vestibule. Remaining parts of the columella and the flap now forming the nasal tip and the medial parts of the alae are shaped into a straight columella during a later stage. — Reginato proceeds as Loeb does. To raise the dorsum more, he additionally mobilizes the skin on the lateral nasal slope and into the cheek bilaterally and approximates it medially.

The method of the *median forehead flap* of Kazanjian (Fig. 394) can also be used for reconstruction of the nasal tip. It is especially suitable in combination with the method of Schmid in cases of contracture of the nose due to lupus. We too are of the opinion that these lupus patients should be helped not only with regard to function (Theissing) but also cosmetically. Since the scar tissue of the contracted soft structures of healed lupus provides a poor base for free grafts of skin and cartilage, we feel that one must use more certain methods. Such methods are, for example, the forehead flaps after Kazanjian, Schmid, and others. The treatment of these defects with distant flaps from the arm or with tubed pedicle flaps is also recommended. In any case it should be preferred to the uncertain procedures of free auricular grafts. Since there is different skin pigmentation surrounding the lupus defect one should also replace the discolored skin when using distant flaps.

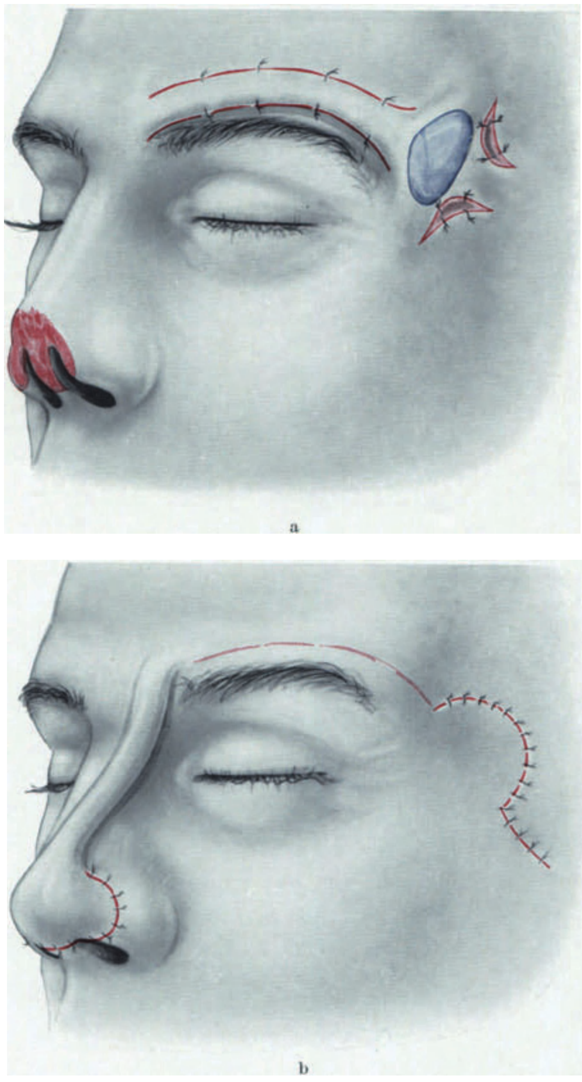
In such cases of lupus, Kazanjian suggests raising the 2 cm wide delayed median forehead flap first and suturing it in place again. In the second stage after at least 1 month the forehead flap is swung onto one of the defective alae and is sutured. Half of the pedicle can be closed to a tube. This must be done with care not to cut off the blood supply in the region of the basal part where the most torsion is present. In the third stage after another 3 weeks the pedicle is detached and is returned to the donor site. The glabella and the stump of the flap are treated as usual.

In order to be able to accept the pedicle, the skin on the upper border of the philtrum is cut to form a shield-like flap and is swung upward. The pedicle of the flap is sutured into the newly created raw area. The end of the forehead flap which has already grown onto the ala is now freshened again medially and is allowed to heal there. In the following weeks this additional healing in the region of the nasal tip and the contralateral ala is continued. The other ala is sometimes slightly less contracted and defective than the first, which has already been covered. It receives its substance from the flap when one splits the corresponding skin from the columellar part. One must be careful that symmetry of the nostrils is created. The newly formed lateral defect on the columella is closed with sutures. In another stage operation improvements are made and the flap is thinned. The columella still stands as a column and, if possible, is joined with the defective septum by means of bilateral preparation and suturing. Support by means of a cartilage graft should certainly be provided later in the region of the columella before contracture of the reconstructed part of the nose occurs (Fig. 394).

Paletta and van Norman recommend a *diagonal forehead flap* for reconstruction of the nasal tip and the columella. The forehead defect is undermined and sutured, which surely is possible only with relatively loose skin. At any rate, for reconstruction of the nasal tip in younger people, i.e. with relatively tight skin, one should avoid forehead flaps and use other methods (see also pp. 362 and 391). Forehead flaps leave visible and sometimes deforming scars.

b) Fronto-temporal flap

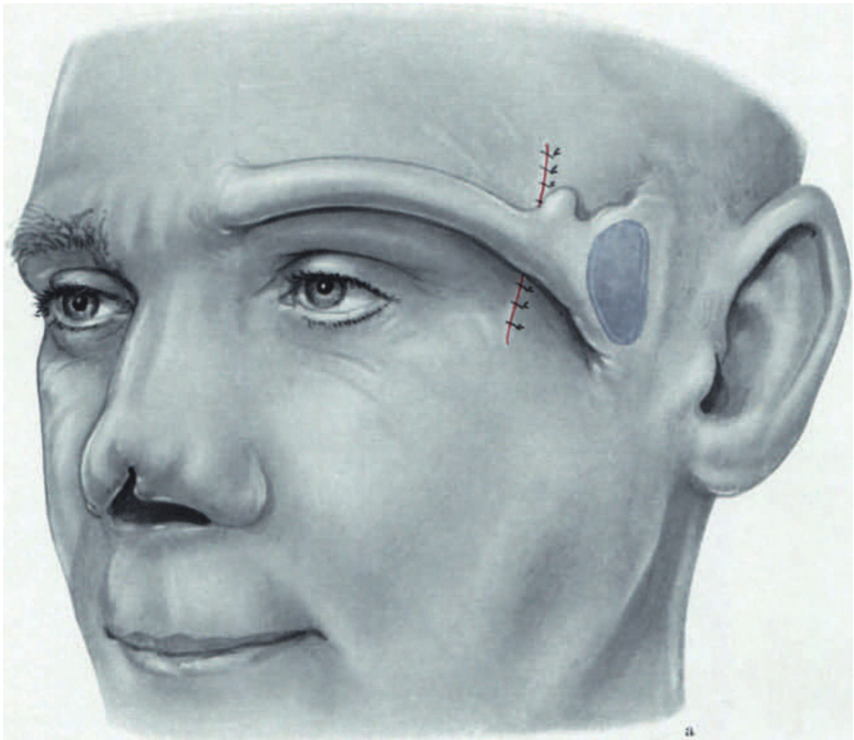
The fronto-temporal flap on the supraciliary arch by Schmid is modified by us (R. Meyer) and used for reconstruction of the nasal tip. The bridge flap on the forehead is made in the manner described above (see p. 359), and a shield-shaped flap is formed on the temple. A cartilage graft from the most curved part of the concha is formed and implanted under the temporal skin through a short incision at the hairline. The convex surface of the cartilage under the skin faces outward. The "handle" of the shield-shaped cartilage lies about on the axis of the bridge flap on the forehead and points laterally rearward toward the ear. It is intended as support for the region at the transition from the nasal tip to the columella. After this cartilage grafting during the first stage operation two pockets are formed, each lined with a Thiersch graft. One pocket is made on either side of the cartilage "handle" which can be palpated through the skin. The two pockets are to form the dome of the vestibule bilaterally later on. Two curved incisions are made on the temple next to the cartilage, one on either side of it (Fig. 448) and below the cartilage graft without injuring the scar which surrounds it. Then a Thiersch graft is placed like a bag in each pocket and is sutured carefully along the edges of the curved incision. This pocket lined with the Thiersch graft is packed completely with petrolatum gauze. It somewhat raises the cartilage graft and the overlying tissue. After 2 to 3 weeks the bridge flap over the eyebrow is lenthened bilaterally underneath to the cartilage graft. One must be careful that the cartilage itself is not exposed but is raised with the connective tissue surrounding it. The new defects on the bridge flap are again covered with Thiersch grafts and the donor site is undermined and sutured. After another 2 to 3 weeks the entire fronto-temporal flap with the temporal part and the grafted cartilage is raised and swung onto the nasal tip defect. To do this one must cut around the end of the flap on the temple according to the shape of the subcutaneously placed cartilage shield. The two niches lined with Thiersch grafts are excised at the same time. The connective tissue capsule on the inner surface of the cartilage must also be raised but appropriately denuded of the Thiersch graft. After rotation of the flap it lies in the central area of the graft bed. The external skin from the temporal part of the flap is sutured on all sides with the exception of the pedicle. The curvature of the cartilage gives the nasal tip the desired shape. The tab of skin between the two Thiersch grafted niches is placed below in midline and forms the transition to the columella. Before this the Thiersch grafted pockets are sutured to the nasal vestibule to form the dome (Fig. 448b). The flap remains pedicled at the nasal tip long enough to guarantee good nourishment. After 2 to 3 weeks the pedicle can be detached and the nasal dorsum above the tip adjusted. If improvements should still be necessary on the columella or on one of the alae, then the



Figs. 448a and b. Reconstruction of the nasal tip using a fronto-temporal flap by R. MEYER. a Transplantation of a strongly convex auricular cartilage graft into the temple and formation of two pockets lined with THIERSCH grafts; the latter pre-forms the dome of the nostrils. b Flap is transferred to the prepared defect and sutured to the alae and columella; donor site on the temple is closed with a rotation flap

pedicle should only be detached at the base in the region of the eyebrow and be swung in a curve onto the defect to be covered. With this procedure we have obtained good cosmetic results.

One can proceed in a similar manner for reconstruction of alae, columella and septum. For the septal reconstruction a plate of skin, cartilage and a THIERSCH



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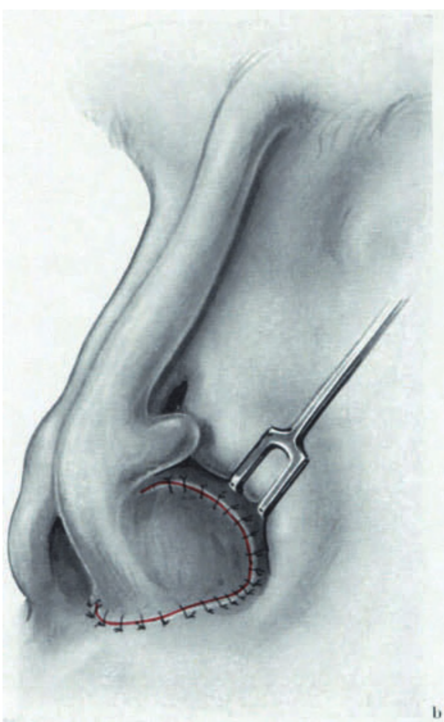

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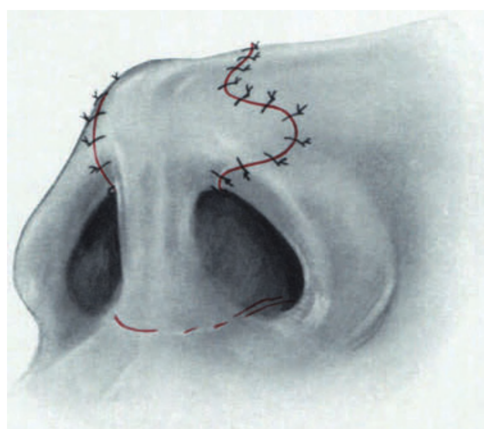

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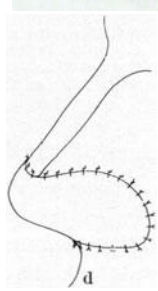


d

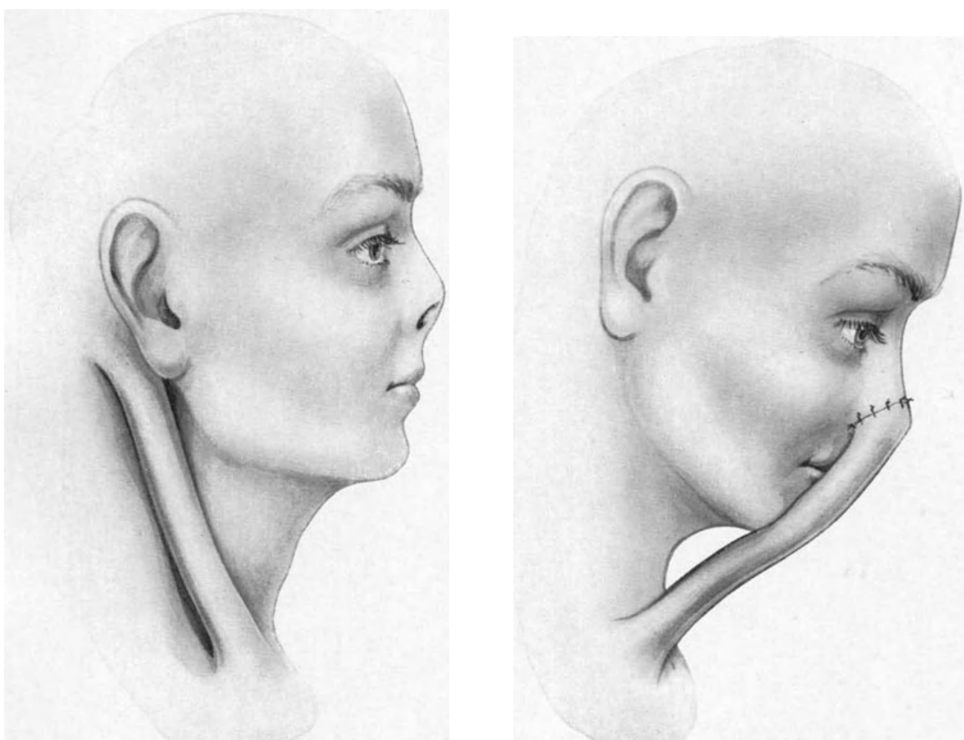
Figs. 449a—d. Reconstruction of nasal tip, columella and septum using a fronto-temporal flap, according to R. MEYER. a Transplantation of an auricular cartilage graft into the temple and formation of a pocket lined with a THIERSCH graft. b Cartilage-reinforced flap is swung onto the septum-tip defect and sutured. c Bridge flap detached. The stump of of the flap is used to model the tip. d Side view of septum (schematic) after suturing the flap as in b graft is pre-formed in the temporal region and is used as in Fig. 449. — Replacement of only the columella using this principle is illustrated in Fig. 398.

For columella and septum reconstruction one can use the most varied types of pedicled flaps. If additional saddling of the dorsum is present, the pedicle can be used as a subcutaneous implant to eliminate the saddle. To do this one must remove the epithelium layer, i.e. make a pedicled dermal flap out of it (see also Fig. 230).

The fronto-temporal flap of Conway should also be mentioned. It can be used for reconstruction of the nasal tip as well.

c) Tubed pedicle flaps from head and neck

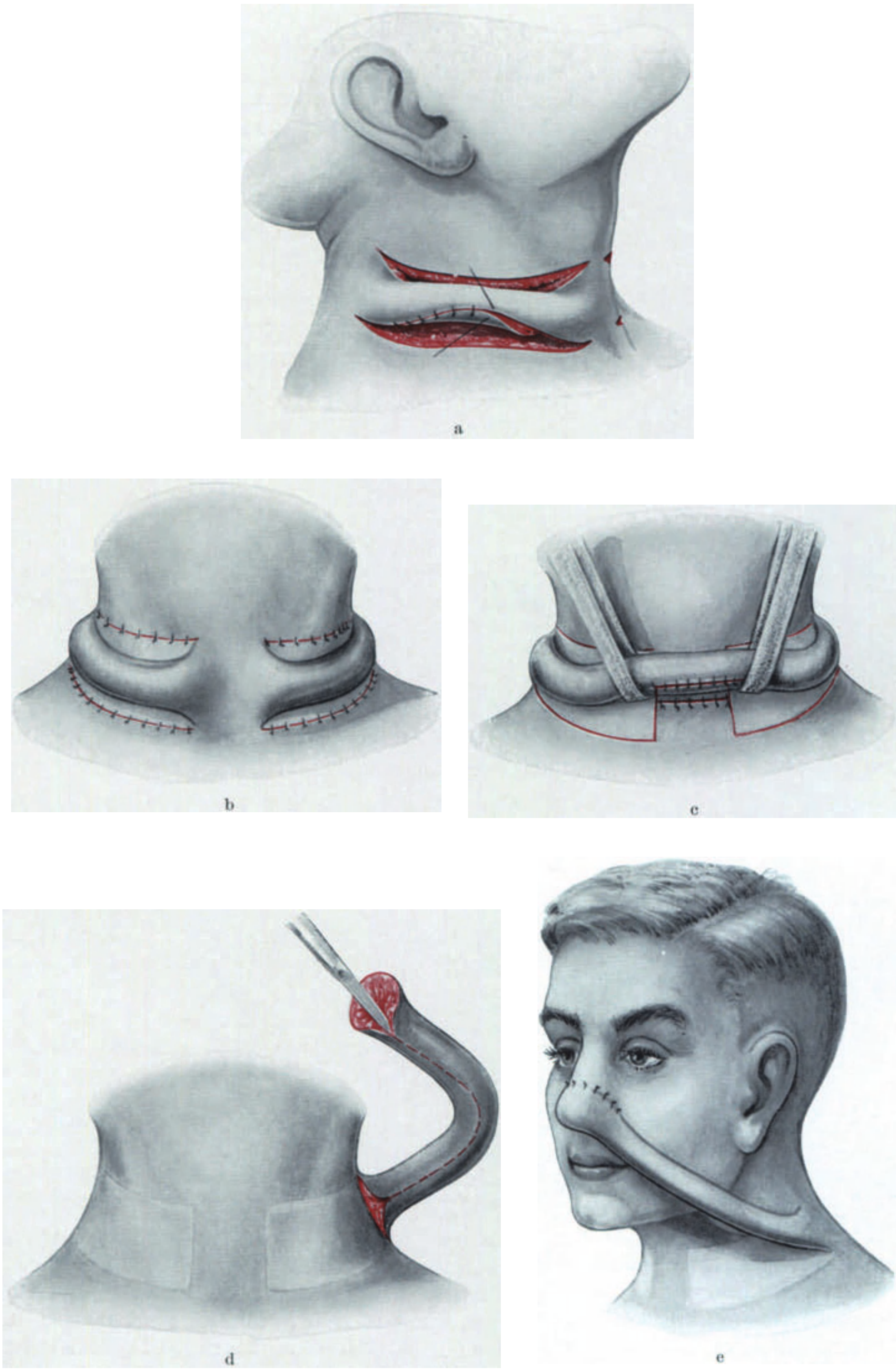
The use of tubed pedicle flaps from the fronto-temporal region, from the neck, or from the acromio-clavicular and acromio-pectoral region have already



a b

Figs. 450a and b. Replacement of the nasal tip using a tubed pedicle flap by Berson. a Formation of the flap. b The tubed pedicle flap is based over the sterno-clavicular joint; its retroauricular skin is sutured into the nasal tip defect

been described in the section on replacement of the ala (see p. 355). These types of flap are also indicated for reconstructive surgery of the nasal tip. The *fronto-temporal flap* can be made in the same region as the temporal artery flap of Sheehan. It has its base just in front of or above the attachment of the helix of the ear. The *diagonal neck flap* along the sternocleidomastoid muscle ends behind the ear and offers hair-free skin of suitable complexion. The horizontal neck flap can be obtained either in the submental triangle or farther below at the



Figs. 451 a—e. Horizontal cervical flap with a median bridge by O. BECKER (USA). a Formation of the tubed bedicle flap on the neck. b Donor sites covered with skin. c Union of the bilaterally situated tubed pedicle flaps py raising the medial bases. One end of the tubed pedicle flap is detached and is prepared. e Migration of the flap to the tip after appropriate preparation of the distal end of the flap level of the hyoid bone. The donor area of the acromio-clavicular flap runs from the sternoclavicular joint to the acromion. With these tubed pedicle flaps the acromial end can sometimes be grafted directly to the nasal tip if the head is fixed in a position slightly downward toward the site. It is better to transfer this flap using an intermediate attachment on the angle of the chin. Such flaps have been described by STRAITH, ULLIK, F. SMITH, HERLYN, PERWITZSCHKY, WEAVER, CRAWFORD, and others. CRAWFORD transfers the flap during the third stage from the clavicular region to the mucosa of the lower lip near the angle of the mouth in order to avoid further visible scars.

BERSON uses a diagonal tubed pedicle flap based on the sternoclavicular joint. The end which is taken from the retroauricular region (Fig. 450) is shaped into a nasal tip with columella after FILATOW. The procedure of BERSON is impractical because the diagonal flaps is too thin at the retroauricular end for formation of the nasal tip after FILATOW, except when the flap is lined with cartilage.

O. BECKER has used a *horizontal neck flap* for reconstruction of the nasal tip. First a two-part bridge flap is formed (Figs. 451a—c). At about the level of the larynx a tubed pedicle flap is formed on either side whose lateral base lies on the trapezius muscle border. The donor areas are covered with intermediate thickness dermatome flaps. In a second stage the medial skin of the neck is raised together with the medial bases of the tubed pedicle flaps, forming one flap from the two. In the third stage one end of the flap is detached above the border of the trapezius muscle and is sutured into the nasal defect after appropriate preparation.

d) Visor flap

SCHUCHARDT describes an original modification of the visor flap or forehead bridge flap of SENN and PERTHES. It is particularly suitable for nasal tip defects due to burns of the area or due to lupus with marked changes in the skin in the vicinity (see p. 418). Using this flap one can reconstruct the upper lip at the same time. The middle part of the bridge flap with a small flap over the glabella provides the material for replacement of the nasal tip and the columella. The upper lip can be reconstructed using tissue from the pedicle of the flap. The bridge flap is pedicled bilaterally on the temple and includes practically the entire forehead skin. It is not rolled but is covered with a THIERSCH graft on the side toward the face. The donor site on the forehead is covered with split-thickness skin grafts. The pedicles of the bridge flap are detached one after the other at the temple and are reattached in the region of the nasolabial fold. Later they are detached from the nose and are used to form the upper lip. To create adequate prominence of the nasal tip one must later implant a cartilage graft for support. This procedure, in which the entire forehead skin is replaced by split-thickness skin grafts, naturally causes considerable additional scarring on the face.

e) Flaps from arm

The history of nasal reconstruction using flaps from the arm goes back to the 15th Century. ANTONIO BRANCA, the son of the physician of Catania, Sicily, is said to be the first to have used skin from the arm for reconstructive surgery of the nose. Today this method of rhinoplasty is still called the Italian method. The first scientific description was given by GASPARE TAGLIACOZZI, professor of anatomy in Bologna. The method was described in his work, "De chirurgia curtorum per insitionem" in 1597. The history of this medieval rhinoplasty is to be found in the treatises by JOSEPH, WEBSTER, GNUDI, and others.

Pedicle or tubed pedicle flap surgery from the arm is still often used today. Pedicle and tubed pedicle flaps from the "snuffbox" ("tabatière", see Figs. 388 to 390), from the forearm and from the upper arm are used. We consider replacement surgery from the "snuffbox" to be too complicated, since the patient finds fixation of the hand in front of the mouth very unpleasant. However this method has not yet been abandoned. Replacement surgery from the forearm practiced much by JOSEPH is hardly used any more today. On the other hand, reconstruction of the nasal tip using pedicle and tubed pedicle flaps from the upper arm, as described in the chapter on columellar surgery (see p. 318) and alar surgery (see p. 362), is generally widespread today. It is to be found in almost all textbooks on plastic surgery.

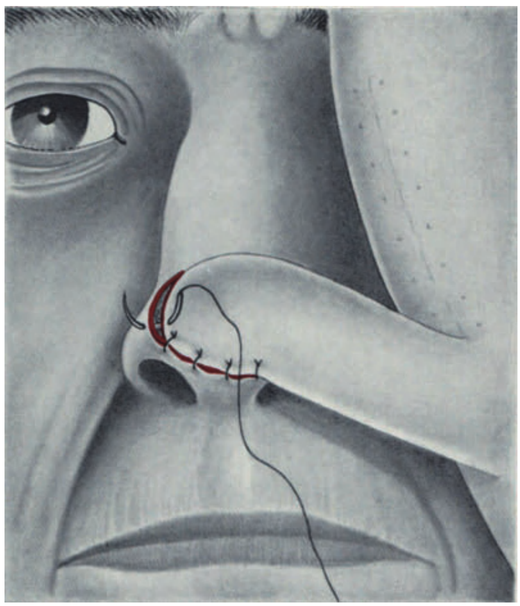


Fig. 452. Elimination of a nasal tip defect using a flap from the inner side of the upper arm (Italian method). The base of the flap is on the axillary end of the donor site. The flap is sutured without tension into the defect on the nasal tip. Subcutaneous fat tissue can be added generously to fill the defect

Technically the method is relatively easy to perform. The flap is formed on the *inner surface of the upper arm* and should be made so that when the arm is raised (Fig. 452) the base of the flap lies almost at the level of the nasal defect. It is better to place the base axillary to the donor site, since in this way the venous drainage is least hindered. NÉLATON and OMBRÉDANNE pedicle the flap toward the elbow. The flap is sutured in the usual way. The surgery is done with the patient reclining, while the immobilization of the upper arm against the head is done with the patient sitting. In order not to create tension in the region of the suture, the length of the flap must guarantee a certain amount of play. The pedicle of the flap can be formed into a tube, but this is not necessary. — When detaching the flap after it has healed, one must also take into account possible defects still to be covered and must not cut the material available too short. The donor site on the upper arm can be covered with a THIERSCH graft if it can not be closed by approximation.

The disadvantage of the pedicle flap from the arm is that after the operation there is a rather considerable difference in color between the graft and the skin around the defect. The skin grafted from the arm is always more noticeable for a while due to the lighter color. Even if equalization of the pigmentation as a result of exposure to sunlight occurs later, the patients still consider the first months after the operation disturbing, and because of this they have to be informed accordingly. The modern *methods of tattooing*, with which surgeons in the USA try to eliminate such color differences, have not yet been perfected. In no case should they be used before 1 year has elapsed after the operation. It is also inadvisable because the new color matches only during one season, summer or winter (LANGE). If the region of the replacement surgery is exposed too strongly to sunlight, sometimes a very pronounced pigment difference can result. — In the case of brunette patients, the grafted skin can sometimes appear even darker than the surrounding facial skin. The cause is probably that an overly large area of skin from the arm, which later assumed the proper size by means of contraction, was healed in the defect and thus brought about the respective increase in pigmentation. The danger of excessive pigmentation is present especially when greatly contracted tubed pedicle flaps are used. This is a very unpleasant complication which can be eliminated only by clever reduction of the healed skin. In 1954 RAPIN described a technique to remedy this disadvantage of pigmentation difference. This method leads to tolerably good cosmetic results. He made a free graft of retroauricular skin onto the arm. After this had healed he formed a tubed pedicle flap which included the grafted skin. Thus this area of skin was transferred to the nasal tip.

In *immobilization of the arm to the head* a few rules are to be observed in order to guarantee certain and complication-free healing. The usual methods of immobilizing the arm and head by means of a plaster cast are still to be recommended today. In the case of quiet patients elastic fixation or a wide elastic tape dressing are also suitable. JOSEPH and others prefer plaster, and WEBSTER Elastoplast dressings. If the fixation dressing is applied after the operation, then one must be absolutely certain that the flap is without tension in the region of the pedicle. That the arm can slip against the head must be prevented by means of good padding. This is to be checked regularly during the first days after surgery. Since fixation of the arm is very painful for the patient during the first days, appropriate medications are to be given. It can happen that the distance to the orbita is very small. With a certain position of the flap on the upper arm and the manner of immobilization of the arm required by this, protection of the eye with an ointment dressing with daily checking is indicated. — We have used immobilizing plaster dressings on patients up to the age of 72. Children accustom themselves to this immobilization more quickly then adults. In the case of patients above 70 no complications were observed. However it was regular practice to detach the flap after a relatively short period so that a change in the shoulder joint could be avoided. In the case of small defects the base of the flap can be severed in spite of age even after 11—12 days without jeopardizing the survival of the flap. — In other cases the upper arm was first immobilized against head and the surgery done 2—3 days later after it was certain that the upper arm would not move with respect to the head. This procedure is indicated when one can not judge beforehand whether the patient can become accustomed to wearing the fixation dressing for a long time. Once the flap on the upper arm has been formed and already sutured, early removal of the fixation dressing is for all practical purposes accompanied by failure of the surgery. — The disadvantage of previous immobilization of the arm becomes apparent during the plastic surgery. The narrow operative field can make formation and suturing of the flap into the defect region more difficult. While one can still work around the non-immobilized arm somewhat, this is not possible after previously completed immobilization. In the narrow conditions given, relatively good dissection is possible only with the headlight, since it alone provides sufficient light in the operative field. — If larger defects are present, it may be necessary to make only a partial covering, so that the flap has a wide base in the region of the nose, from which the reconstruction can be completed after the pedicle is detached. — After radiation therapy of the nose the time necessary for healing is longer, so to guarantee absolutely certain nourishment. — Difficulties can occur with this method if the patients are broad-shouldered and short-limbed. Then one must resort to other methods.

f) Reattachment of nose

With regard to these methods one question must be answered: In case of complete avulsion of the nasal tip, should the severed part of the skin and cartilage be reattached or not? Certainly the time elapsed between the trauma and suturing of the avulsed soft tissues is important. In 1957 a case of nasal tip amputation and treatment by means of immediate reattachment was described by Dubost and his colleagues. The avulsed and resutured nasal tip healed for the most part. A remaining defect was filled out by means of free grafting of skin and cartilage. The authors write that they found no instructions in recent literature of rhinoplasty concerning reattachment of parts of the nose. On the other hand they report on descriptions from older literature. G. Martin is said to have quoted cases of reattachment of noses with healing in this manner. Other bibliographical data as by R. J. C. Garengeot sound improbable. No cases of reattachment are known from the recent Algerian war in which Arabs who fought on the side of the French were punished with amputation of their noses by their countrymen.

There is no data in medial literature concerning the greatest permissible time lapse between trauma and resuturing.

V. Reconstruction in other partial nasal defects (lateral nasal wall and dorsum)

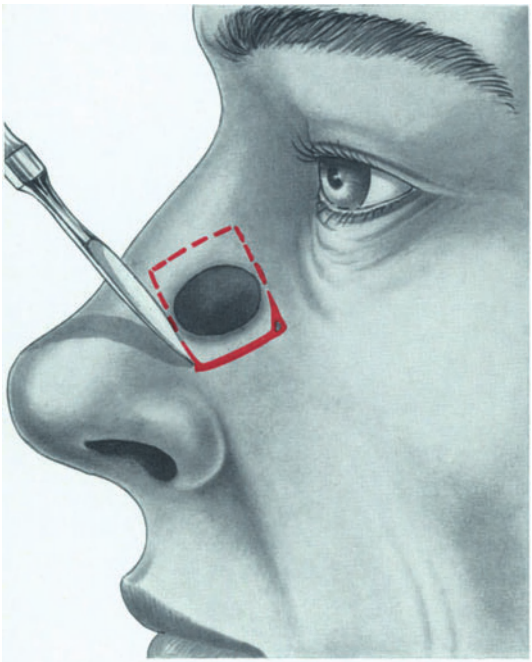
Larger defects of the nose in the upper as well as the lower part can seldom be repaired by means of local methods. Such methods are: transfer of flaps from the defect border, transposition flaps, or rotation flaps from the immediate vicinity. Nor are free grafts suitable for these defects. For this purpose one must use larger flaps from the forehead or from the cheek, or better, distant flaps.

In the discussion of partial defects, upper perforating and non-perforating defects in the region of the bony nose are to be considered in particular. Such defects in the lower third were already discussed in the chapters on reconstruction of the columella, alae, and nasal tip.

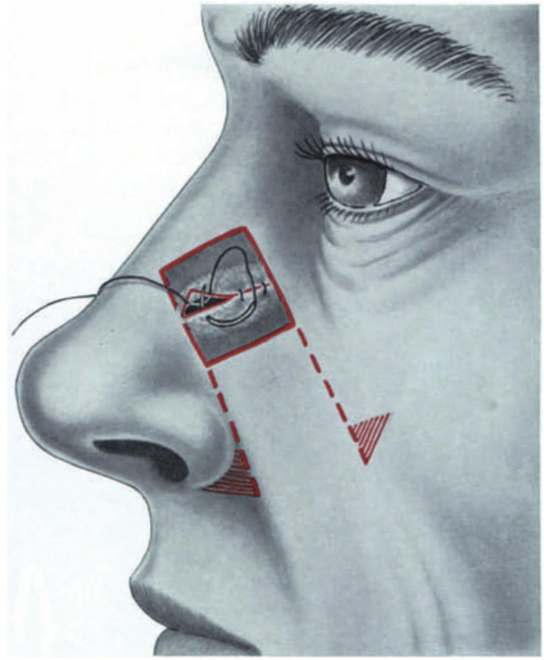
1. Reconstruction using free full-thickness skin grafts

Only in a few cases can *free full-thickness skin grafts* be used for covering larger defects which affect only the skin or cicatricious skin areas.

In cases of slate dust tattooing of the entire nasal skin, we have removed the skin in its full thickness and have replaced it with full-thickness skin grafts from the retroauricular or supraclavicular region or with intermediate dermatome grafts. The thickness of the graft depends upon the age of the patient and the condition of the skin. For full-thickness skin flaps the thickness is between 0.8 and 1.0 mm. For dermatome grafts it is about 0.5 mm. We recommend obtaining them by means of the dermatome so that they are uniform. With



a



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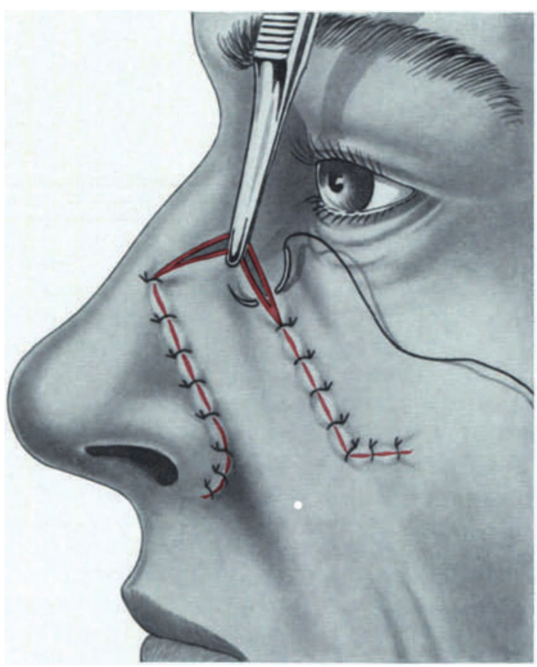
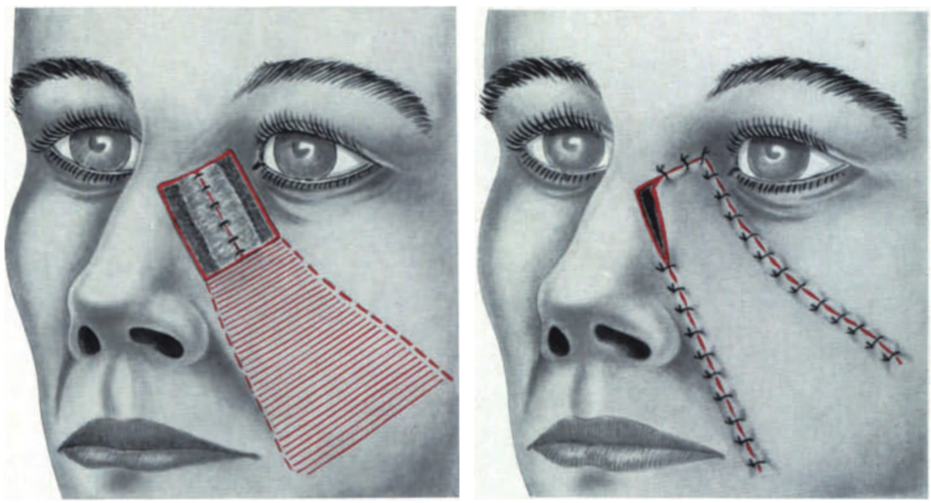


c

Figs. 453a—c. Elimination of a perforating partial defect on the lateral nasal wall. a Incision of the skin on the rim of defect for inner lining. b The inner lining is formed by swinging the hinge-flaps inward; incision for a straight advancement flap from the cheek with two Burow triangles for release of tension. c Suturing the advancement flap imbedding of slate dust by explosions as well as abrasions due to traffic accidents, the entire subcutaneous tissue layer is impregnated with these discoloring enclosures which sometimes are as deep as the periosteum and the perichondrium of the underlying bone and cartilage. Often inflammatory processes of the connective tissue are in the immediate vicinity of the embedded material. This tissue must be removed also. An uneven surface remains due to this. This surface must be smoothed before grafting. Sometimes this can be done with the burr.

2. Reconstruction using straight advancement flaps

Along with rotation flaps, straight advancement flaps *from the glabella* are suitable for covering non-perforating defects on the nasal dorsum. In order to



a b

Figs. 454a and b. Closure of a perforating defect of the nose with inner lining provided by hinge-flaps from the surrounding region and external covering provided by a straight advancement flap without Burow triangles. a Inner closure. Red hatching shows mobilized advancement flap. b External closure. The upper suture line is to be applied with as little tension as possible

do this, triangular excisions must be made bilaterally on the upper border of the eyebrow. The skin of the forehead is undermined almost to the hairline so that it can be pulled downward far enough. This way the rectangular flap above the glabella is advanced a few centimeters.

For small defects of the lateral nasal slope, which can also be perforations, a straight advancement flap *from the cheek* can be used if it suffices to swing the borders of the defect inward as hinge flaps onto the defect for inner lining (Figs. 453a, b and Fig. 454a). In somewhat larger defects we avoid swinging the marginal skin inward as a hinge flap for inner lining. A certain inner lining for the perforating defect is obtained by means of a hinge flap turned from the neighboring area. Like E. Schmid we previously reinforce the flap with auricular cartilage and cover the donor site of the flap as well as the exterior of the defect with an advancement flap from the cheek (Figs. 453c, 454b).

3. Reconstruction using rotation and transposition flaps from cheek

Esser and d'Agata recommended *rotation flaps from the cheek* to close defects on the lateral wall of the nose. The cheek is rotated onto the nose by means of a long, curved incision extending rearward into the preauricular region and downward over and beyond the angle of the jaw to the neck. Small triangular excisions are made at various points on the lateral border of the curved incision

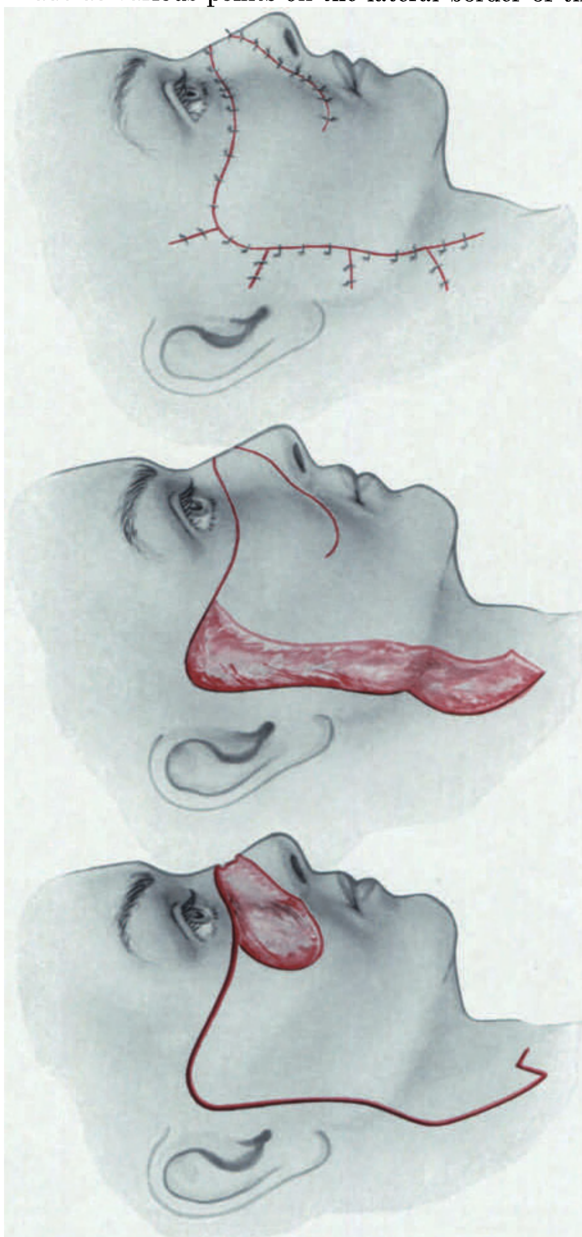
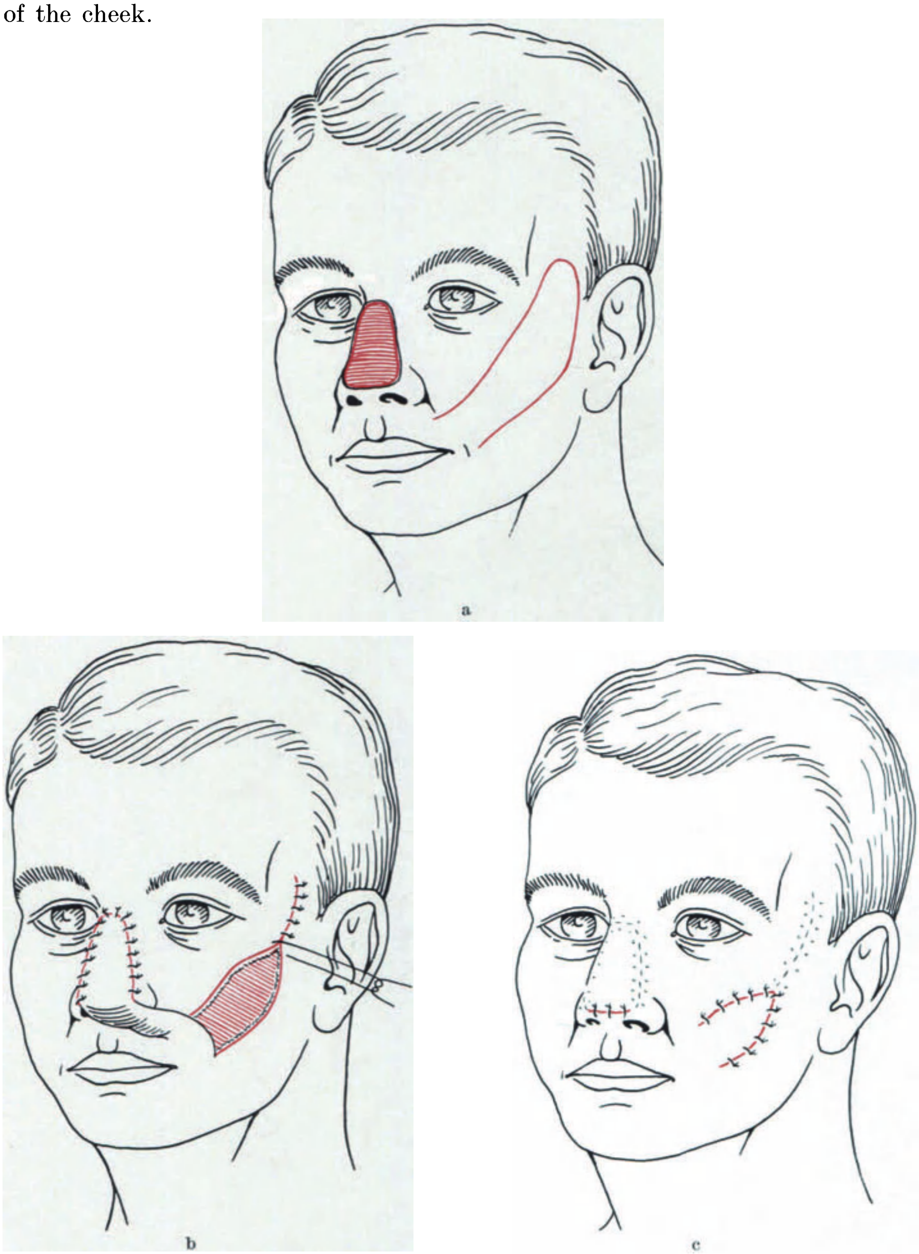


Fig. 455. Covering a partial defect of the lateral nasal wall and the adjoining cheek by means of a rotation flap from the cheek, by ESSER; this method is contraindicated in male patients with a heavy beard because hair is moved to the nose and cheek

(Fig. 455). During the décollement of this skin flap one must proceed precisely in the proper layer because of the danger to the thin branches of the facial nerve. The use of this flap is less suitable for male patients because of the advancement of the beard area in the region of the nose and the anterior cheek. With regard to younger women it is better to avoid the additional scars in the region of the cheek.



Figs. 456 a—c. Transposition flap from the cheek according to JOSEPH. a Solid red line shows incision; red hatching shows defect. b Flap sutured into the defect. Donor site on the cheek (red hatching) is closed by approximation. c Pedicle is detached and the base of the pedicle is replaced on the cheek

The *double flap* of ESSER and ZIMANY (Fig. 431) should be mentioned here again. It was described in the discussion of alar reconstruction. — POLYA has worked out various advancement flaps from the cheek. One of these has been modified by ZOLTAN. This was likewise mentioned in the chapter on alar reconstruction (see p. 353).

Transposition flaps from the cheek for covering partial defects in the upper part of the nose correspond approximately to those used in reconstruction of the nasal tip and the alae. Labial flaps are less suitable than the large, diagonal cheek flaps of JOSEPH (Fig. 456) and the smaller ones of SANVENERO-ROSSELLI which run diagonally toward the temple from the nasolabial fold, where their base is located. They are transferred onto the defect and remain pedicled like a bridge in the nasolabial fold until the distal end has healed. Then the pedicle is detached and removed or in part replaced (SANVENERO-ROSSELLI, Fig. 445). We have also used this technique but in recent years have abandoned it in favor of other techniques like fronto-temporal, rotation and tubed pedicle flaps. — The nasolabial cheek flap by HAGERTY and SMITH contains the facial artery which runs upward next to the angle of the mouth and anastomizes with the dorsal-nasal branch of the ophthalmic artery as the angular artery. — Lymph drainage is disturbed by these methods, resulting in postoperative edema for several months. — Transposition flaps can be lined with a THIERSCH graft in one stage if they are to be used to close perforating defects.

4. Reconstruction using rotation and transposition flaps from forehead

In smaller non-perforating defects on the glabella or the nasal root short rectangular or trapezoidal *median rotation flaps from the forehead* can be used (McGREGOR, Fig. 457).

Transposition flaps from the forehead are still preferred by many surgeons especially for use on older male patients. These flaps are used primarily for defects on the upper part of the nose and on the glabella (Figs. 458—461). The flaps can be used with the skin surface outward to cover an external, non-perforating defect, as well as with the skin surface for the inner lining of a perforating defect, in which case external covering is still needed. They can also be lined with a THIERSCH graft on the raw surface and be used in this epithelized condition to close a smaller perforating defect (Fig. 459). FERRIS SMITH has described an incision whereby the nourishing supraorbital artery is rotated with the forehead flap. He lines the caudal end of the flap with a THIERSCH graft to close a perforating defect on the nasal root by the transposition (Fig. 460).

Fistulas to the nasal cavity in the region of the nasofrontal duct which are located externally medial to the eye on the lateral slope of the nose often occur after frontal sinus operations. These are covered by means of simple, diagonal transposition flaps from the forehead, if it is possible to close the mucosa defect by approximation of the mucosa borders (Fig. 461). ZOLTAN recommends closing a perforating defect on the medial border of the orbita with communication *to the ethmoidal air cells* by means of an anterior hinge flap from the border of the defect. This provides the inner lining. He sutures it to the mucosa border. For external covering he rotates a flap forward from above the upper lid and one from below the lower lid (Fig. 462). With such flap procedures the possibility of ectropion must be avoided at all costs. Therefore the method can be used only for small defects in the vicinity of the eye and on patients with loose skin.

The median forehead flap after KAZANJIAN (see p. 326) can also be used here (HOLDSWORTH). In case of defects in the upper part of the nose the flap does not have to extend to the hairline. It is also possible in cases of low forehead.

In the case of *perforating defects on the lateral nasal slope* which communicate with the nasal cavity, KAZANJIAN designs a diagonal forehead flap which he folds down onto the defect for inner lining and sutures it to the mucosa borders. The external defect is covered with a free retroauricular skin graft. If a thicker layer is necessary, he covers the defect with a two-layer auricular graft. To cover larger defects he uses a flap from the arm. When the skin has healed after 2 to

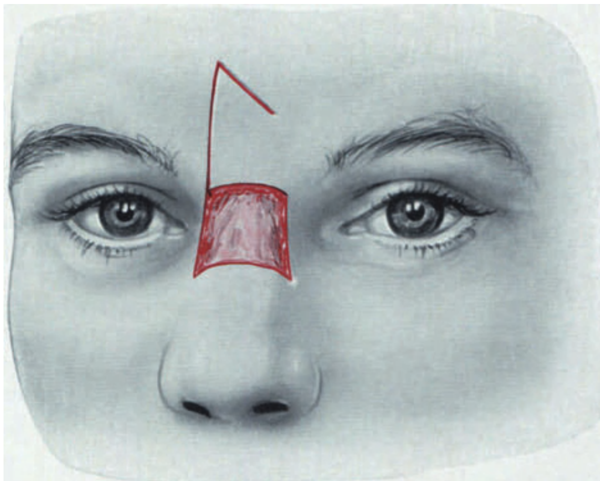


Fig. 457a. Defect on the bony nasal dorsum. Correction by means of a rotation flap from the glabella

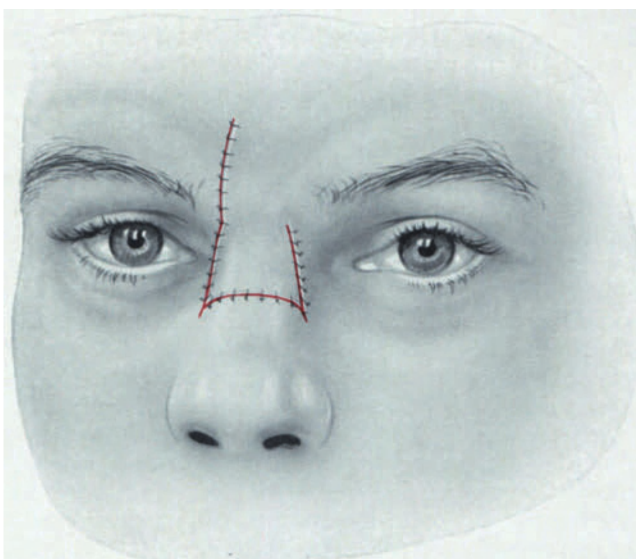


Fig. 457b. Rotation flap after suturing

3 weeks as mucosa replacement, the pedicle can be detached and replaced on the forehead (Figs. 463a—c). Sometimes it is necessary not to replace the pedicle on the forehead but to use it for completion or improvement of the external covering, if this has not healed well. Naturally the flap must be folded over again, since its raw surface faces outward. When this is done it may be necessary to lengthen the pedicle by moving the base, i.e. by extending the original parallel

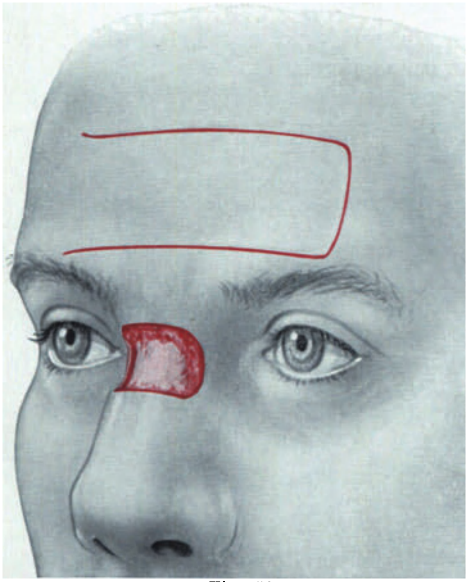


Fig. 458

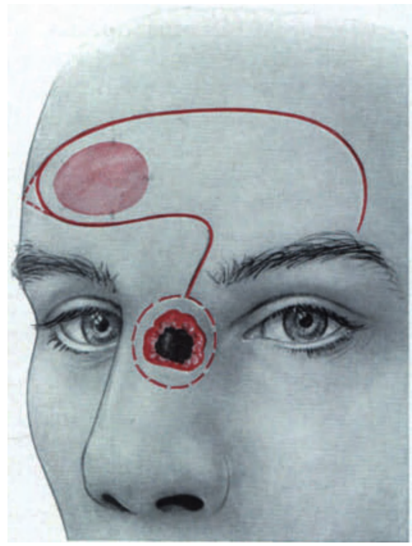


Fig. 459

Fig. 458. Covering a non-perforating defect on the nasal root using a transposition flap from the forehead

Fig. 459. Closure of a small perforating defect using a transposition flap from the forehead; the flap may also be lined with a THIERSCH graft for inner lining. Dotted red line around the defect shows area to be prepared

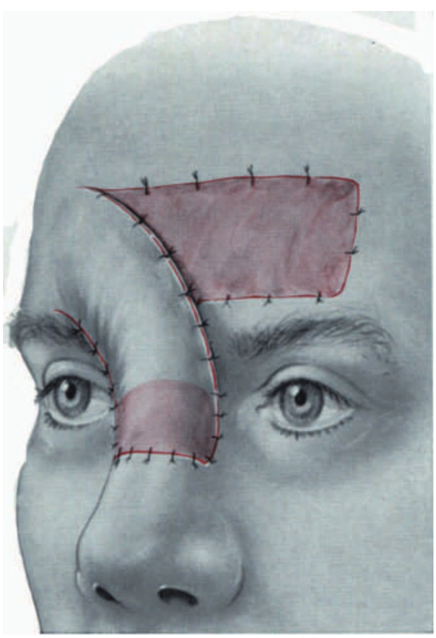


Fig. 460

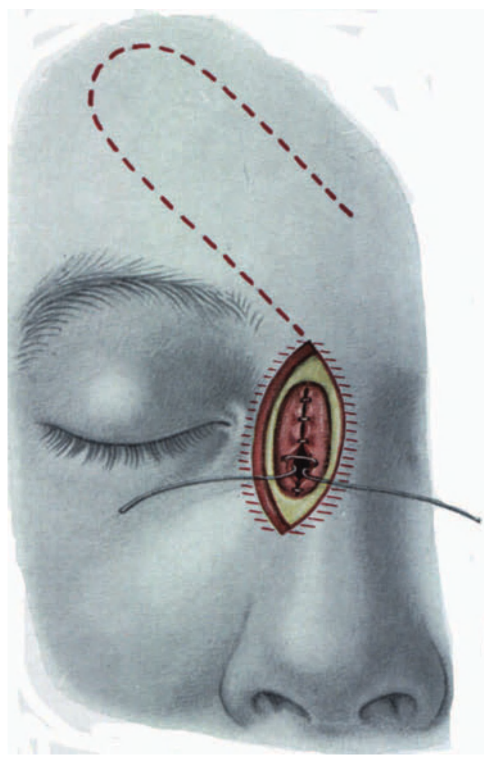


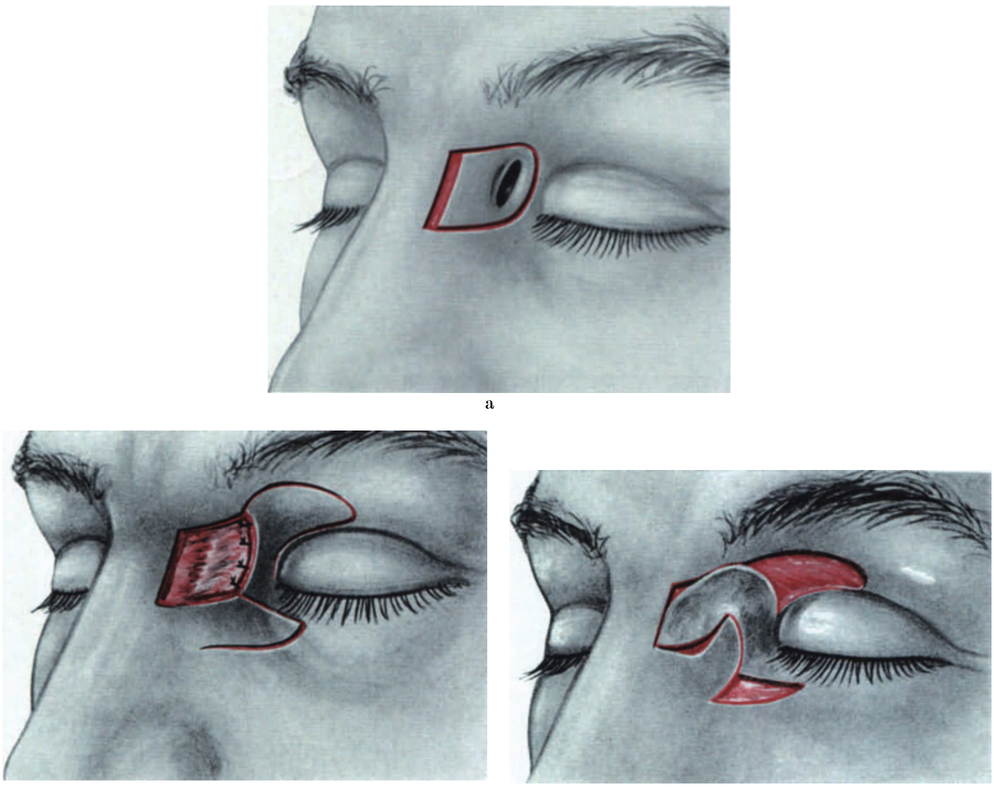
Fig. 461

Fig. 460. Transposition flap from the forehead; the flap is lined with a THIERSCH graft for closure of a perforating defect at the nasal root; covering of the donor site with a free skin graft (by F. SMITH)

Fig. 461. Closure of a fistula opening into the nasal cavity. The borders of the skin or mucosa are sutured together to form the inner lining. Forehead flap formed for external covering of the defect. Red hatching shows mobilization area to be undermined of the skin. (From H. J. DENECKE)

skin incisions. If it is necessary to improve the original external covering, one must remove the shrunken freely grafted tissue beforehand.

In the case of *larger perforating defects on the lateral nasal wall* one can also proceed so that the forehead skin is used as external covering. One prepares an adequately large horizontal or diagonal forehead flap by lining it with two THIERSCH grafts while the flap is being delayed. Such extensive split-thickness grafts are best obtained with the dermatome from the upper thigh or the lateral



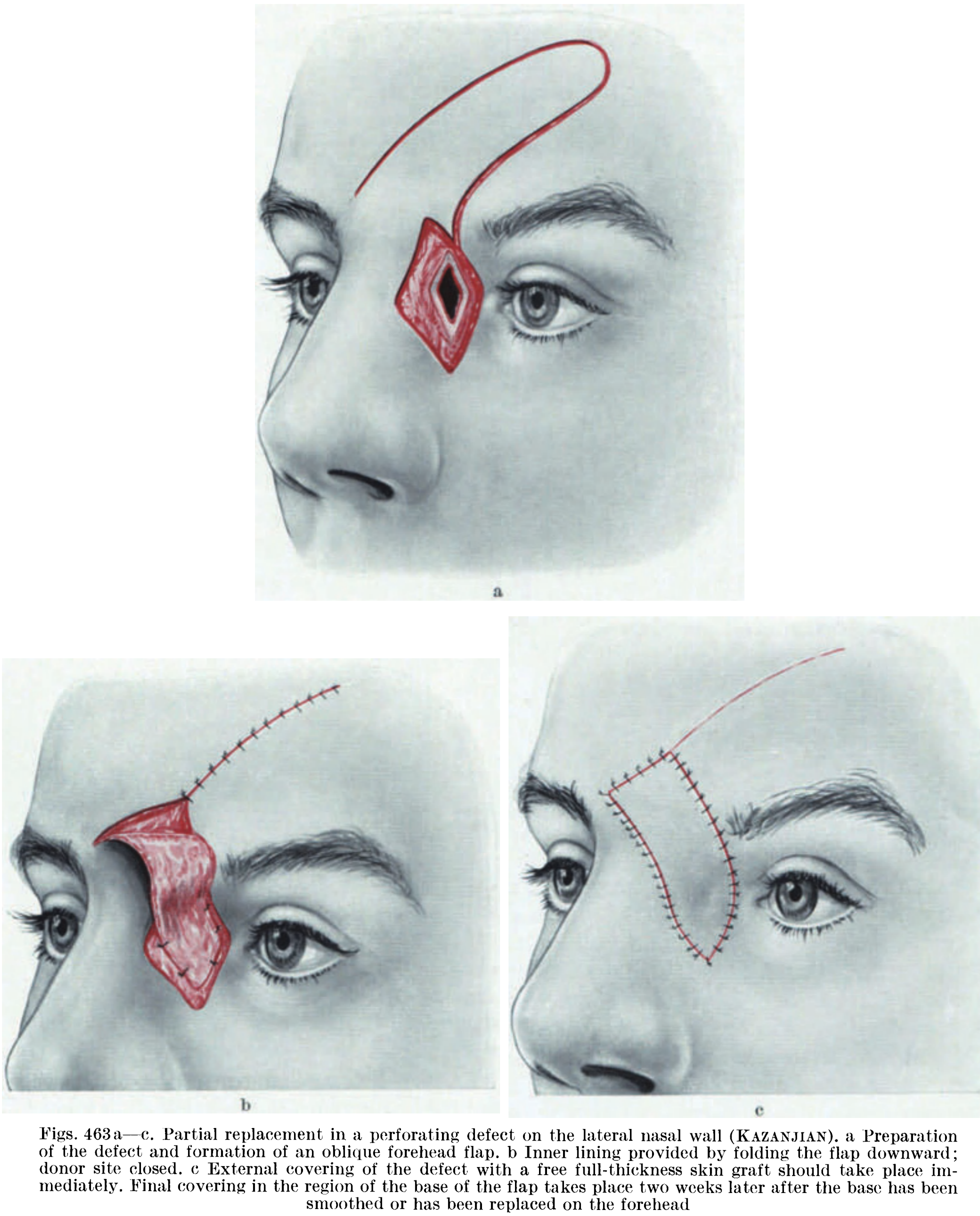
a

b c

Figs. 462a—c. Closure of a perforating defect in the upper nasal wall, by ZOLTAN. a Incision of the neighboring skin intended for inner lining. b Cutting a rotation flap above the upper lid and below the lower lid; inner lining sutured. c Flaps swung into place

part of the chest. One larger THIERSCH graft is sutured with the raw surface downward toward the forehead fascia. Thus it covers the largest part of the donor area on the forehead. The smaller THIERSCH graft is sutured with its raw surface outward, i.e. against the raw surface of the forehead flap. This is intended for inner lining of the nasal defect. With lining the flap is sutured to the forehead and delayed. After a few weeks it is carefully raised and swung onto the nose (Fig. 464). Its external surface faces outward on the defect. The flap is sutured at two levels. First the borders of the THIERSCH graft are sutured to the borders of the mucosa with atraumatic catgut. Then the skin flap is sutured where it is not pedicled, on its new anterior, lower, and posterior edge.

For covering a perforating defect on the nasal root ZOLTAN cuts a horizontal forehead flap. For the inner lining of the defect he swings a hinge flap from the lower border region into the perforation and sutures it to the nasal mucosa. The donor site on the forehead is covered with a dermatome graft from the upper thigh. — In the case of younger patients, such extensive forehead flaps



Figs. 463a—c. Partial replacement in a perforating defect on the lateral nasal wall (KAZANJIAN). a Preparation of the defect and formation of an oblique forehead flap. b Inner lining provided by folding the flap downward; donor site closed. c External covering of the defect with a free full-thickness skin graft should take place immediately. Final covering in the region of the base of the flap takes place two weeks later after the base has been smoothed or has been replaced on the forehead

naturally leave additional noticeable scars, especially when there is a tendency toward keloid formation. This factor is found disturbing especially by women.

The use of external skin to close mucosa defects in the nose sometimes leads to creation of ozena-like crusts, even if the skin has adapted somewhat to the humidity of the nasal cavity in the course of time. Since the skin has no mucous glands it will always be a little dry and cause a more or less slight ozena-like odor in larger defect operations.

For us, free or pedicled oral mucosa has proved to be the best graft material for the inner lining of the nose. The long mucosa flap, whose base is in the region of the upper lip, is brought to the defect through an opening between the oral vestibule and the nasal cavity in front of the piriform aperture, as described by JESCHEK for the ozena operation.

5. Reconstruction with fronto-temporal flaps

The fronto-temporal flap described in the chapters on reconstruction of the columella, alae and tip (Figs. 398, 440, 448, 449) has also proved useful to us (R. MEYER) for closing perforating defects in the middle and upper part of the

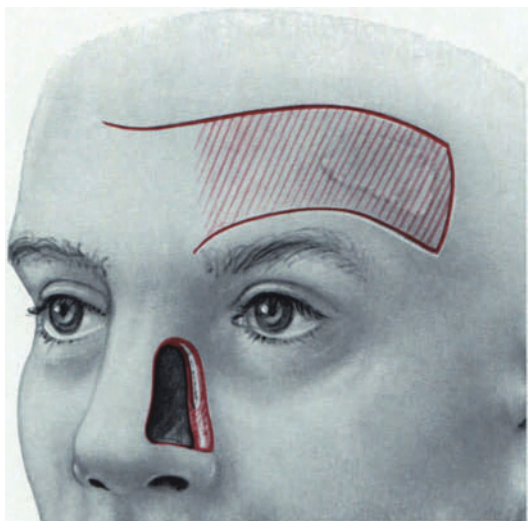


Fig. 464. Closure of a perforating defect on the lateral nasal wall using a horizontal forehead flap, the end of which has been lined with a THIERSCH graft. The entire donor site is also covered with a THIERSCH graft

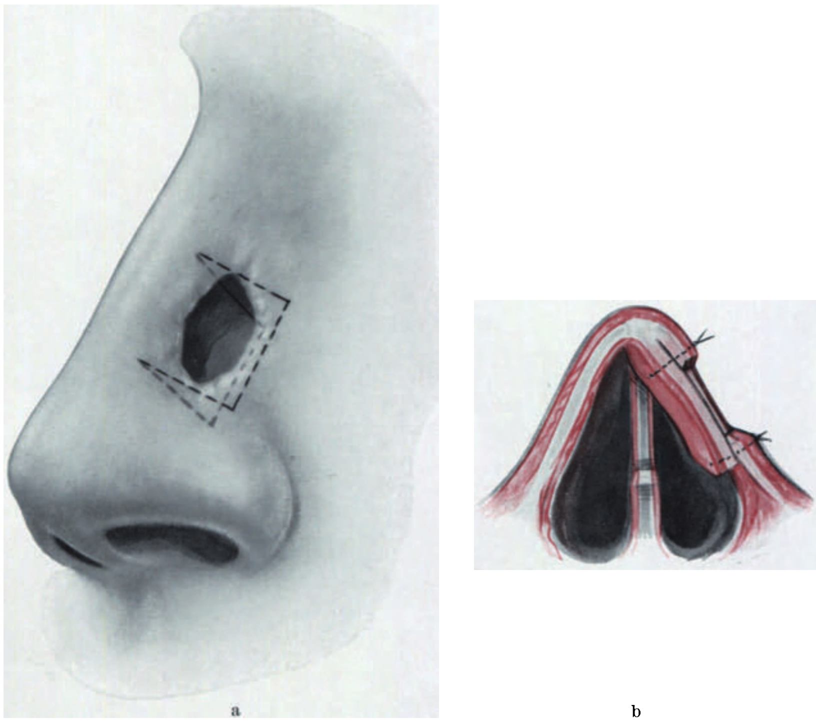
nose. Here as well we have somewhat modified the SCHMID technique. In the first stage the *bridge flap on the supraciliary arch* is made. The part of the nose to be reconstructed is preshaped on the temple at the same time. To do this one grafts a cartilage plate from the auricular concha under the upper layer of skin on the temple. A pocket lined on all sides with dermatome grafts is formed in a deeper subcutaneous layer directly over the fascia. In this way a rather thick, doubly epithelized flap with a cartilage implant is formed on the temple. After about 3 weeks this is transferred to the defect and sutured, remaining connected to the superciliary bridge flap. After another 3 weeks the 3-layered flap has healed in the defect. Now the nourishing bridge flap can be detached. — The fronto-temporal flap described by CONWAY is also to be mentioned here.

It should be pointed out again that such flaps are suitable especially for older patients with loose skin (see also pp. 362, 372).

6. Reconstruction with septum flap

The old method of DE QUERVAIN must be mentioned as a peculiarity for plastic closure of perforating nasal defects. It was already described in the chapter on alar reconstruction (p. 353; Figs. 432, 433).

For non-marginal defects the *septum flap* to be swung onto the defect is denuded of its mucosa opposite the defect and is fixed to the rim of the defect by means of mattress sutures (Fig. 465). External covering is done with rotation or transposition flaps. Today this method has no practical importance since many other techniques are available which do not cause such great damage as this with such a septum perforation.



a b

Figs. 465a and b. Closure of a perforating defect on the lateral nasal wall using material from the septum (DE QUERVAIN). The dotted gray line shows the incision on the septum; the dotted black line shows the position of the septum flap in the defect. b Cross-section of the septum flap which has been swung into the defect. The mucosa is removed at the points of contact on the rim of the defect. The external skin defect is covered with a rotation flap or a transposition flap

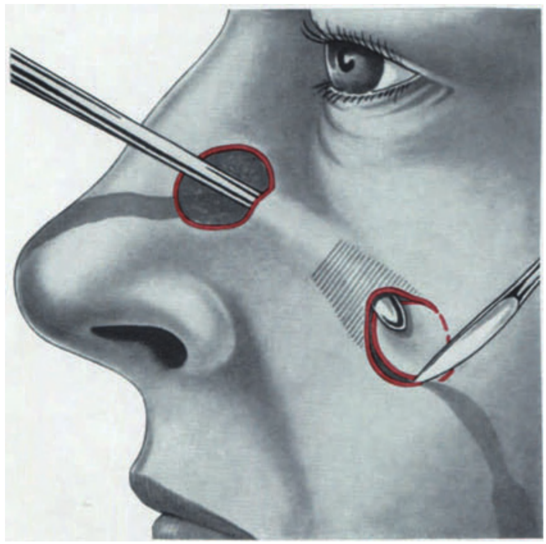
7. Reconstruction with island flaps

(MONKS' method)

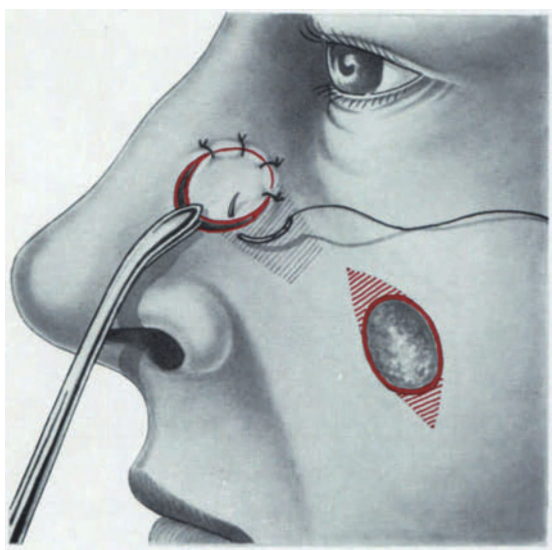
An ingenious and good method for covering partial defects on the nose is the *island flap technique* after MONKS. The original technique was worked out by MONKS for reconstruction of the eyelids. DURHAM transferred the method to rhinoplasty. One uses island flaps from the cheek, the forehead, or the temple.

The island flap *from the cheek* can be transferred as the inner lining or outer covering of nasal defects (Fig. 466). It can be attached to a long pedicle of fat based half way between the donor site and the defect. When using the island flap for inner lining of the nasal cavity, one must be sure that the torsion on the pedicle does not cut off circulation (Figs. 467a and b). The external covering can be obtained by means of straight advancement flap from the cheek, from the immediate vicinity of the donor site of the island flap (Fig. 467c).

In the technique using an island flap *from the forehead* an island of skin of the proper size and shape is cut in the region of the frontal artery. The frontal artery ends about 1.5 to 2 cm above the eyebrow. For this reason the use of



a



b

Figs. 466a—c. Elimination of a partial skin defect on the lateral nasal wall using an island flap from the cheek. a Prepared defect; cutting around the island flap; skin between the island flap and the defect is undermined and a pedicle of fat tissue (black hatching) is formed. b Suturing the island flap

a flap taken from here is restricted to the upper half of the nose. The artery can rarely be palpated. One must guess at the position according to the atlas of topographical anatomy and cut around its end (Fig. 468). At the beginning of the operation the size and shape of the flap are determined and marked. This is done best with an old rubber glove from which a piece corresponding to the shape of the defect is cut. The piece of rubber is laid on the desired area of the forehead and serves as a pattern for cutting the skin flap. The skin flap should be 1 to 2 mm larger than the pattern on all sides because it contracts

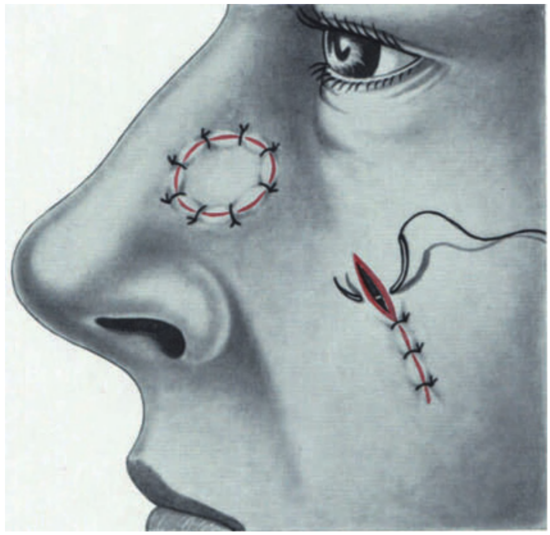
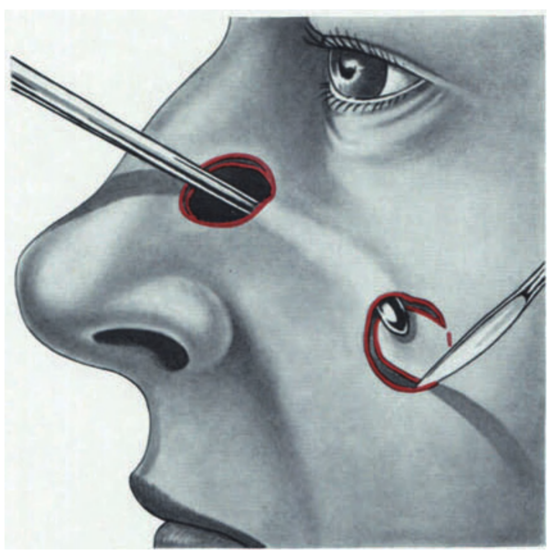


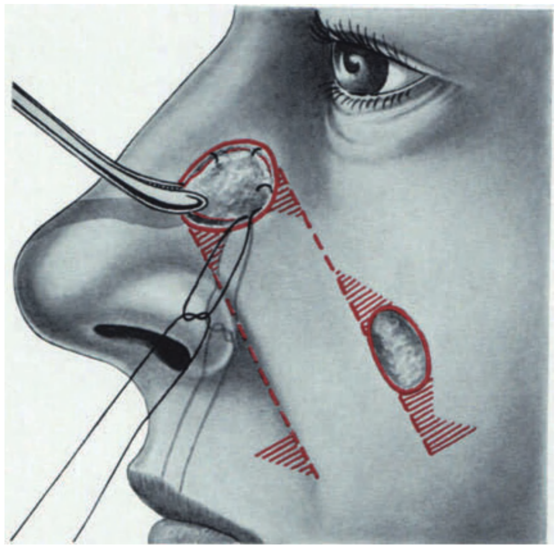
Fig. 466c. Closure of the donor site



a

Figs. 467a—c. Closure of partial perforating defect on the lateral nasal wall using an island flap from the cheek. a Rim of the defect prepared. Formation of the island flap with pedicle of fat tissue

somewhat after excision. The island flap limited by circular incision is now sutured in and dressed. When making the incision one must be sure to make only a superficial incision along the lower border of the flap so that the frontal artery is not severed. In a second stage working from the lower border of the flap one makes an incision toward the eyebrow in the supposed direction of the frontal artery. From this incision a pedicle prism or stick-pedicle containing the frontal artery is cut from the subcutaneous tissue. The skin between the lower end of the incision at the medial end of the eyebrow and the defect on the nose is under-



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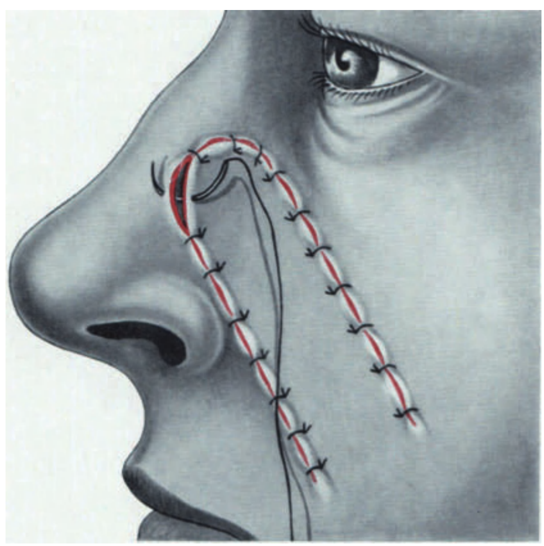


c

Figs. 467b and c. b Suturing the pedicled island flap for inner lining of the defect; formation of a straight advancement flap from the cheek. c Advancement flaps sutured. The BUROW triangles are sutured straight and the donor site is included in the suturing

mined by means of tunneling. The island flap with the pedicle of subcutaneous tissue is carefully passed through this tunnel to the border of the nasal defect. If the pedicle bearing the island is long enough, the island can be sutured into the defect. If it is not, then the incision at the eyebrow must be extended downward (Fig. 469). According to CONVERSE and WOOD-SMITH median oval island

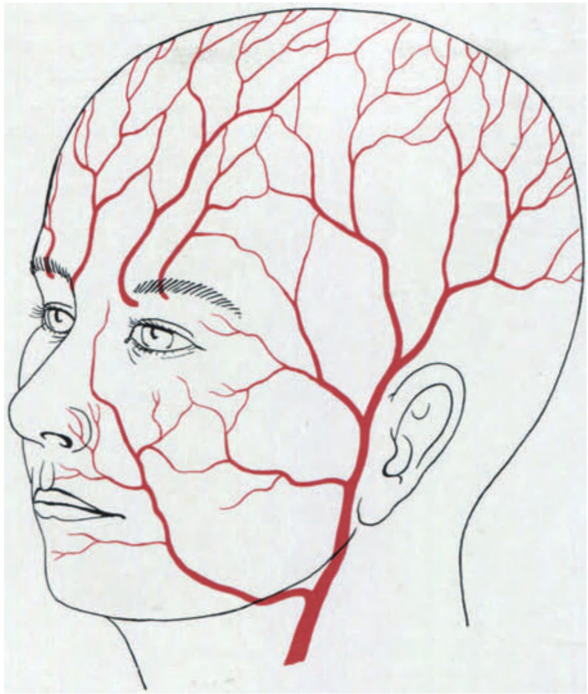
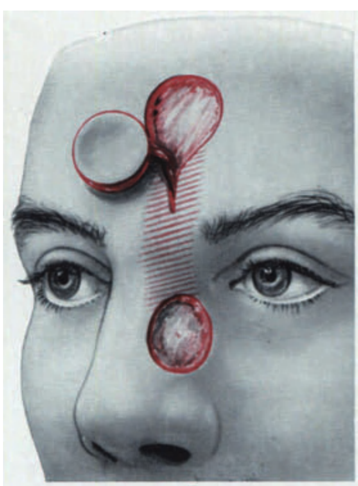
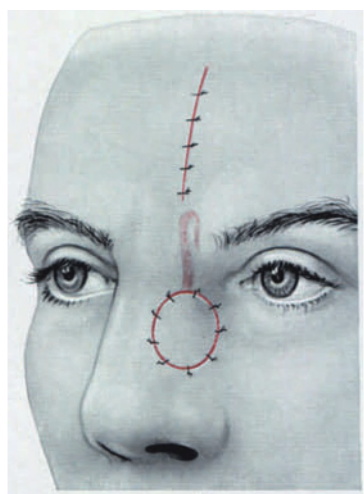


Fig. 468. Schematic representation of the facial arteries which must be taken into consideration when flaps are made



a



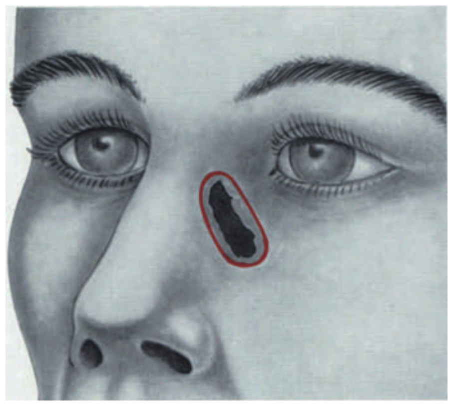
b

Figs. 469a and b. Island-artery flap of MONKS from the forehead for covering a partial nasal defect. a Cutting the island and formation of the arterial pedicle; skin is undermined (red hatching). b Suturing the island artery flap which has been moved into place subcutaneously

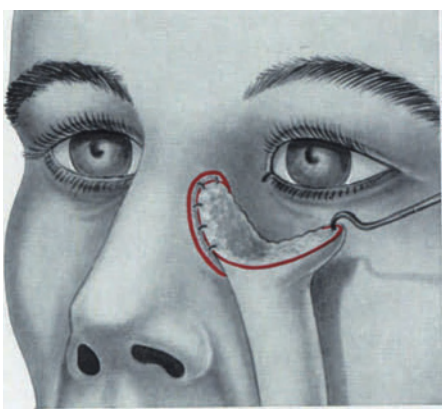
flaps can be transferred to the nasal dorsum more easily if the bridge of skin on the glabella is split rather than undermined. The torsion of the wide, connective tissue pedicle containing the artery can be controlled more carefully because of this, and there is greater assurance of nourishment of the flap. —

The defect on the forehead is closed by approximation, by means of free full-thickness skin grafts, or by means of rotation flaps. — One can use these island flaps from the forehead for external covering of superficial defects (Fig. 469) as well as for formation of inner lining in perforating defects.

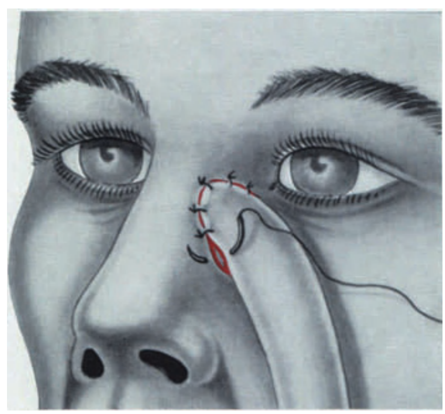
KERNAHAN and LITTLEWOOD cover larger lateral nasal defects by means of *island flaps from the temple*, whose pedicle is based in front of the ear and contains



a



b



c

Figs. 470a—c. Closure of a perforating defect on the lateral nasal wall by means of a tubed pedicle flap. a The rim of the defect is prepared. b Inner lining partially sutured. With protection of the nourishing fat of the pedicle, one carefully cuts around the circumference of the island of skin which has been sutured in place before suturing the rest of the flap. c External covering

the temporal artery. The subcutaneous tunnel which is formed in the region of the cheek and which brings the pedicle to the nose is formed as in the procedure of HEANLEY.

8. Reconstruction with tubed pedicle flaps

Partial defects in the upper part of the nose can also be covered by means of tubed pedicle flaps. As in alar reconstruction (see p. 358) one can use *flaps from the forehead, neck, upper thoracic region, from the arm, and distant flaps.*

In case of large perforating nasal defects one usually resorts to a tubed pedicle flap. The *inner lining* of the nasal cavity at the defect must also be provided.

Fig. 471. Perforation of the lateral nasal wall; correction with a tubed pedicle flap from the forehead lined with a THIERSCH graft, according to SANVENERO-ROSSELLI

Figs. 472a—g. Reconstruction of large perforating defects on the lateral nasal wall which also affect the cheek. a Abdomino-brachial sandwich flap in place at the donor site

This is done by means of splitting the end of the flap (Fig. 470b), or else the end of the flap is provided with a THIERSCH graft which fits into the mucosa defect, as described by SANVENERO-ROSSELLI in 1931 (Fig. 471). TAMERIN described another solution in 1951. He sutures the tubed pedicle flap so that the

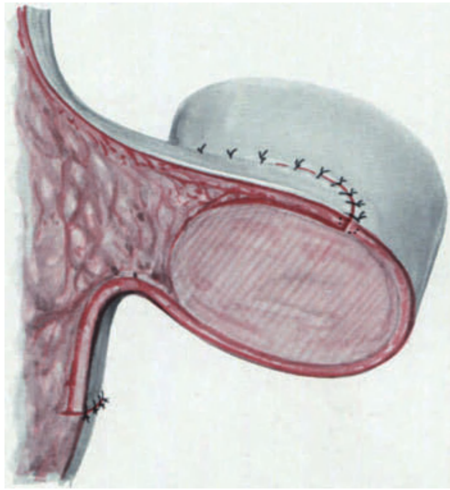


Fig. 472b. Abdomino-brachial sandwich flap at the donor site, cross-section

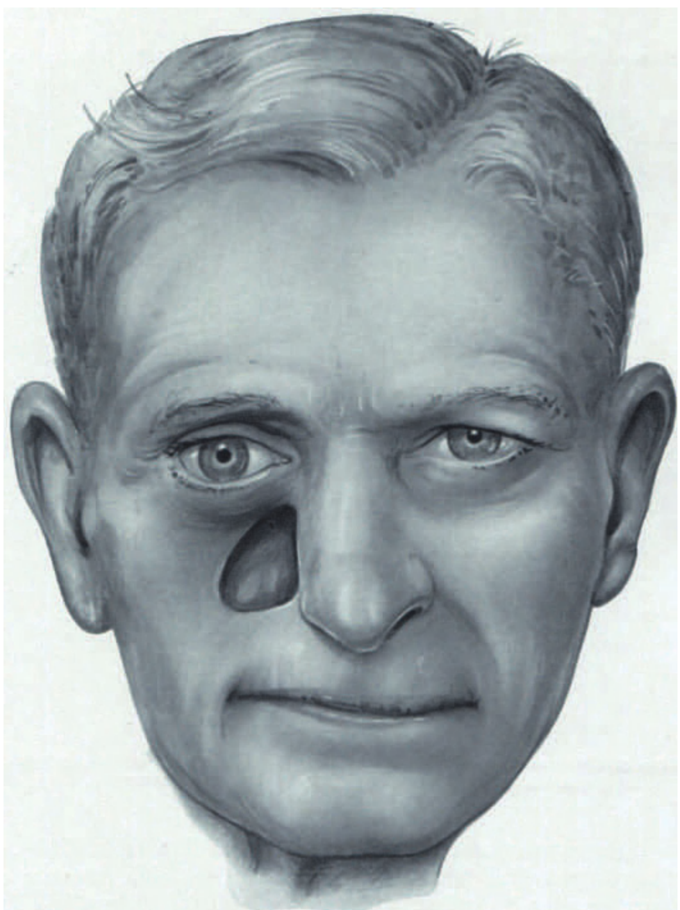


Fig. 472c. Defect on the nose and cheek to be closed

skin surface faces inward and the THIERSCH part outward. The tubed pedicle flap from the neck must be turned daily for 3 weeks for an increasingly longer time each day so that the flap becomes accustomed to the torsion necessary for suturing to the nose. The free end of the flap is covered with a THIERSCH graft, which shrinks somewhat during the course of the three weeks used in delay. For transfer of the flap to the defect in the region of the frontal process of the maxilla, the ala must be severed at its lateral attachment. The skin surface

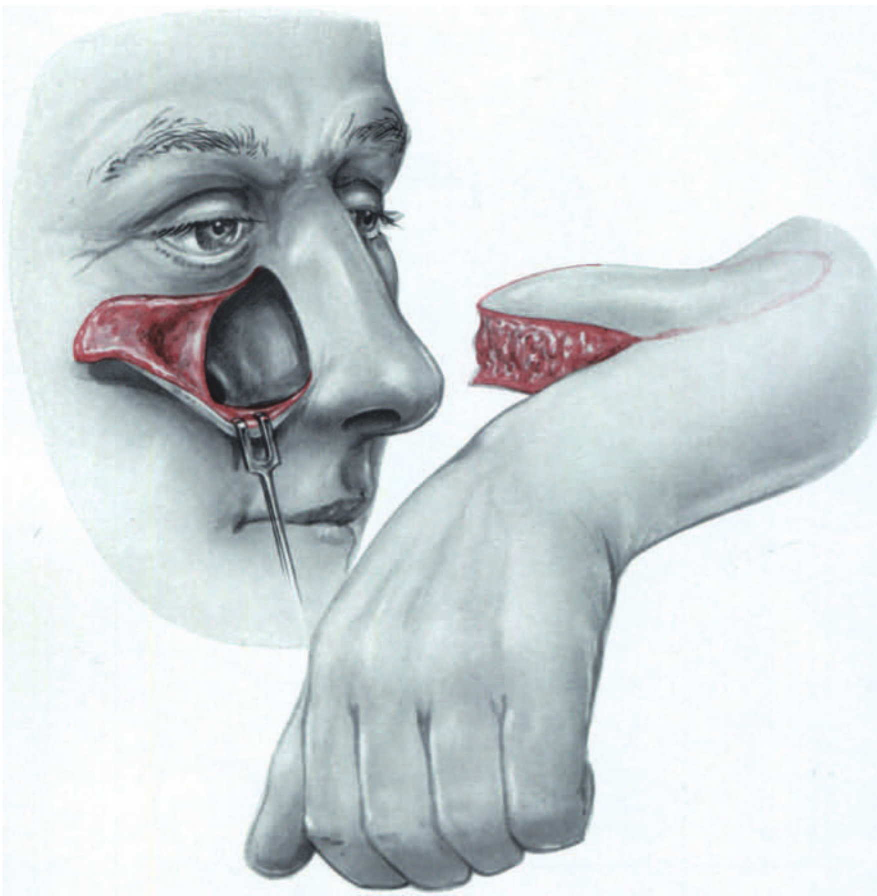


Fig. 472d. Preparation of the edge of the flap and the rim of the defect

of the end of the flap is sutured into the mucosa defect so that the somewhat shrunken THIERSCH graft faces outward. The skin is mobilized on all sides of the defect so that it can be placed beyond the fat of the tubed pedicle flap on the circular border of the THIERSCH graft. After healing of the end of the flap on the defect, the pedicle can be detached and the ala sutured in place. After a few more stages the THIERSCH graft facing outward can be eliminated completely and replaced by approximation of the surrounding tissue. — The method with temporary use of a THIERSCH graft seems too time-consuming and complicated, since the tubed pedicle flap practically always provides sufficient epithelium for inner and outer covering. If a THIERSCH graft should be used, then it is more suitable for inner lining, as mentioned above. — That which has been said on pages 362, 372 and 390 concerning additional scars on the face applies also for tubed pedicle flaps from the forehead.

9. Reconstruction with abdomino-brachial sandwich flap

For *larger defects on the lateral nasal slopes which also affect the cheeks*, we (R. Meyer) have recommended a kind of flap worked out by Jayes for other facial defects. It is derived principally from a technique by Converse. This is

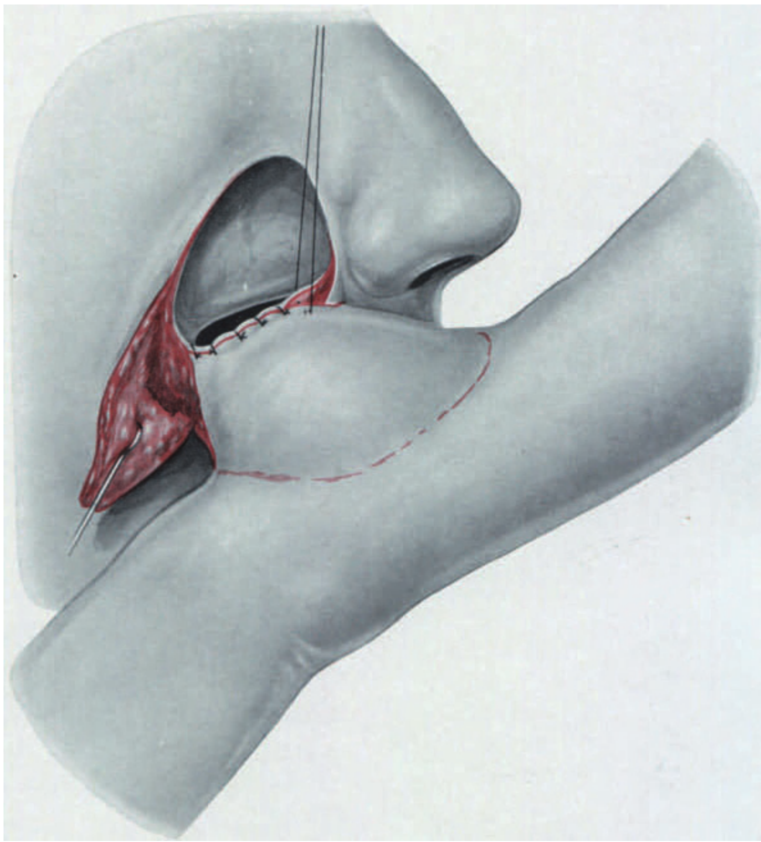


Fig. 472e. Suturing the inner lining. Abdominal skin is sutured in the region of the lower border of the mucosa defect

an abdomino-brachial sandwich flap composed of abdominal skin, fat and forearm skin. It can be formed considerably thicker than the usual tubed pedicle flap, especially in case of thin patients, and has the advantage of better circulation and stiffer consistency. On the abdomen a skin flap about 6 cm wide and about 10 cm long is cut together with the entire underlying fat layer down to the muscle fascia. It is placed together like a sandwich with skin flap of about the same size from the inner side of the forearm and is sutured laterally (Figs. 472a and b). In a second stage after 2 to 3 weeks the flap is detached from the abdomen and transferred to the perforating nasal-cheek defect (Fig. 472d). The end severed at the abdomen is sutured to the lower border of the defect so that the hairless, whitish abdominal skin forms the inner lining of the lateral nasal wall and possibly also of the oral vestibule, while the skin from the lower arm faces outward

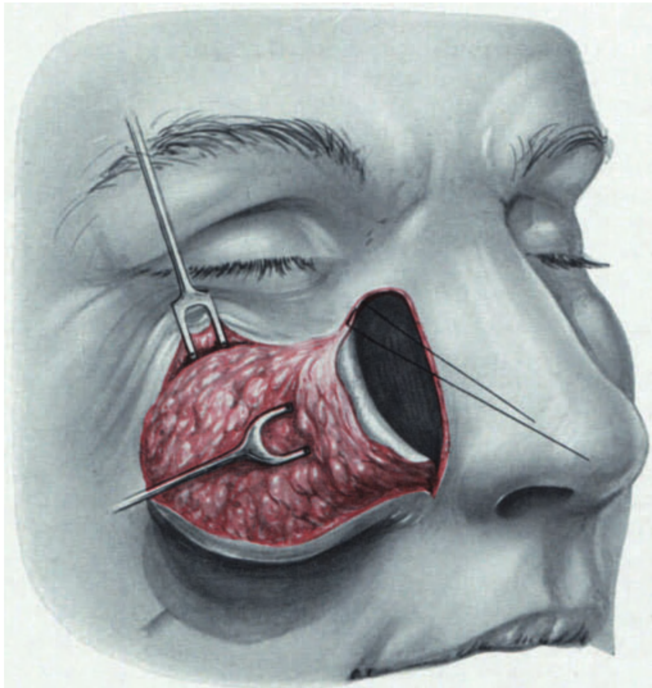


Fig. 472f. Flap detached from the arm; abdominal skin is sutured for complete closure of the mucosa defect; the rest of the flap with the skin from the forearm is used for external covering

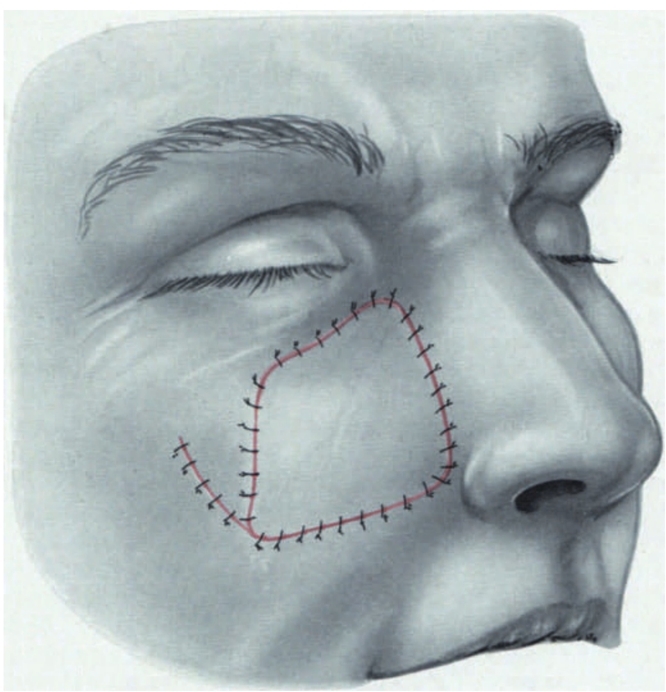


Fig. 472g. Situation after treatment of the defect

(Fig. 472e). After healing of the flap on the defect border, i.e. after another 2 to 4 weeks, it can also be detached from the arm and completely sutured in place (Figs. 472f and g). The abdominal skin is sutured on all sides to the nasal mucosa of the antronasal wall. The fat layer fills the maxillary sinus where the mucous membrane has been removed and the somewhat pigmented forearm skin is sutured on all sides into the external skin defect. In case of perforation of the oral vestibule toward the nasal defect, the oral mucosa can first be sutured during a fourth stage to the lower part of the abdominal skin which has already healed in the nose.

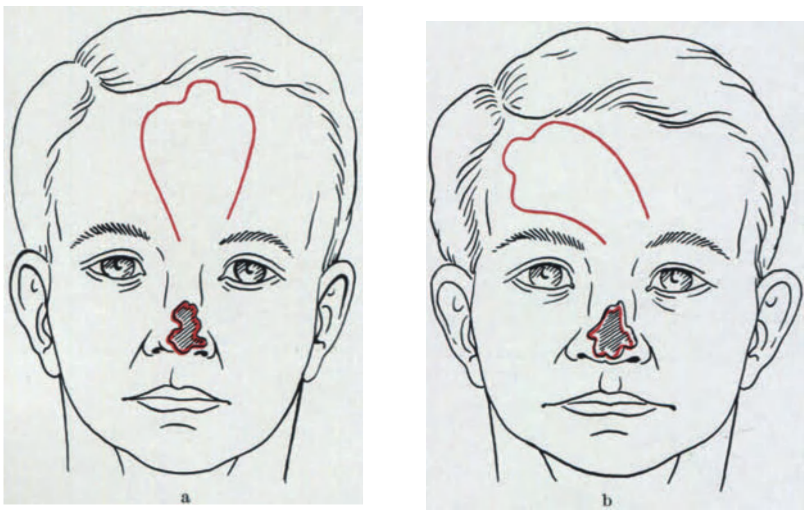
VI. Partial and complete nasal reconstructive surgery

1. Indian method and Italian method

It seems rather certain that plastic surgery of the nose, especially reconstructive surgery, was already developed 3000—4000 years ago in India. At that time this field of surgery is said to have been highly developed, since amputations among prisoners of war at that time were extremely gruesome. In addition it is supposed to have been the custom in some sections to amputate the nose of criminals. Naturally all of these amputees needed to have these sometimes defamatory deformities eliminadet after their release. Thus the Indian method of the fore-head flap was developed. A long time passed before this method became known in the western world. Only in 1450 did BRANCA in Catania introduce it into Europe, and more than a century later rhinoplasty flourished under TAGLIACOZZI (1546—1599). He was also the one who further developed reconstruction from the arm, the "Italian method". BRANCA's son is said to have first performed this. At times performance of plastic surgery of the nose was prevented by church and state. The Indian method was taken up again in 1815 by CARPUE. Reconstructive surgery of the nose was advanced considerably by the methods of VON GRAEFE, REINER, and DIEFFENBACH in Germany; DELPECH, DUPUYTREN, LISFRANC, and SERRE in France; and of WORN in America. Before World War I, J. JOSEPH, among numerous other authors, made a name for himself in this field. In and after World War I rhinoplasty was developed considerably by surgeons like GILLIES, JOSEPH, LEXER, and others. In 1931 JOSEPH, now already a nose and face specialist, recorded his experiences in the well-known treatise.

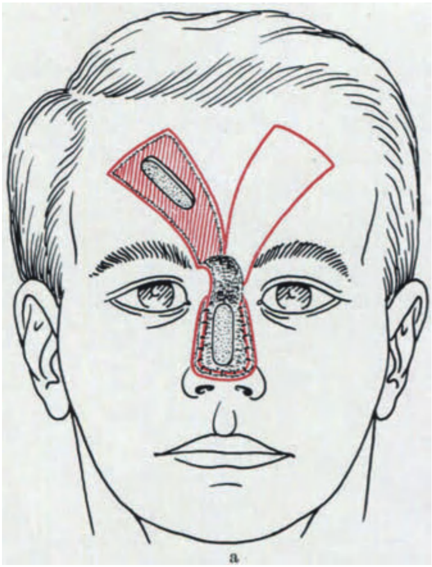
Thus until World War I reconstruction of the nose using forehead and arm flaps was common. During and after this war reconstruction with tubed pedicle flaps (distant flaps and migrating flaps) was developed by GILLIES, GANZER, and FILATOW and became a further very advantageous method. The method was perfected between the two World Wars and during and after World War II. Today numerous modifications and combinations with old methods are still devised. GILLIES, who published his method in 1917, helped essentially to create the breakthrough of this important method. GANZER published his method and its use on March 30, 1917 at the "Berliner laryngologische Gesellschaft" (Berlin Laryngological Society). He also used the "strand-flap", as he first called it, again and again in his plastic surgery. According to his article he used the flap first for covering a palatal defect. Since a long time is necessary for such operations, one can guess that even he used this method as early as 1916. The three authors lived in different countries separated by the war. The rapidly increasing number of wounded forced them to provide a better method of reconstruction. Thus the same new idea was conceived in three different places after the flap technique used by DIEFFENBACH in 1845 had been forgotten. In the era of sulfonamide and antibiotics reconstructive nasal surgery increased greatly because the complications could be reduced to a minimum.

The *Indian method* (Figs. 473a and b) forms the basis for the sometimes rather complicated *forehead flap methods* mentioned above. The Indian method originally consisted of a median flap. Franz König's (1886) used a forehead skin flap including bony tissue from the frontal bone as support (Figs. 474a and b). This is based in part on the previous work of Ollier and v. Langenbeck, who used neighboring bone as support. The method stimulated further modifications like those of von Hacker (Figs. 475a and b), Schimmelbusch (Figs. 476a to c), and Lexer I (Figs. 477a—c). The procedure in each of these methods can be seen best in the illustrations and their legends. — Epithelialization of the

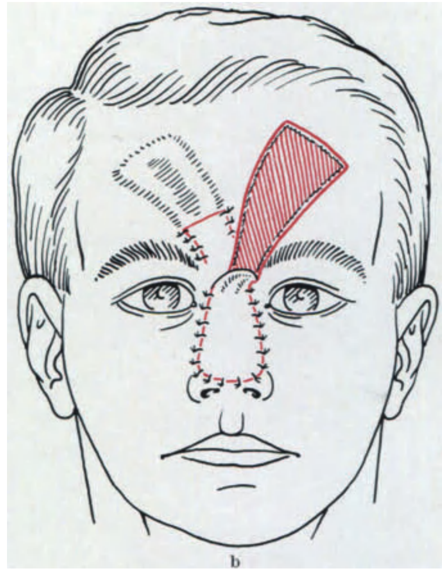


Figs. 473a and b. Forehead flap according to the Indian method. a Original median flap. b Oblique flap in case of low forehead (Nélaton)

frontal bone with a Thiersch graft is not reliable. This later caused surgeons to make the support out of other material, since the donor site on the forehead was difficult to cover. — In 1896 Israel transferred the principle of a bony support to the Italian (brachial) method by raising a bone graft from the ulna with the skin flap. — A further modification is the transplanting of autogenous cartilage (Nélaton) and of bone from the tibia (Foramitti and Lexer) under the forehead flap. Lexer modified his first method in this way by transplantation of a tibia graft (Figs. 478a—c). He later recommended this principle of bone grafting for formation of the structures for the Italian method as well. In order to guarantee certain functioning of the nose, flaps from the neighboring areas were used for inner lining. In this way methods were developed like those by Thiersch, von Hacker, and Joseph with lateral nasolabial flaps and cephalic border flaps (Figs. 479a—d), by Joseph using modified sutured nasolabial flaps (Figs. 480a and b), and by Payr and Volkmann. In the procedure of Payr both nasolabial flaps are reinforced with cartilage and are sutured medially to form a septum, and inner lining of the nose. Gillies combines this procedure with the likewise cartilage-reinforced glabellar flap of Volkmann. In extending and perfecting the Israel and Lexer method of 1914 Fritz Koenig pre-formed the nose on the forearm in the brachial method by means of reinforcement with a cross-shaped bone-cartilage graft from the sternum and by epithelization of

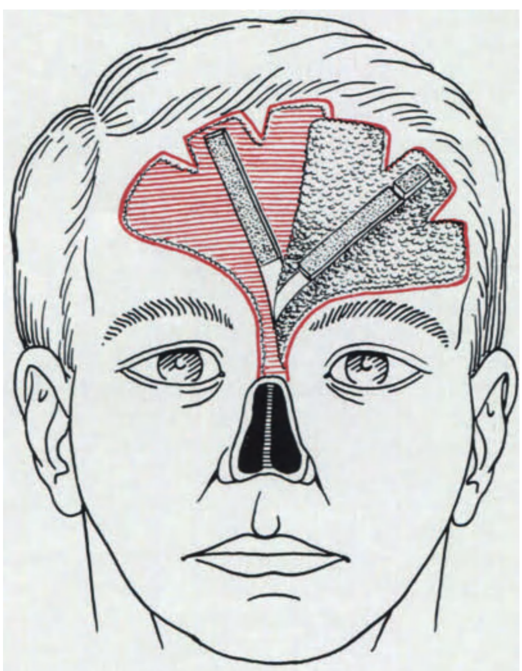


a



b

Figs. 474a and b. Reconstruction of the nose by FRANZ KÖNIG (1886). Formation of two forehead flaps of which one is used for inner lining of the nose and which has a bone and periosteum graft attached to it for support. The other flap is used for external covering. a The inner lining with the bone support is sutured. The flap for external covering is cut. b External covering sutured. After the flap with the bone graft has healed, the base of the flap is replaced on the donor site which has been covered with a THIERSCH graft; the base of this flap is shown in the illustration. Similarly, the base of the flap used for external covering is replaced as far as possible on its donor site (red hatching)



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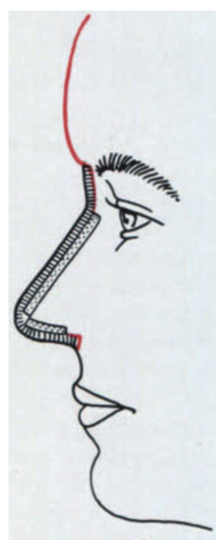
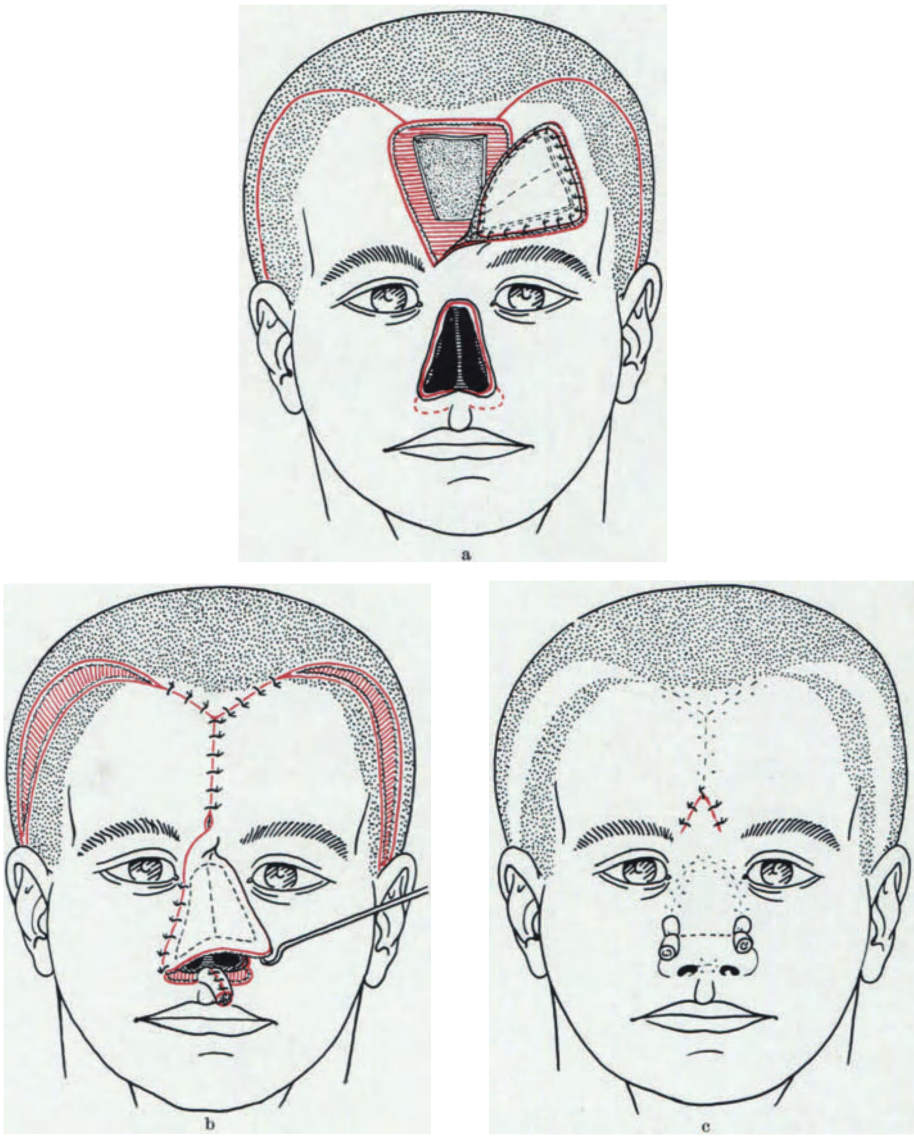


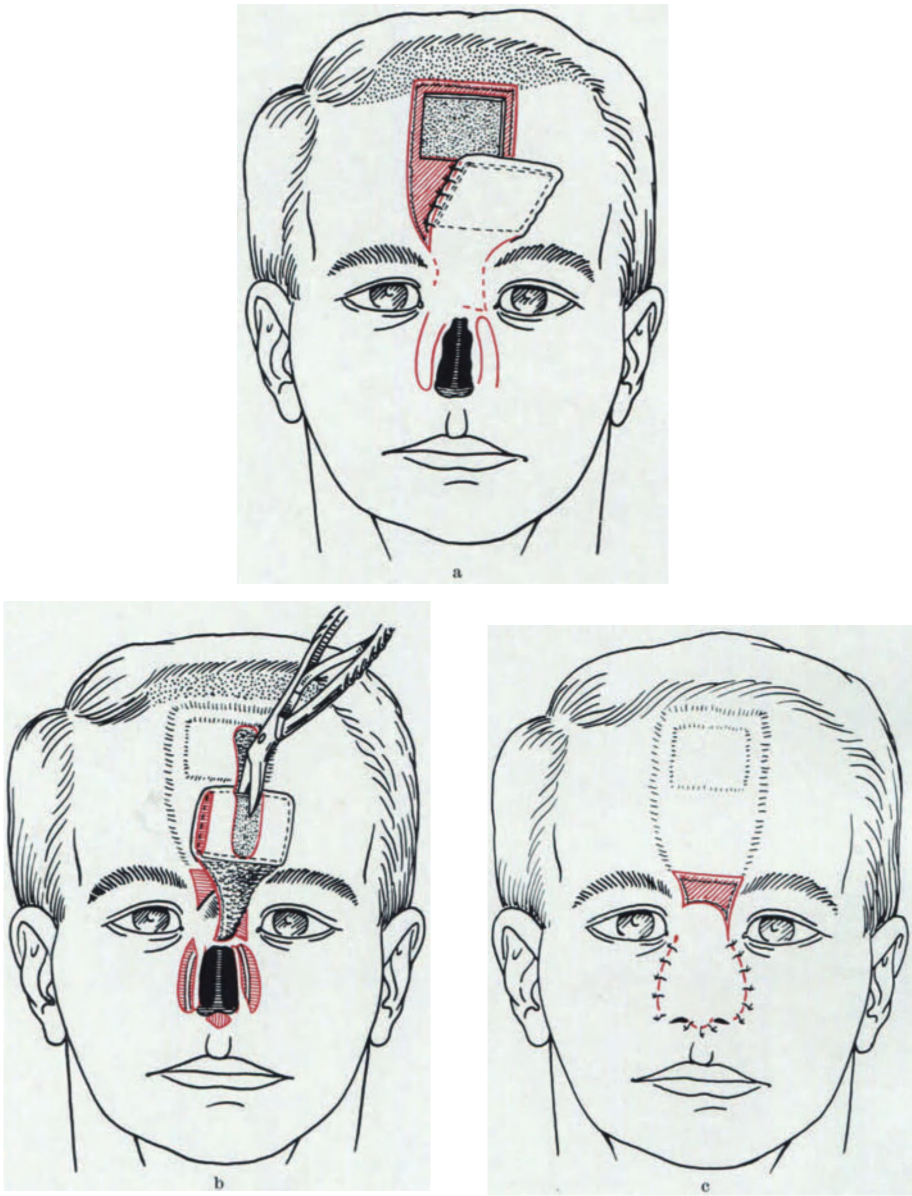
b

Figs. 475a and b. Reconstruction of the nose by VON HACKER (1887). Formation of a unilateral oblique forehead flap including a bone graft for formation of the external nasal covering with a profile support. The raw surface is partially covered with a THIERSCH graft for inner lining. a The flap is raised together with its bony support (donor site shown by red hatching). Cross-section of the profile support with the sutured flap, side view the columella (Figs. 482a and b). In later modifications of the Indian method such bone and cartilage grafts were inserted afterward in the loose, soft-structure complex after it had healed. This was done first by JOSEPH with bone grafts



Figs. 476a—c. Reconstruction of the nose by SCHIMMELBUSCH (1895). Formation of a median forehea d fla including a large bony plate which is split in midline to form a large nasal roof. a Raising the skin and cartilag flap, on which a THIERSCH graft is sutured; lateral rotation flaps for closure of the donor site are shown by solid red line; bilateral flaps on the upper lip for forming the columella are shown by dotted red line. b Suturing the flap into the nasal defect; columella formed, donor site covered with bilateral temporal rotation flaps. Red hatching indicates covering with a THIERSCH graft. c Base of the flap replaced on the forehead; through-and-through fixation suture in the lower third of the nose to shape the nasal tip

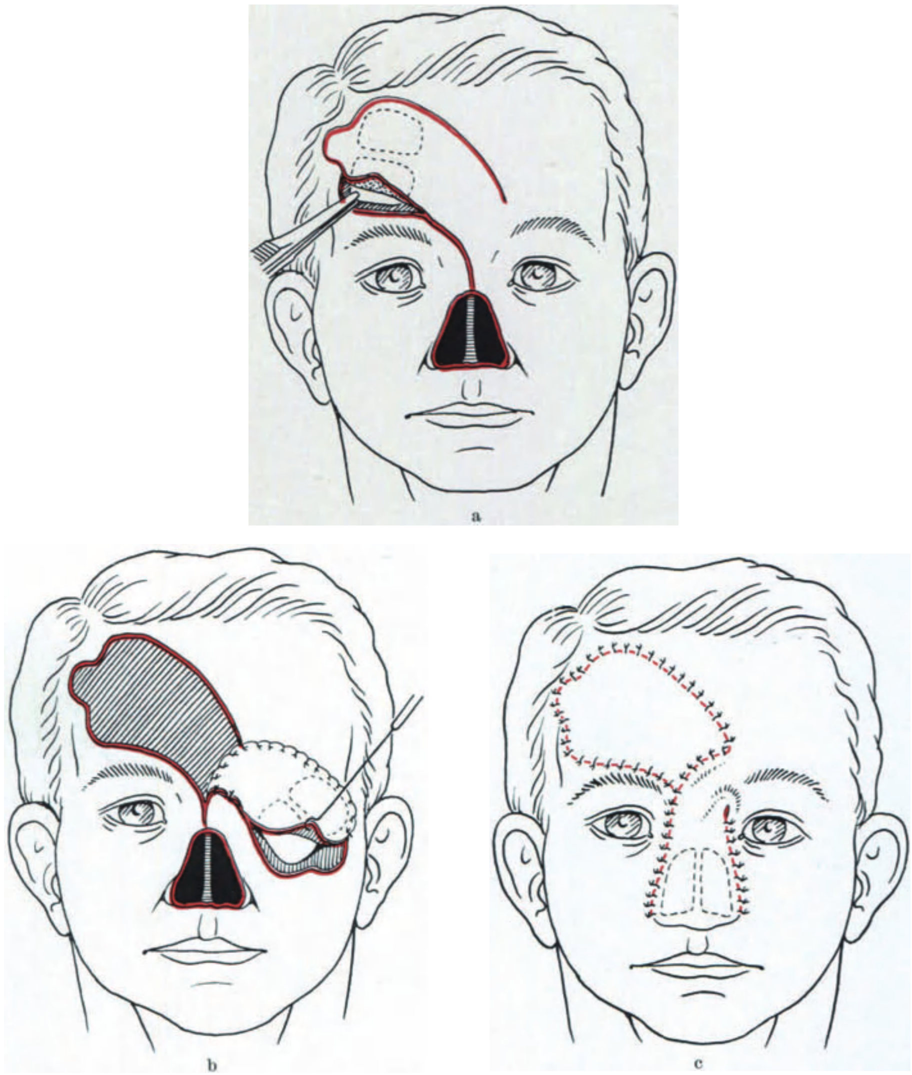
and later by SCHUCHARDT using three rib cartilage grafts (Figs. 483a and b). But LEXER already pointed out the disadvantage of soft tissue shrinkage and decubitis in cases of later graft insertion.



Figs. 477a—c. Reconstruction of the nose according to LEXER I. Formation of a forehead flap including a wide bony plate in the uppermost part. First the flap is folded over once for epithelization of the bony plate on both sides; after this it is swung onto the nose. a Flap of skin and bone folded over and sutured. Dotted red line shows extension of the pedicle; solid red lines on either side of the piriform aperture show excision of scars and formation of flaps to enlarge the nasal opening. b A small flap is raised and the bony plate is split in midline; the small flap is intended for formation of the columella; the host sites are prepared. c Forehead flap swung into place and sutured; donor site on the forehead covered with a THIERSCH graft. Red hatching shows area for replacement of the base of the flap on the forehead

If the incision of the flap in the Indian method extends into the scalp, then hair must be removed from this part of the scalp. This is done best by means of careful removal of the hair follicles, which according to RÉTHI appear as small black spots when seen from the wound surface.

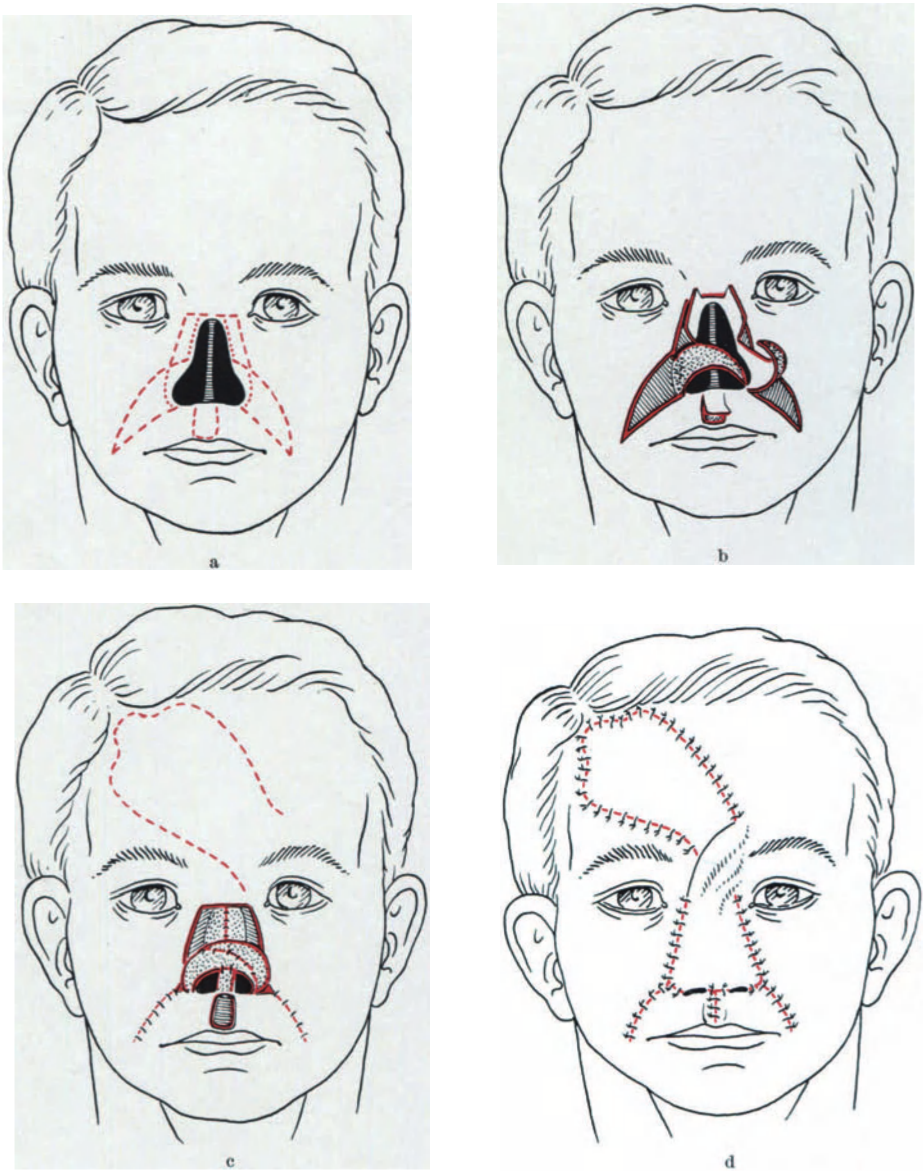
Sometimes it is impossible to form the inner lining of the partial or complete nasal defect using flaps from the neighboring areas like the nasolabial fold and the upper lip as by THIERSCH, VON HACKER, PAYR, JOSEPH, etc. (Figs. 479—481). In such a case the middle part of the forehead flap must be lined with a THIERSCH



Figs. 478a—c. Reconstruction of the nose according to LEXER II. Formation of an oblique forehead flap which is reinforced with two bone grafts from the tibia and whose raw surface is covered with a THIERSCH graft. a Insertion of tibia grafts. b Covering the raw surface with a THIERSCH graft. c Situation after rotating and suturing the flap; donor site covered with full-thickness skin graft

graft before the flap is transferred to the nose. The lateral third of the forehead flap needs to lining, because it is folded under itself to form and fully epithelialize the alae and columella.

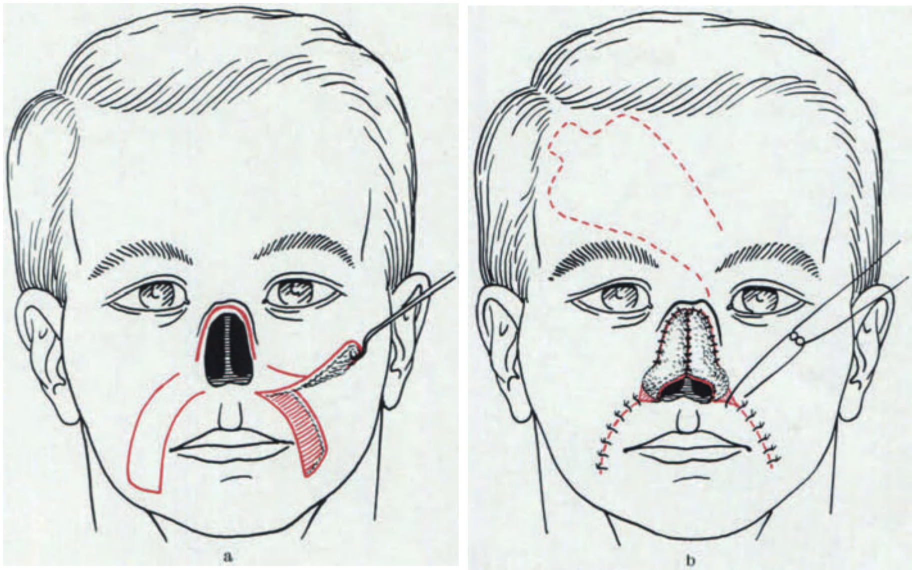
In certain cases of partial nasal defects the median forehead flap of KAZANJIAN (Fig. 394) can still be used. But then it can only be used for inner lining of the nose. Its raw surface which faces outward must be covered with an intermediate



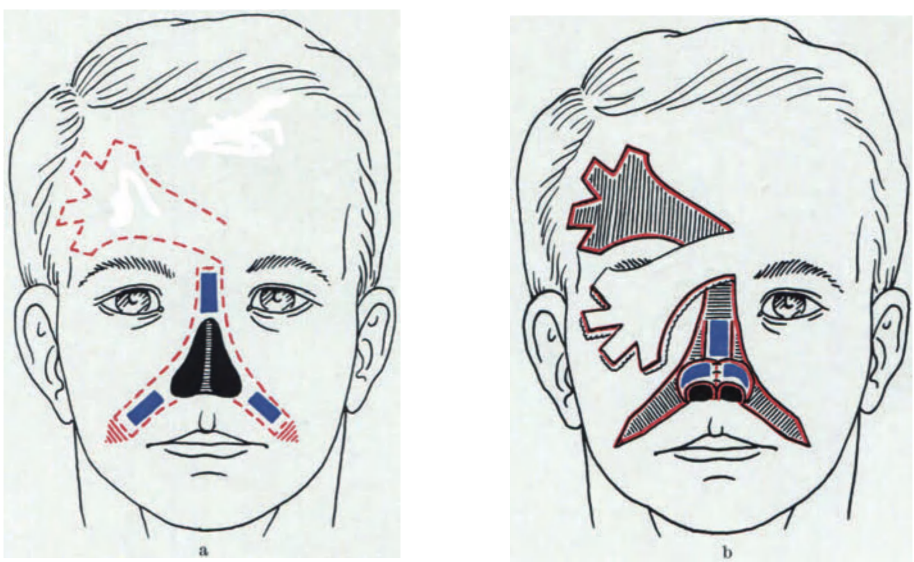
a b c d

Figs. 479a—d. Reconstruction of the nose in the combined method of THIERSCH, VON HACKER, and JOSEPH. Inner lining is formed by turning the nasolabial folds and the lateral borders of the defect inward bilaterally; external covering by means of the oblique forehead flap. a Incision of the neighboring skin in the region of the columella and the bony and cartilaginous nose. b Skin flaps are swung inward. c The flaps are sutured; closure of the nasolabial donor sites; formation of a forehead flap for external covering. d Forehead flap sutured and donor site on the forehead covered

thickness dermatome flap, or better, if the circulation is good enough, with a full-thickness skin graft. The forehead flap should of course be cut wider than 1.5 to 2 cm. The donor site can not be closed by approximation. As KAZANJIAN also described, it must be closed by rotation of two large flaps based at the temple. The flaps should include the entire forehead skin.



Figs. 480a and b. Reconstruction of the nose by JOSEPH. Inner lining using bilateral nasolabial flaps; external covering by means of an oblique forehead flap. a Solid red lines outline the nasolabial flaps; flap is swung onto the nose. Donor site shown by red hatching. Rim of the defect is prepared. b Nasolabial flap sutured bilaterally for inner lining; donor site sutured; forehead flap for external covering shown by dotted red line

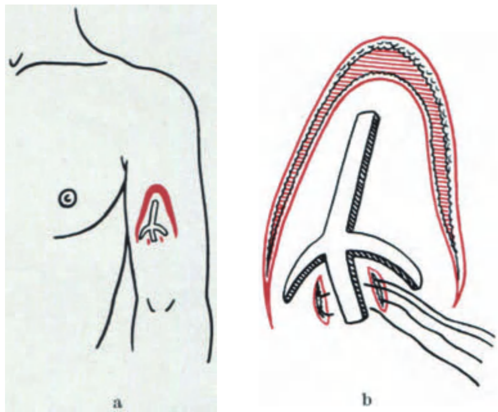


Figs. 481a and b. Reconstruction of the nose by GILLIES. Formation of a glabellar flap reinforced with cartilage (VOLKMANN), as well as two similarly cartilage-reinforced nasolabial flaps (PAYR) for inner lining and formation of the septum. External covering by means of an appropriately shaped oblique forehead flap. The donor site of the small glabellar flap is covered by the base of the forehead flap. a Cartilage (blue) is used to reinforce the three flaps on the rim of the defect; dotted red line on forehead shows forehead flaps. The two nasolabial folds (PAYR) and the glabellar flap (VOLKMANN) are folded over together with the cartilage for inner lining. The forehead flap is raised

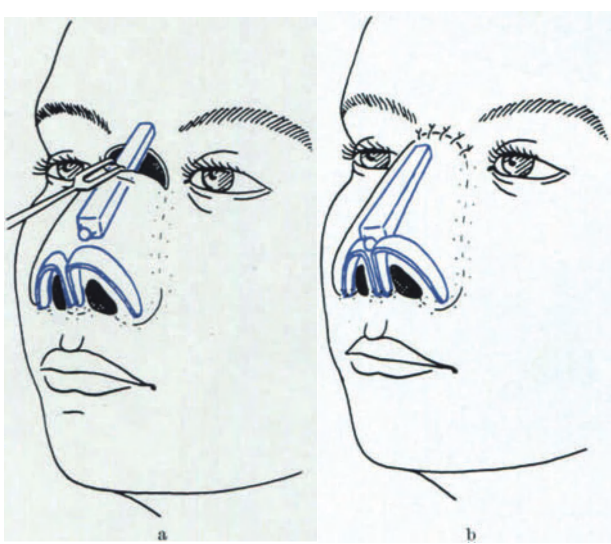
GILLIES developed a hook-shaped forehead flap which extends into the scalp. Because of the paramedian position of the base, the flap has good arterial supply. This flap is known as the "up and down" flap (Fig. 484).

A similar flap was described by KILNER (Fig. 485). Its supply is also provided by the frontal branch of the superficial temporal artery and by the medial and lateral frontal arteries.

The fronto-temporal sickle flap described by NEW is a further development of this type of flap. It is not sufficient for partial and complete nasal recon-



Figs. 482a and b. Pre-shaping the nasal structure on the arm, according to FRITZ KÖNIG. A cross-shaped graft of bone and cartilage from the middle of the sternum is transplanted to a point under the skin on the arm above the biceps. a Bone-cartilage graft in place on the arm. b Preparation of the columella by enclosing the columellar part of the structure in skin. Red hatching shows the raw surface after incising the skin to change the source of nourishment of the graft



Figs. 483a and b. Two-stage formation of the cartilaginous structure by SCHUCHARDT in complete reconstruction of the nose. a Insertion of a cartilage graft into the dorsum. The bilateral replacement of the lower lateral cartilage was made one month before. b Completed cartilage reinforcement

struction. This flap is discussed in the chapter on alar reconstruction (Figs. 434 and 435).

On the other hand DURHAM and GILLIES described an extended version of NEW's sickle flap. The distal end of the flap is prepared for construction of the lower soft structures by means of a double fold (Fig. 486c). The idea of shaping a nasal tip with alae and columella from the distal end of a flap was put into use over 100 years ago by PETRALI. This way of pre-shaping the nose was taken up by SERRE in 1842, BLAIR, SMITH, and SANVENERO-ROSSELLI.

GONZALES-ULLOA and STEVENS use a similarly large sickle flap whose distal end extends as far as the superciliary arch. An L-shaped plastic support is implanted later in the nose reconstructed with this flap. After such a large flap has been removed and the donor area covered, the forehead is considerably deformed. These authors recommend removing the remaining forehead skin and covering the entire forehead with a dermatome graft ("regional aesthetic unit"). Naturally, in spite of the stiffness, such treatment of the forehead is cosmetically better than unilateral treatment of the donor site, which results in asymmetry of movement. Still we would like to do completely without deformity of the fore-

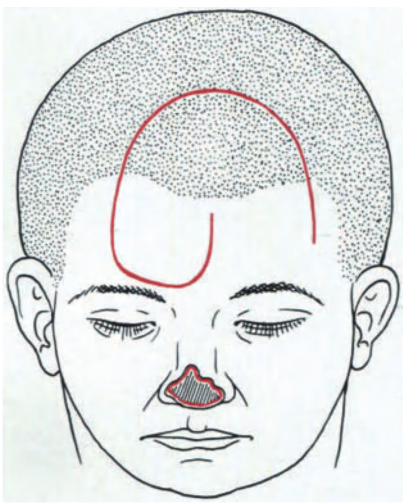


Fig. 484

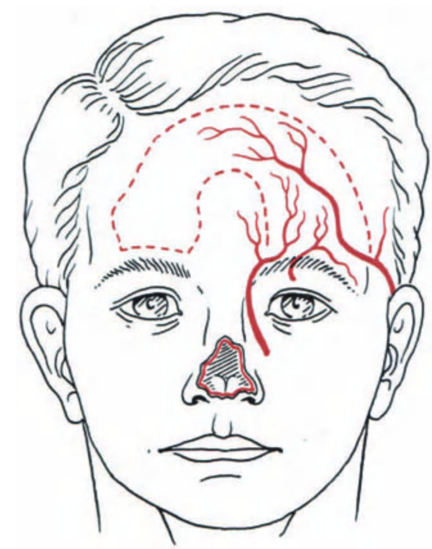


Fig. 485

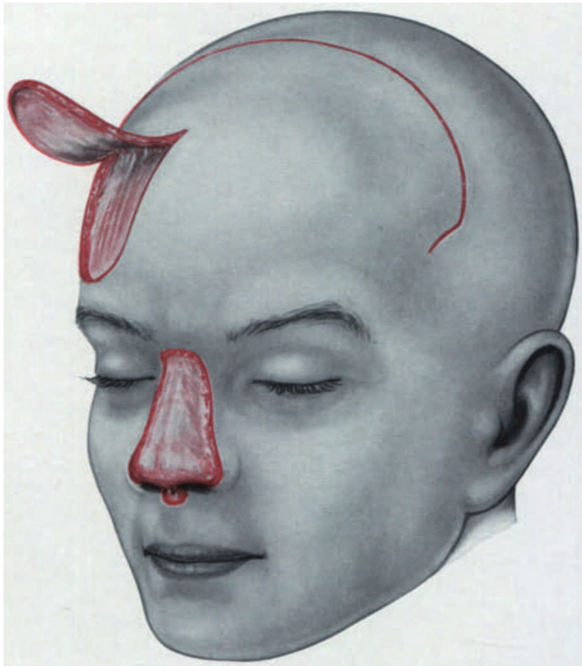
Fig. 484. "Up and down" flap of GILLIES

Fig. 485. Curved forehead flap of KILNER with arterial nourishment of the base from the Aa. frontales medialis and lateralis and the frontal branch of the A. temporalis superficialis

head when such large areas of skin are necessary for replacement of the nose. We recommend using distant flaps.

MILLARD uses a wide flap based over the ear with the distal end on the contralateral part of the forehead just above the arch of the eyebrow. After lining it with a THIERSCH graft, he swings it into the defect. In order to avoid unattractive cicatricious contraction of the suture line where the nose merges with the cheek, he lets the edges of the flap overlap the rim of the defect and immobilizes the flap only with mattress sutures. Another stage operation is for shaping the wound borders. In our experience, however, this smooth transition can be obtained immediately by means of shaping the corresponding defect and flap borders with diagonal contact surfaces.

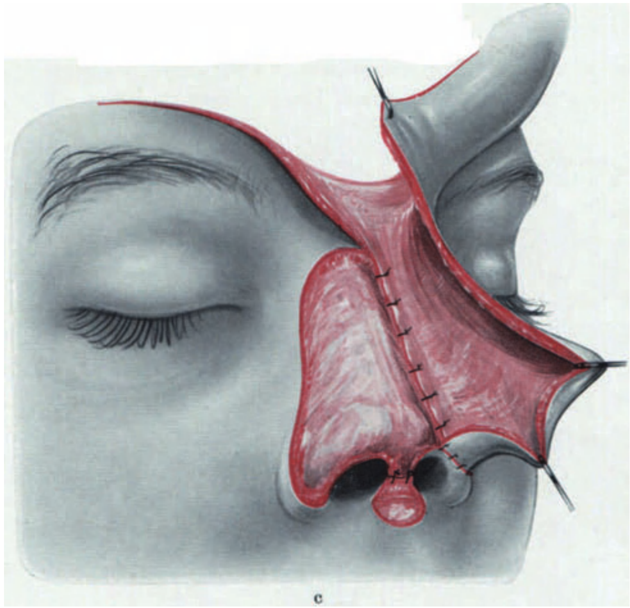
In 1942 CONVERSE worked out a new flap method called the "scalping forehead flap." This flap has the advantage that the incisions lie behind the hairline. The only skin without hair included in the flap comes from one of the angles of the forehead. A curved incision is made from one side of the forehead over the scalp to the temple on the other side. In the angle of the forehead the flap is cut in midline as far as the hairline and raised without the M. frontalis and the



a

b

Figs. 486a—e. "Scalping forehead flaps" by CONVERSE. a A skin flap free of hair which fits the defect is raised without forehead muscles from the angle of the forehead. Extensive base of the flap on the forehead and in the scalp is shown. b The flap including the base is raised. The forehead muscle and the Galea aponeurotica are also raised along the base



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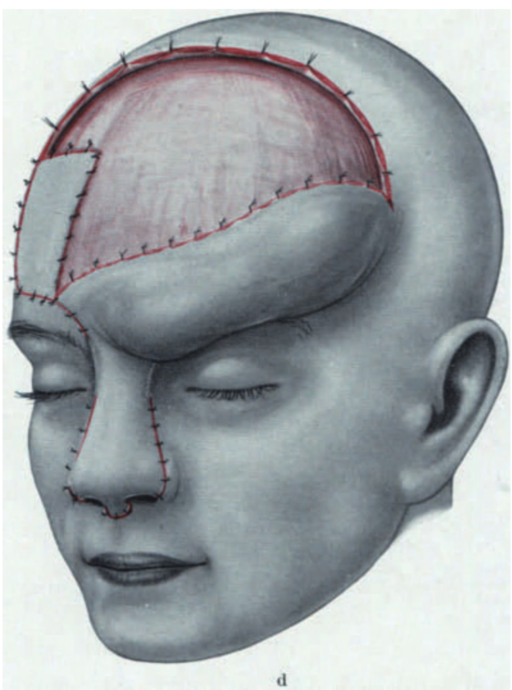

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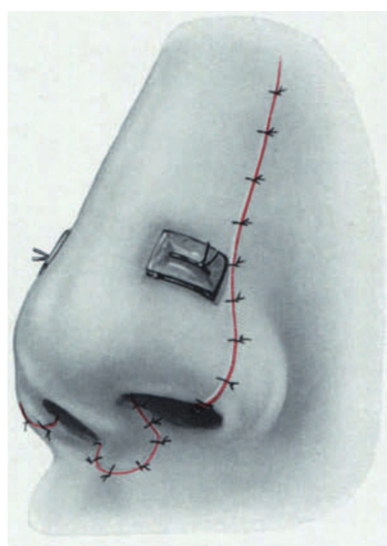
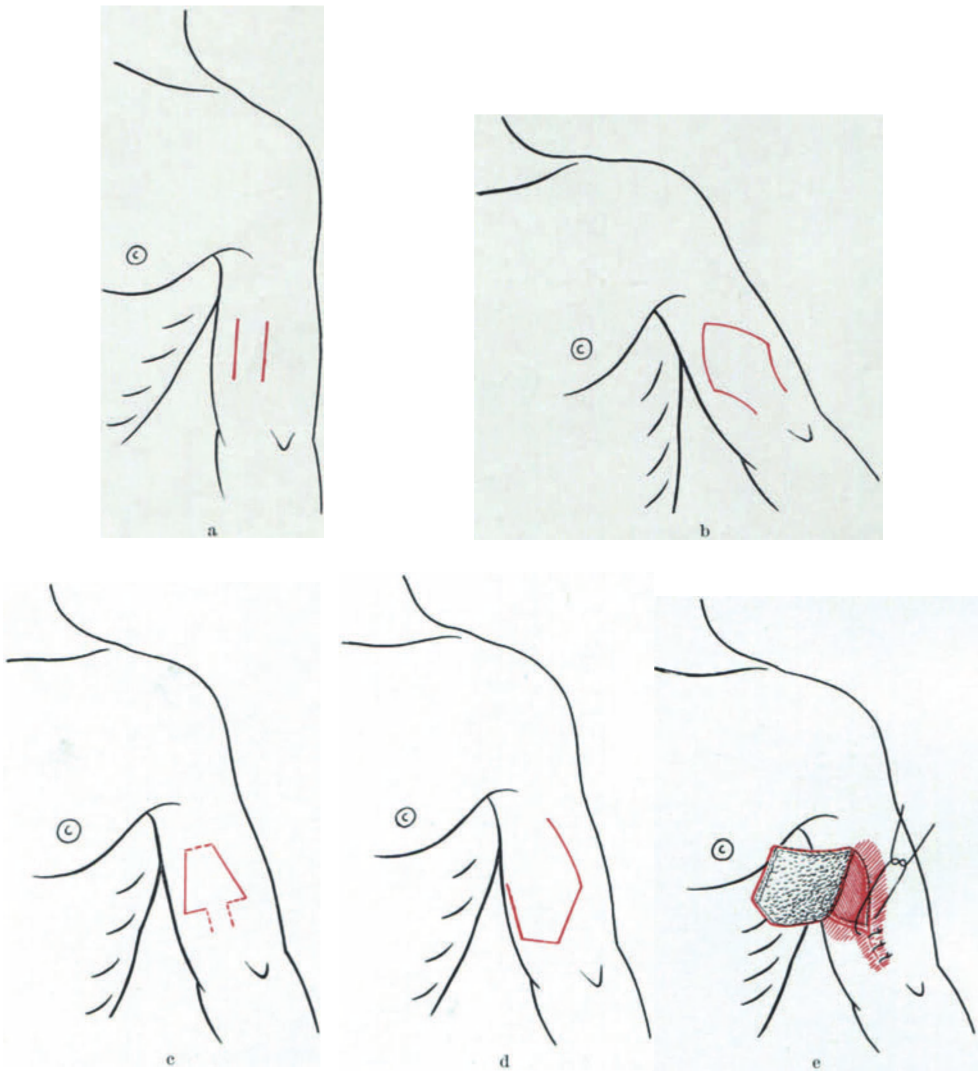


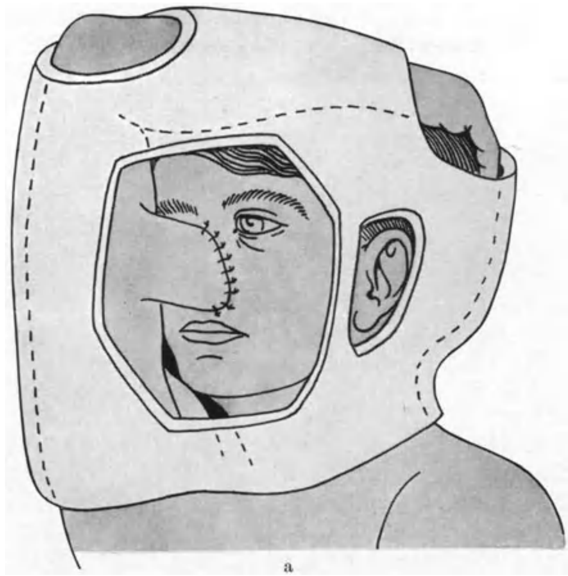
e

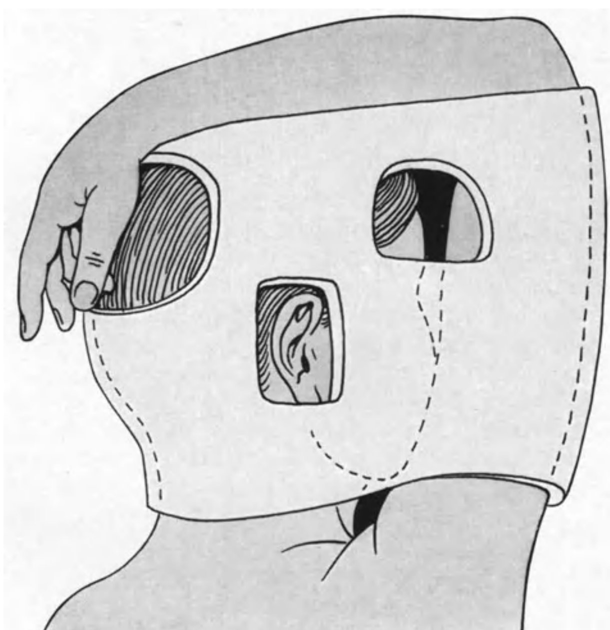
Figs. 486c—e. c The inner part of the columellar base is formed from a small philtrum flap and is sutured to the inner lining on the nasal tip. External covering is provided by rolling the scalping flap onto the defect and by turning the lower border inward. Duplication of the border forms the alae and the columella. d Scalping flap sutured into the defect. The angle of the forehead is covered with a full-thickness skin graft; the rest of the donor site is temporarily covered with a THIERSCH graft. After healing the nasal part of the flap, the major part of the donor site is later covered by replacement of the base of the flap on the forehead. e To assure the narrow shape of the nose and dorsum, through-and-through wire sutures tied over metal plates are applied at the level of the upper lateral cartilages galea aponeurotica. The rest of the wide-based flap includes almost all of the forehead skin and an area of the scalp. This is raised together with the frontal muscle and the galea aponeurotica so that the periosteum of the skull is exposed. The flap is rolled downward in a large fold so that the part without hair covers



Figs. 487a—e. Shape of the flap on the arm for the Italian (brachial) method. a By TAGLIACOZZI (pedicled below); b by VON GRAEFE (pedicled below); c by DIEFFENBACH (pedicled below); d by JOSEPH (pedicled above or laterally). e Closure of the donor site on the arm after raising the flap of JOSEPH. Skin area shown with red hatching is to be undermined

the nasal defect. It is sutured to the nose on both sides and on the columella. This is sufficient for formation of the alae bilaterally or a part of the alae and of the columella. To immobilize the flap the upper border of the fold in the flap is sutured to the periosteum on the forehead. A full-thickness skin graft is sutured onto the angle of the forehead where the smooth skin for the nose was removed. The remaining donor area of the scalp is only covered with a





Figs. 488a and b. Fixation of the arm in the Italian method by means of a plaster cast. a Oblique front view; elbow, wrist, auricle and face are exposed. b Oblique rear view, with modification of the plaster cast; the forearm is not included in the cast

THIERSCH graft. The THIERSCH graft can be immobilized with single sutures. The pressure dressing should cover only the two grafts. The full-thickness skin graft for the angle of the forehead is taken from the retroauricular region. — To form the columella, a tab of skin from the upper region of the philtrum is raised, turned toward the nose and is sutured to the border of the inner lining of the nasal vestibules at the nasal tip. The end of the flap which has been folded into a columella is swung into place over this and is sutured (Fig. 486). — After 2 to 3 weeks the wide pedicle can be detached at the hairline in the region of the glabella and the entire fold of the flap replaced on the forehead and smoothed. The THIERSCH graft which covers the periosteum must be removed beforehand. The full-thickness skin graft remains intact (Fig. 486d).

All of these older and more recent forehead flaps are unsuitable for men with little hair, since with increasing baldness the scars become quite visible. Nor are they recommended for women with a relatively smooth forehead, since the more or less extensive scars are generally found to be very disturbing.

In the course of time various flap shapes have been developed, like those of TAGLIACOZZI, VON GRAEFE, DIEFFENBACH, JOSEPH, and others, for formation of the soft tissue covering in the Italian (brachial) method (Figs. 487a—e). The flap on the upper arm pedicled above, i.e. toward the shoulder, has the least disturbance in circulation since venous drainage is better than in a flap with its base below. Fixation of the arm for the Italian method was formerly accomplished by a plaster cast, as it is done today (Figs. 488a and b). Other fixation dressings are also possible. Additional information concerning this can be found on p. 379. LABAT, PETRALI and FILATOV introduced a differentiated shaping of the alae and the columella at the end of the flap for the Indian method as well as for the Italian method. BLAIR and SMITH gave more precise measurements of the end of the flap for the duplication of the lower soft structures of the nose on the forehead and arm.

2. Reconstruction with visor or bridge flaps

MOURE, DUFOURMENTEL, Sr., and PERTHES devised a bridge flap or *visor flap from the forehead.* It is pedicled with its base on both temples and is swung downward onto the nose like a visor.

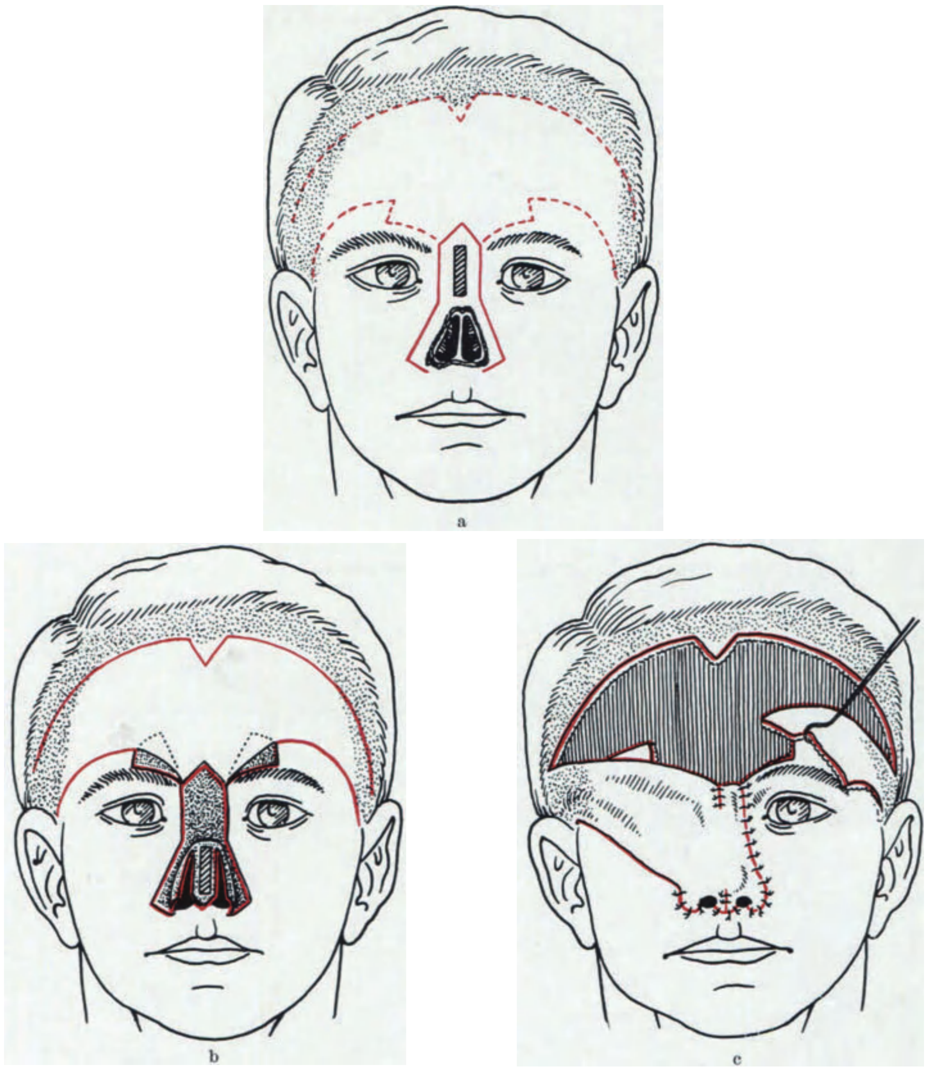
LEXER formed *lateral visor flaps from the scalp and the forehead* for replacement surgery of the nose and upper lip. The sickle flap of NEW mentioned above for alar reconstruction (Figs. 434 and 435) is similar to this flap of LEXER.

For inner lining, GILLIES used the glabellar flap reinforced with cartilage or bone after VOLKMANN (1874) and two lateral border flaps. In addition he modified the bridge flap along its lower border so that double epithelization of the alae results (Fig. 489). With an extended flap of SCHUCHARDT (Fig. 490) reconstruction of the upper lip is possible at the same time if the latter is also absent (Fig. 487). — A large number of patients, especially younger patients with relatively tight skin, will be annoyed by the extensive, unavoidable scars in the region of the forehead resulting from these procedures and will prefer other reconstructive procedures. GILLIES showed how, in an opposite manner, a bridge flap from the chest and neck region can be swung upward to the nose (Fig. 491). The lateral pedicles of the flap can be tubed.

3. Reconstruction with fronto-temporal flaps

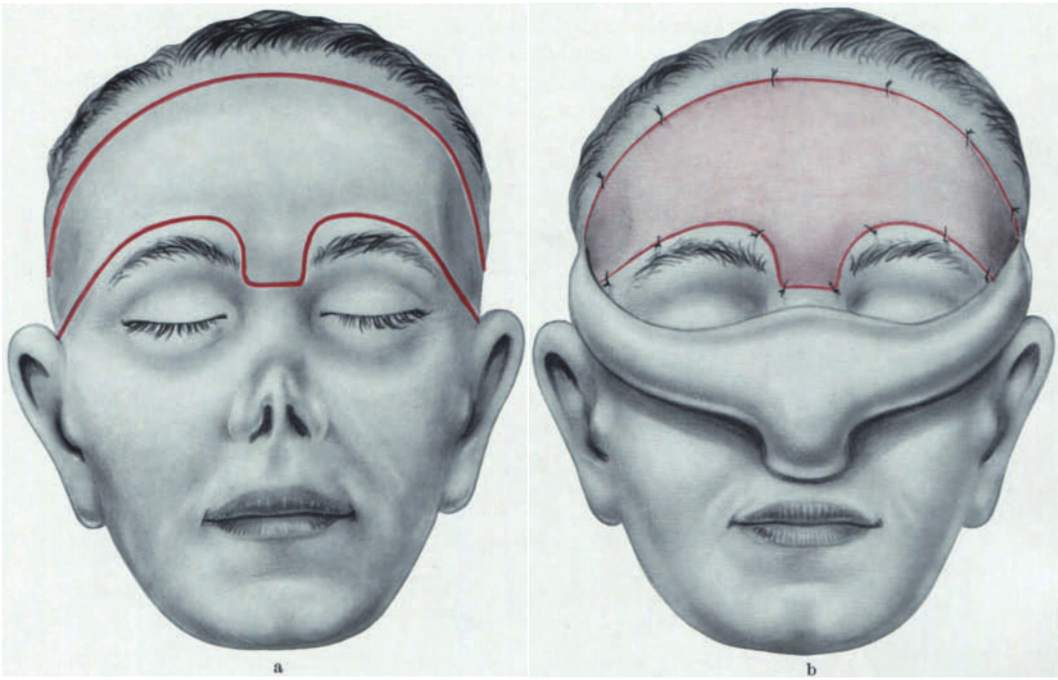
The method of SCHMID with fronto-temporal flaps is described in the chapter on alar and tip reconstruction (see pp. 362, 372). It can also be used in partial and complete reconstruction of the nose.

We (R. MEYER) have used a modification of the SCHMID technique for partial and complete nasal defects as well. First a pedicle flap is formed bilaterally above the eyebrow and on the temple, as described on pp. 362 and 372. Before these flaps are transferred to the nose, a tubed pedicle flap from the neck or a migrating flap is placed like a bridge over the defect, with one base on the glabella and the other at the upper end of the philtrum. The dorsum and the

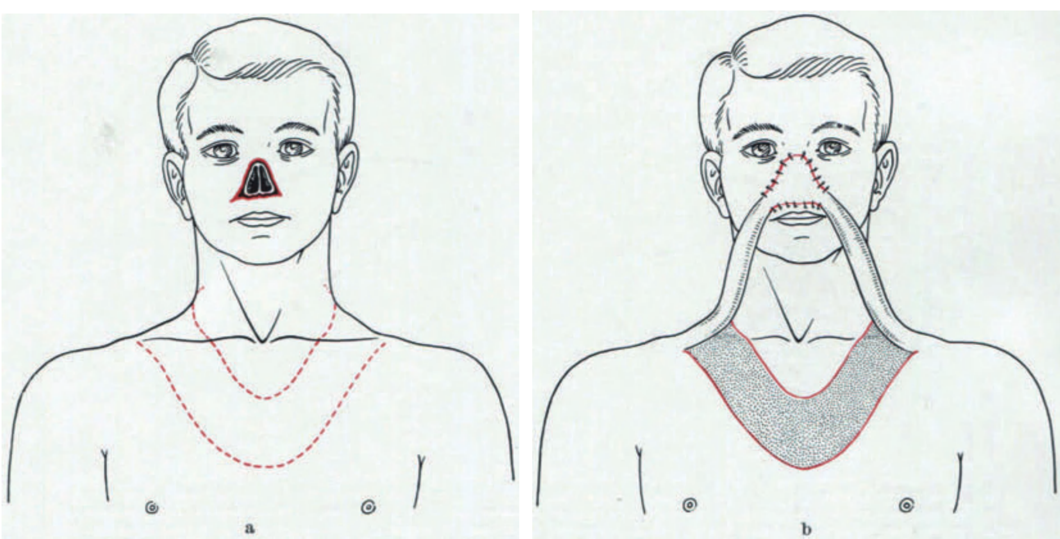


Figs. 489a—c. Reconstruction of the nose using a bridge flap from the forehead by MOURE-GILLIES. a Dotted red line outlines the flap. Solid red line outlines the small flap for inner lining (glabellar flap by VOLKMANN). b Inner lining swung into place. Dotted black line shows where skin is folded under for duplication of the alae. c Bridge flap for external covering of the nose swung into place and sutured. The pedicles of the fronto-temporal flaps are detached one after the other following healing of the central part of the nose and are replaced on the forehead. Illustration shows situation during replacement of one bridge flap on the forehead

columella are formed by means of this tubed pedicle flap. Small tabs can be swung from the columellar part of the flap onto the remainder of the septum which still may be present. An L-shaped cartilage or bone graft can be implanted in this arch of soft tissue for support. This graft can be obtained from rib cartilage. SCHMID also transplanted bone from the scapula. A plate reinforced by grafts



Figs. 490a and b. Modification of the Gillies visor-flap by SCHUCHARDT



Figs. 491a and b. Total reconstruction of the nose using a pectoral bridge flap by GILLIES. a Dotted red line outlines the flap on the neck and chest. b The flap is transferred to the nasal defect; inner lining can be provided by a THIERSCH graft

now exists in midline onto which the lateral walls of the nose and the alae can be placed. The two fronto-temporal flaps are swung down and sutured. The shoe-shaped parts of the flaps become the alae, and the bridge flaps lateral walls. The reinforced tubed pedicle flap is slitted laterally on both sides to accept the pedicles from the superciliary region. The lateral walls are sutured to the cheek skin. Only after they have healed can the pedicle be detached bilaterally at the inner end of the eyebrow and be used for shaping the nasal wall. — In another modification of the procedure of SCHMID an L-shaped cartilage graft can be implanted under the forehead skin above the eyebrow and the temple and this be joined with the boot-shaped flap before it is swung downward. This method is most suitable for reconstructive surgery of asymmetrical nasal defects if a larger portion of the ala and lateral wall is still present.

4. Reconstruction with tubed pedicle flaps

Much skin and fat tissue is available for complete reconstruction of the nose with the use of tubed pedicle flaps. In reconstructive surgery of the nose additional scars in the neighboring area should be avoided if possible. For this reason this type of flap has become more important recently, even if forming the flap requires more time. In this method as well, as when using other methods already mentioned bone or cartilage can be inserted for support of the nose while forming the flap at another part of the body or after the flap has healed in the defect. Enough material can be provided easily with the tubed pedicle flap. One must wait for this material to contract. If the supporting graft is implanted after this contracture, the danger of decubitis and penetration of the grafts is considerably reduced. As described below, well-chosen scars on the skin and in the fat of the flap retain the shape of the newly constructed nose even without supporting implants. But it must be emphasized that sometimes a certain flattening and depression of the structure with obstruction of the nasal airway can occur years later due to loosening and slackening of the scars.

The disadvantage of the tubed pedicle flap is, on one hand, that it is technically more difficult to form it well than to form other types of flaps. On the other hand, the difference in pigmentation between the flap and the neighboring facial skin is sometimes considerable for a while. Certain discoloration of the facial skin, especially towards red, as is found in case of cardio-vascular disease, can contraindicate the use of a tubed pedicle flap, since the grafted nasal skin would be much lighter in color. Experience shows that slight differences in pigmentation equalize themselves after several months under the influence of light.

The tubed pedicle flaps used most frequently for nasal reconstruction are the *acromio-clavicular and the acromio-pectoral flaps*, which are formed with a medial or lateral base. Acromio-pectoral and sternal tubed pedicle flaps are migrated best with the lateral submental or the medial submental region as an intermediate base (Fig. 492). Supraclavicular flaps take three stages to reach the nose. For infraclavicular flaps, three to four are necessary. The stages for supraclavicular flaps are as follows: first, formation of the tubed pedicle flap; second, transfer of one end of the flap onto the defect; third, detachment of the base. CRAWFORD recommends a longer route of migration for tubed pedicle flaps from the clavicular region. He has the flap migrate first to the submandibular region. Then he sutures it to the oral mucosa of the lower lip near the angle of the mouth, and in the fourth stage swings it onto the nasal defect. He, too, does this at about 3-week intervals. The number of stages for flaps outside the minimal radius is proportionately larger according to the distance. If thinner tubed pedicle flaps are necessary, they can be taken from the neck. In the case of lean patients a *medial or lateral abdominal* flap must be formed. This is transferred to the region of the defect by migrating across the chest or by means of attachment to the forearm. The flaps should have good blood circulation before they are transferred. Temporary ligation is used as a circulation test. Before being transferred, the flap should have no edema or discoloration. Skin infections must not be present. The patient must be in good health and the skin not infected.

Before final healing of the flap in the defect one must see that the patients do not subject the migrating flap to strong sunlight. Patients sometimes do this to create pigmentation of this skin. Sunburn on the tubed pedicle flap leads to

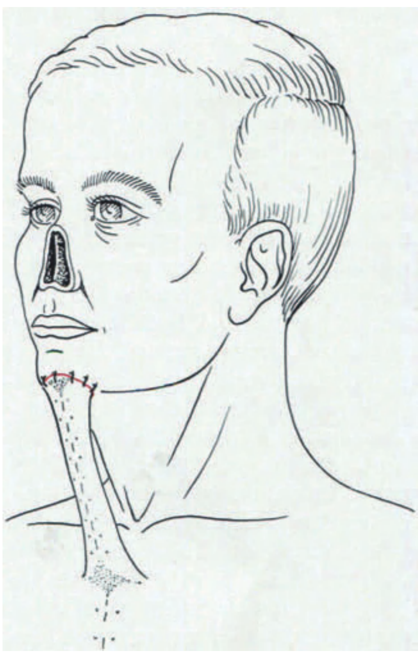


Fig. 492

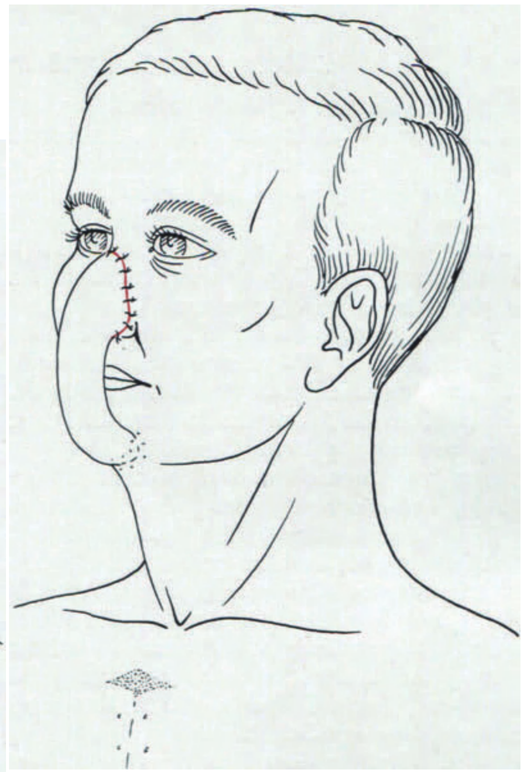


Fig. 493

Fig. 492. Complete replacement of the nose using a tubed pedicle flap. Tubed pedicle flap sutured on the chin

Fig. 493. Complete replacement of the nose using a tubed pedicle flap. The flap formed on the sternum has been migrated to an intermediate base on the chin and is sutured into the defect

circulatory disturbances which can cause necroses of part of the flap, since the circular tube of skin can stretch no further. If bluish discoloration has occurred after such nutritional disturbances in the flap, one should not hesitate to open the flap by incision on the longitudinal scar to relieve the tension and thus to improve the circulation. These measures can also be necessary in case of erysipelas.

Before *suturing* the tubed pedicle flap *in the region of the nose*, one must make sure that the base nourishing the flap is formed high enough in the region of the neck, proportional to the length of the flap. If the patients do not want a scar on the neck, then one must place the last base of the flap just above the clavicula and use a relatively long tubed pedicle flap in order to reach the level of the glabella. In some cases there is no other way but to have the patient incline his head forward until the flap has healed on the glabella and the nose. In such cases it is better to transfer the flap to the nose by means of the forearm. Sometimes the *skin is badly damaged by radiation* or there are *scars caused by lupus or tumor surgery*. In such cases it has proved useful, even with sufficiently long tubed pedicle flaps, to place the patients in a plaster cast in a fairly comfortable body position so that the head can not be moved against the base of the tubed pedicle flap. This has the advantage that the prepared border of the defect, which has a relatively poor tendency to heal in such cases, can more surely accept the end of the tubed pedicle flap when attached. With the patient sleeping there is no disturbance of the healing of the freshly joined tissues by means of a sharp pull due to movement of the head. These security measures considerably speed healing as well as the nourishment provided by the face. The patients become accustomed to this position after 1 to 2 days and can be kept under sedation additionally. Since the tubed pedicle flap can be rather heavy, tension on the sutures in the region of the nose should be relieved by means of adhesive tape straps for the first 8 to 10 days. The adhesive tape must not be attached to the plaster. Otherwise, if the plaster cast should slip, the base of the tubed pedicle flap would be pulled so strongly against the body that the periphery of the end of the flap would become necrotic. Before the raw surfaces on the nose are prepared for attachment of the tubed pedicle flap, one must consider to what extent existing tissue can be used in the reconstruction. Complete defects (Fig. 494) which extend as far as the glabella must obtain their *inner lining* completely from the tubed pedicle flap. If the bony structure is intact, it is recommended to fold over the skin still covering this region for inner lining and to form the entire dorsum from the tubed pedicle flap (Fig. 495). This way one avoids a scar across the nose which might possibly contract, between two types of skin with different pigmentation. In cases of lupus and heavily irradiated carcinomas one should not use the skin overlying the bony part of the nose for inner lining, since nutritional disturbances are unpredictable and skin necroses can cause later stenosis of the nasal passages. In this partial reconstruction surgery as well, the nasal dorsum should be formed from one piece of skin along its entire length as far as the glabella.

The end of the tubed pedicle flap can be sutured into the defect in one of two ways. In more favorable cases a glabellar flap can be folded downward (Figs. 496—498), or, if this flap can not be formed, one can prepare the border of the defect as extensively as possible (Fig. 498). If the inner lining is formed completely from the tubed pedicle flap, one must be absolutely sure that the corresponding trimmed raw surface on the tubed pedicle flap fits precisely into the defect without tension. — If for any reason a tubed pedicle flap should tear away from the border of the defect, one should try to suture the flap in place again immediately. In the case of restless patients one applies an appropriate fixation dressing between the head and chest.

If the flap has healed at its new base after 12 to 14 days, then one begins carefully to *shut off the circulation at the base*, by temporary ligation an hour at a time, in the region of the neck or forearm. In case of heavily irradiated tissue in the region of the nose, one must wait about a week longer before detaching the base. The new base on the nose may be too small for the tubed pedicle flap. Then one extends the base toward the alae, as long as the original base on the neck is still present. One must consider that when the flap has been severed at the neck and one continues the plastic operation, the flap loses a part of its nourishing base because of the operation. In addition the edema surrounding the new wound disturbs the base of the flap even more. Because of the swollen condition of the skin, strong internal pressure is created in this kind of flap.

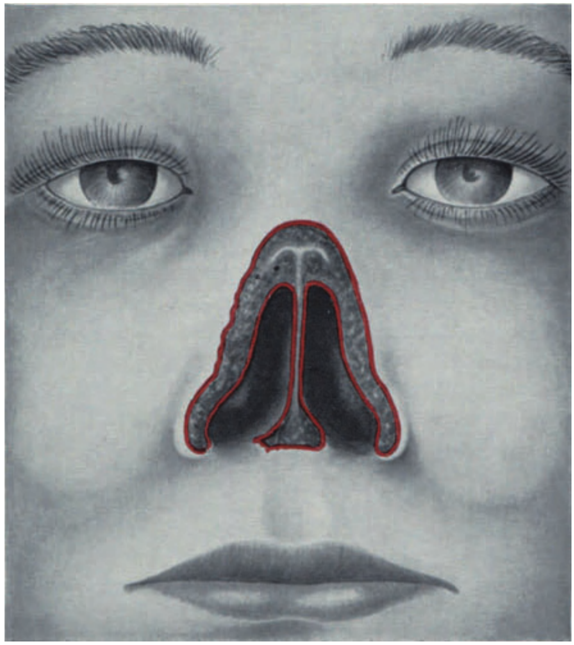


Fig. 494. Complete defect of the nose (following avulsion). Replacement by means of a tubed pedicle flap is intended

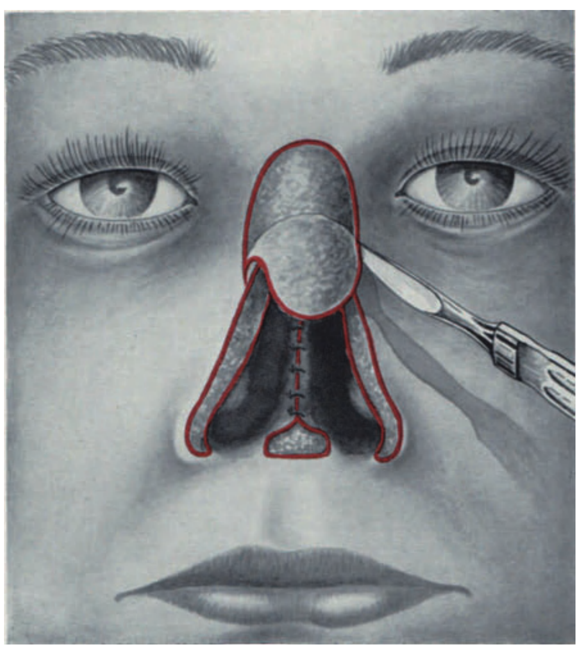


Fig. 495. A glabellar flap is folded down into the nasal cavity for partial replacement of the inner lining. Small areas must be resected in the region of the base of the glabellar flap bilaterally

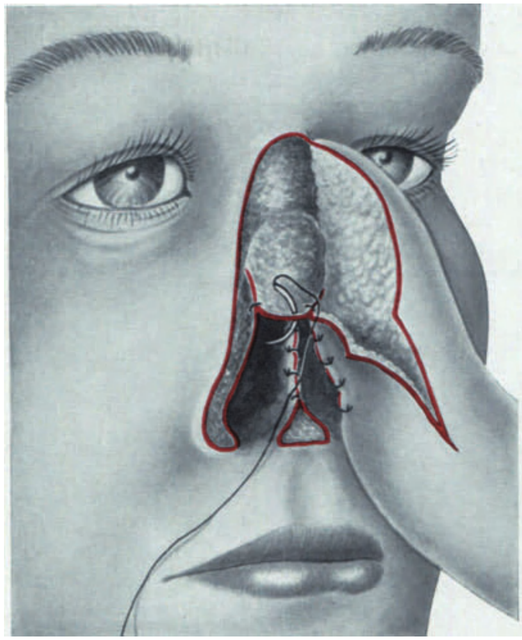


Fig. 496. Suturing the tubed pedicle flap to extend the inner lining of the nasal cavity; the glabellar flap is sutured to the inner rim of the defect and to one part of the tubed pedicle flap. A part of the tubed pedicle flap can likewise be sutured to the prepared part of the defect at the base of the columella for later formation of the columella

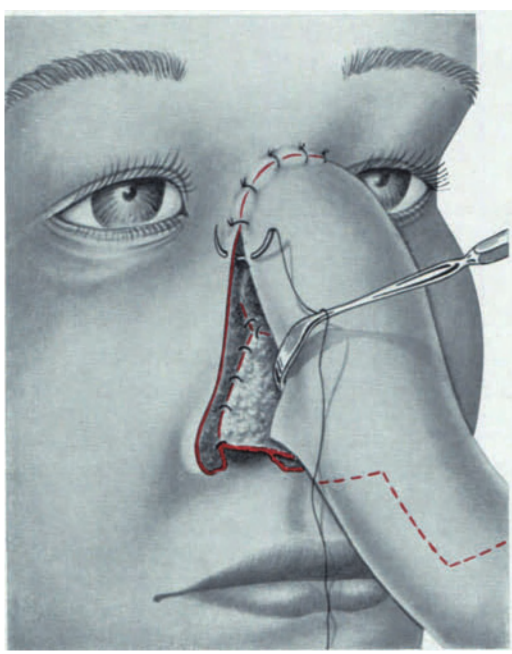


Fig. 497. Inner lining with the vestibule is formed. The upper part of the inner lining comes from a glabellar flap. Dotted red line shows the flap for formation of the columella to take place in another stage operation

This can cut off the nourishment in the fat tissue of the flap. It is very possible that large portions of such flaps might die if one does not immediately decide to open the flap along its longitudinal suture and relieve the pressure. In order to avoid this danger it is recommended that one does not leave the tubed pedicle flap to take care of itself when the *base is detached at the neck*, but rather that one treats the wound so that it heals primarily. That an erysipelas or sunburn of the skin can jeopardize the nourishment of the tubed pedicle flap has already been pointed out above.

When the base is secured, one can begin with the *construction of the nose.* In favorable cases with a relatively narrow nose and a sufficiently thick tubed

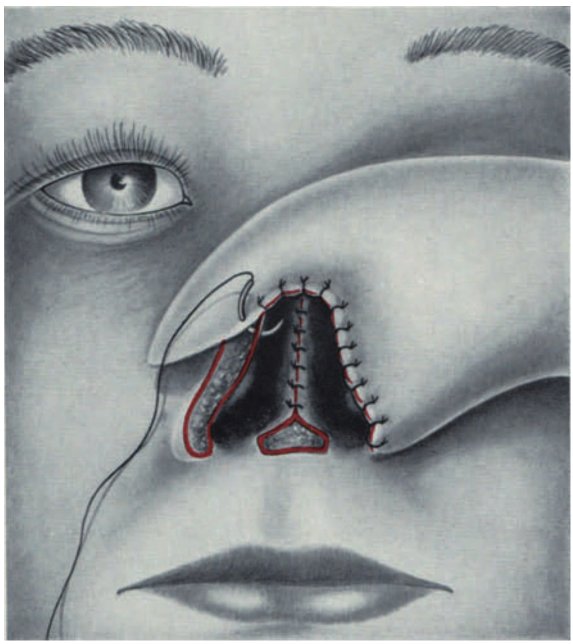


Fig. 498. Suturing the tubed pedicle flap to the border of the defect; flap sutured to the inner rim of the defect border. Preparation in the region of the columellar base is already illustrated here; it is used later to receive the part of the flap which is intended for formation of the columella (see also Fig. 497, dotted line, and Fig. 500). In this case the width of the flap extends bilaterally to the alar attachment while providing adequate prominence of the nasal tip

pedicle flap with fat, it is possible to construct the shape of the nose including the nasal tip with sufficient prominence in one stage. But with tubed pedicle flaps it often happens that insufficient skin for shaping the tip is available in the region of the alae and tip due to the width of the nose. This applies particularly when a part of the skin from the flap must be used for inner lining. One is then forced to form the lower part of the wall from the excess tubed pedicle flap by folding back the end of the flap. If parts of the alae are still present at the base, they are usually retracted upward. One releases them from the scarred area and shapes them with the corresponding parts of the tubed pedicle flap, which makes the construction of the nose considerably easier. Thus this stage of the operation ends. With a dressing one immobilizes the remaining part of the tubed pedicle flap which has not yet been used so that it does not disrupt the fresh sutures.

Fig. 499. Suturing in the region of the outer rim of the defect border. The inner lining has been provided completely by the tubed pedicle flap without resorting to a glabellar flap. The tubed pedicle can likewise be attached in the region of the columellar base so that the columella can later be formed

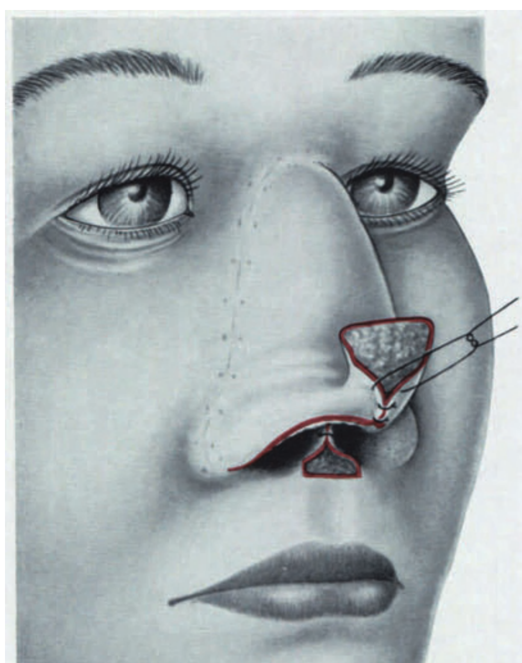
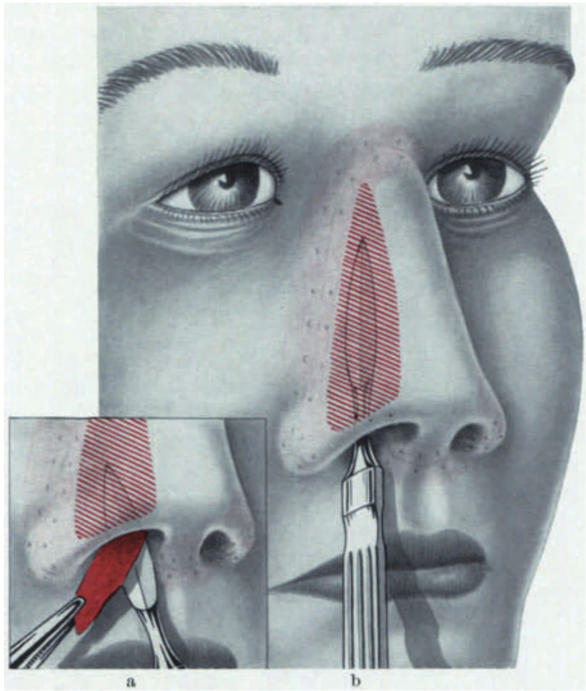


Fig. 500. Formation of the columella from the remainder of the tubed pedicle flap as shown in Fig. 497

Fig. 501. Situation after suturing the columella in the region of the base

Fig. 502. Insertion of plastic tubes which should be adapted to the shape of the nostril

After a period of 2 to 4 weeks or more the *nostrils and the columella are formed* from the remaining part of the tubed pedicle flap (Fig. 500). It may be necessary to remove submucous scar tissue in the interior of the nose or to excise fat from



Figs. 503a and b. Shaping the nose by means of excision of fat. a Surplus fat tissue is excised through an endonasal skin incision; fat is removed especially from the lateral nasal walls. b Fat is removed in layers. Red hatching shows the area of excision which often protrudes somewhat

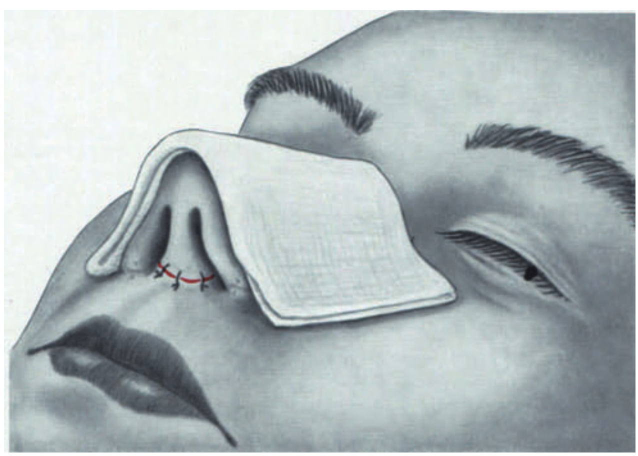


Fig. 504. The shape of the nose is retained by applying a plaster dressing for several weeks. If necessary the angle at the base of the columella can be corrected at the same time (shown by sutures)

the tubed pedicle. One does this so that the corresponding parts of the skin can be repositioned or sutured into the interior of the nose. Plastic tubes are made to size (Fig. 502). These must extend far enough into the nose and are inserted at the base of the columella after the columella has healed. They are supposed to prevent too much narrowing of the nostrils due to contracture. But in no case should they create such strong tension that the newly formed columella tears out at the upper lip or that pressure necroses in the interior of the nose occur. The plastic tubes are worn by the patient for several months. During this time the external shape can be improved. By means of a modelling operation (Fig. 503) which is done from the interior of the nose, unsightly cicatricious unevenness is smoothed. After this the nose is covered with a plaster cast for 2 to 3 weeks or longer to retain the desired shape. This way the dorsum

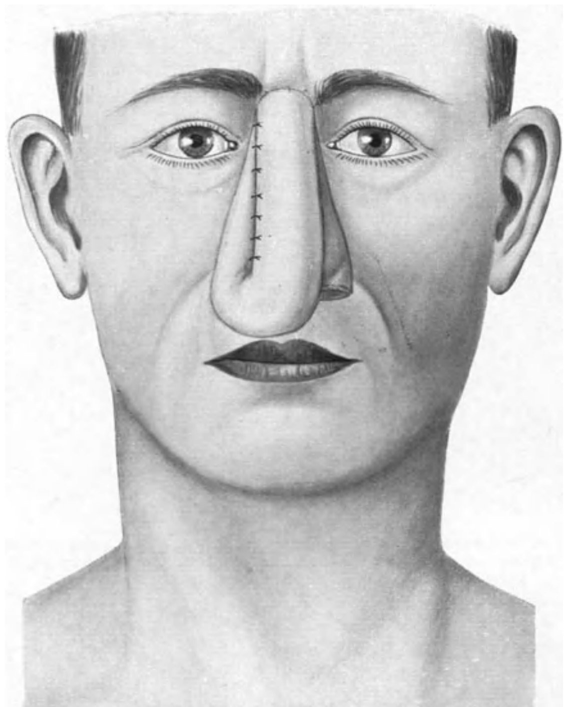


Fig. 505. The new free end of the tubed pedicle flap is attached for replacement of the left nasal wall and ala. Then the columella and future nasal tip are joined. Replacement of the right nasal wall is made similarly. (From HERLYN)

and the transition of the nose to the cheeks can be shaped advantageously (Fig. 504).

Most tubed pedicle flaps can be used in this way for complete reconstruction of the nose. Naturally other variations are possible or necessary, especially when the base of the nose is wide and the *width of the flap which is available is inadequate*. When suturing the flap bilaterally to the cheek, i.e. when establishing the width of the flap, one must also consider tip prominence and that insertion of a support may be necessary. No tension should occur here which might cause a decubitus. When this happens the tubed pedicle flap is sutured into the defect unilaterally at first. In a second stage the lower part of the flap is folded over so that it forms the other side of the nose. The fold of the flap is in the region of the tip, columella, and alae, which will be formed later. With thin flaps, HERLYN even suggested triple application of the parts of the pedicle for construction of the nose (Fig. 505). For construction of the lower half of the nose, VOGEL crosses the two parts of the tubed pedicle.

In Joseph's method the tubed pedicle flap is folded once to form the nostrils. In this method a triangular hinge flap is cut as in atresias and fat is appropriately excised (Figs. 330 and 331). It is advantageous to suture the tubed pedicle flap in the region of the base of the columella while making the fold. The bilateral hinge flaps are then used for lateral lining of the columella. Bilaterally the lateral wall of the vestibule is provided by means of a part of the flap based at the alar attachment. Sometimes if there is good nutrition of the tubed pedicle the nostril and the columella can be formed at the same time. In such cases it is recommended to form one nostril first, and in a later stage to form the other one.

Fig. 506

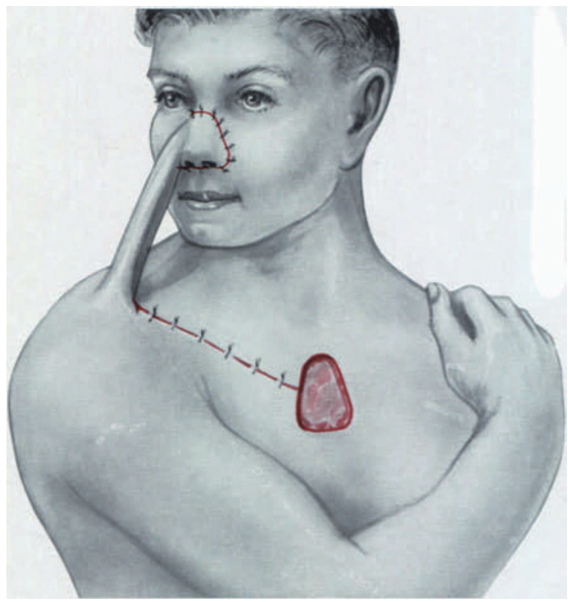


Fig. 507

Fig. 506. The shape of the nose is pre-formed on the distal end of the flap. Skin for lining of the vestibule and formation of the columella has been turned inward. Possible reinforcement is made in a later stage; Thiersch graft can be used for inner lining

Fig. 507. Pre-formed nasal shape on the end of the tubed pedicle flap has been transferred to the defect and sutured. The donor site on the chest is covered with a rotation flap. Fixation of the head and shoulder position is best done with a plaster cast

This way a necrosis of the lateral covering of the columella and the contraction caused by this is avoided. An asymmetry does not necessarily occur.

In Russia in 1948 Hitrov recommended the method of the *de-fatted tubed pedicle flap* for complete replacement of the nose. He rejected the general concept that basically nourishment of the tubed pedicle flap is supplied by the vessels which run through the fat tissue of the pedicle. Thus he removed the fat from the flap. The circulation of blood and lymph of the flap prepared in such a manner is supposed to be completely adequate for the newly constructed nose. In the opinion of Hitrov, removing the fat makes it easier to shape the nose. After the flap has healed at the glabella and has been de-fatted and then detached at its base, the remainder of the flap is folded at the proper length under the de-fatted strip of skin and is sutured as inner lining. To create the external shape of the nose Hitrov now folds the doubled skin flap along its longitudinal axis. This way the flap is shaped like a roof and the nasal dorsum is formed. The inner skin duplication is likewise folded under the ridge of the roof. The danger of this method lies in the poor nutrition as a result of the folds. Slight technical mistakes, e.g. stretching the skin, could lead to partial necroses of the inner lining and of the septum. To avoid the disadvantages, KAVRAKIROV

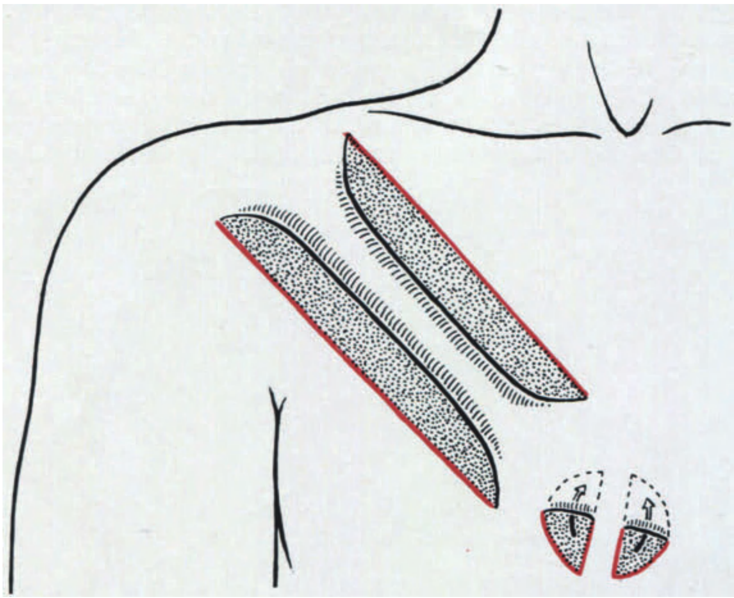


Fig. 508. Formation of the columella and alae by GILLIES; duplication for inner lining of the vestibules (see arrows)

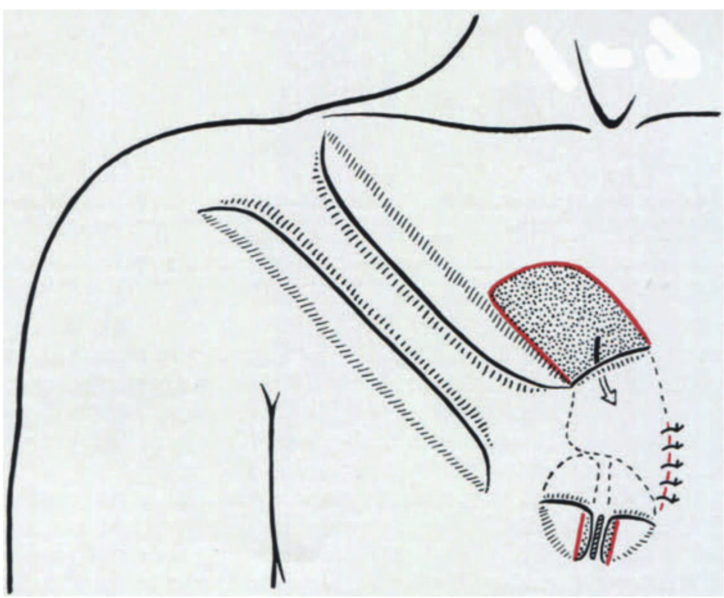


Fig. 509. Modification of the GILLIES method; skin duplication in the flap (arrow) for inner lining of the nose

modified this method by doubling the flap only in its lower part which forms the alae and the columella. This way better nourishment of the flap is assured. The tubed pedicle flap which has healed on the glabella and upper lip is opened longitudinally in the region of the upper lip. This way it can be used for covering the lateral defect borders on the nose at the transition to the cheek. The flap attached at the glabella is de-fatted and is used to form the external nose. For inner lining of the nose in the middle region a tongue-shaped flap is cut from the tubed pedicle flap and is sutured laterally on both sides. In Poland the method of HITROV was modified by BARDACH. For inner lining he cuts a triangular piece of skin from the tubed pedicle flap.

Considering these suggestions we can not imagine that using a de-fatted tubed pedicle flap is suitable and feel that healing of the usual tubed pedicle flap is more certain. In addition, the postoperative modelling of the healed, fatted flap probably guarantees a better cosmetic result than thinning the flap beforehand does.

As in the Indian and Italian methods, according to PETRALI, the *nose can be pre-shaped on one end of the tubed pedicle* flap as well, either on the arm or on the chest. The pre-shaped nose is then transferred to the nasal region (Figs. 506 and 507). In preshaping the nose on the base of the flap one must lay out the structure so that the rotation of the tubed pedicle flap is taken into consideration. One of these procedures comes from GILLIES. He used an acromio-pectoral tubed pedicle flap and pre-shaped the end of it into a nose with alae and columella (Fig. 508). — Other authors have described modifications of this method of pre-shaping the nose (Fig. 509).

When there is much hair on the skin of the chest is it recommended that one choose the tubed pedicle flap of NEW from the infraclavicular region to the acromion or of SMITH and SANVENERO-ROSSELLI from the acromion to the region of the biceps.

Naturally the possibility exists of combining the procedures of structure formation with each of the methods of skin replacement:

1. the Indian method with subsequent implantation of a profile support in the finished soft part of the nose;
2. the Indian method with pre-implanted profile support;
3. the Indian method with pre-implanted nasal roof;
4. the Italian method with subsequent implantation of a profile support in the finished soft part of the nose;
5. the Italian method with pre-implanted profile support;
6. the Italian method with pre-implanted nasal roof;
7. the tubed pedicle flap with subsequent implantation of a profile support in the finished soft part of the nose;
8. the tubed pedicle flap with pre-implanted profile support.

VII. Plastic procedure in nasal tumors

1. Approach and reconstruction following removal of tumors of and in nose

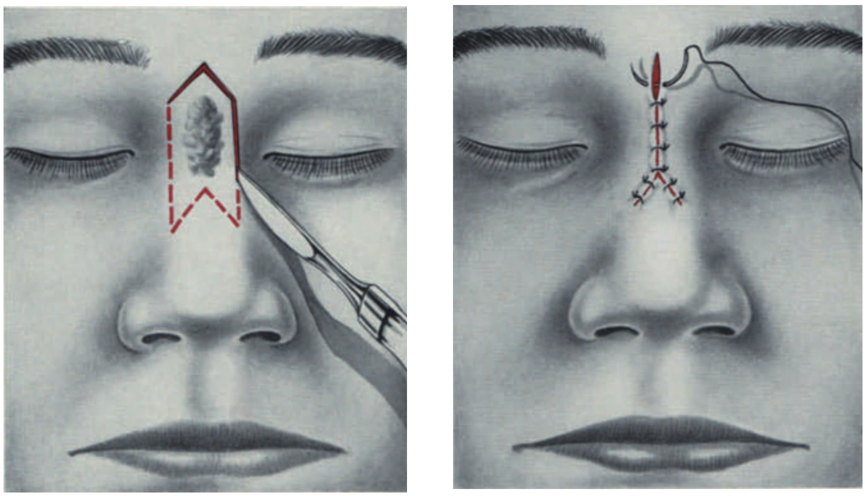
Following the removal of a tumor it is not always possible to cover the resulting defect immediately by means of plastic surgery. Many surgeons feel that one should be cautious after removal of malignant tumors. One should wait $^1/_2$ to 1 year to be relatively sure that there is no tumor recurrence. We feel that with the surgical procedures common today, some of which are performed under magnification, an adequate degree of safety can be obtained for immediate plastic surgery in many cases. This is especially true because modern plastic surgery has raised the limit of safety into relative security in the extirpation of tumors. But one must decide these things from case to case. However one should never jeopardize the safety of the patient.

If plastic surgery can be done immediately after removal of a malignant tumor, because the excision was made in healthy tissue according to human estimation, then as short a plastic procedure as possible should be chosen. This is done so that the patient can receive the appropriate postoperative radiation therapy relatively soon. In case of very large defects, much time is necessary for preparation of a tubed pedicle flap on the trunk or on the neck. This time can sometimes be filled with implantation of radioactive isotopes or with the start of the appropriate postoperative radiation therapy. Then one must make the best of the poorer healing tendency of the area during healing of the tubed pedicle flap. For psychological reasons it is often inadvisable to wait for a safety period of a year. One may bridge the time by means of temporary plastic repairs. Thus one can close larger nasal defects, for example, by means of flap rotation and months later reconstruct the underlying skeletal structure which was also destroyed by removal of the tumor. In any case the surgeon must know what method of replacement surgery will be used when extirpating a tumor in the region of the nose.

Small superficial malignant tumors can be removed by means of cautery, or better, by cutting around the tumors in the normal tissue. This way plastic repair of larger defects is not necessary. Undermining of the borders and approximation (Fig. 510) or a flap transposition (Fig. 511) suffice. In general with removal of small tumors of the nasal skin covering the defect can be improved when possible by rotation and advancement of the neighboring skin with the excision of Burow triangles. One tries to make the defect as small as possible, but under no circumstances should the radical tumor removal suffer because of this. Spinocellular carcinomas should be excised especially wide around, even if the difficulty of plastic covering is considerably greater. With basal cell carcinomas one may proceed somewhat more conservatively. In all cases the position of the excised tissue should be marked during the operation with needles, ink, or threads at the border and sent for frozen section. After microscopic examination the pathologist is to confirm or deny that the excision has been complete within normal tissue. Naturally further excision in the corresponding area is necessary if incomplete excision has been determined.

In the case of *deep-seated tumors on the dorsum* a wedge in the entire thickness of the bony-cartilaginous skeleton must sometimes be excised. As Holdsworth and Sugrue have shown, it is possible to cut out a piece like an orange segment from the nose. The defect is closed so that the nose is shortened. Naturally this is recommended only for long noses. First the borders of the mucosa on the septum and the lateral wall of the nasal cavity are sutured carefully and then the wound borders of the external nose are closed. The *decortication method* of Šercer, called the "open method" by Rehrmann, can be used as an approach for subcutaneous tumors which affect the nasal skeleton, such as gliomas, glomus tumors of the dorsum, and dermoid cysts without fistulas opening externally. This method is an extension of the method of folding the columella skin upward as by Gensoul and Lexer. We too cut around the columella for this approach (Fig. 233). If one extends the incision for decortication by Šercer farther around the alae, one obtains the incision described by Coughlin for the correction of flattened nasal tip in "dish face". Hage described this approach in 1959 for removal of tumors of the nose. After raising the entire nasal roof of skin and cartilage, the septum can also be severed above the nasal tip diagonally rearward toward the vomer. One opens the nasal cavity even farther by swinging the lower part of the septum downward or to the side. Or, as HAGE has shown, the upper lateral cartilages can be severed paramedially from the septum, and the lower lateral cartilages can be separated medially.

The simplest approach for the *resection of sinus tumors* is the incision of MOURE or DIEFFENBACH. This extends from the base of the columella to the



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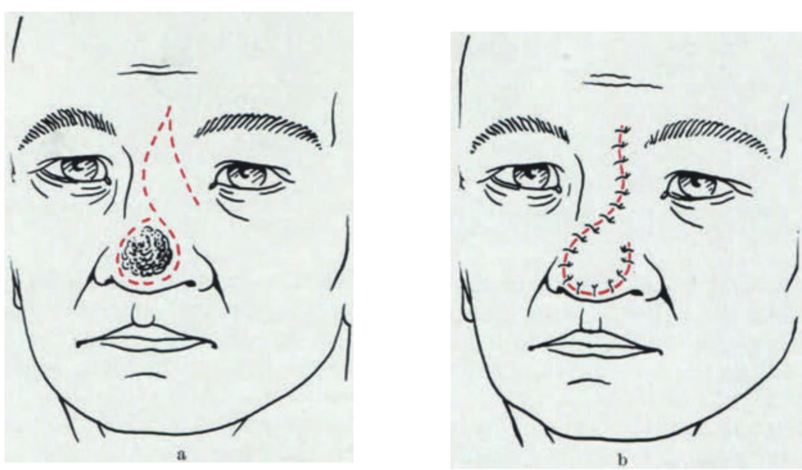
Figs. 510a and b. a Tumor excision at the root of the nose by H. MARTIN. Closure of the defect by means of undermining and approximation of the borders. One should avoid tension on the inner canthi



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Figs. 511a and b. a Tumor excision on the nasal tip. b Region of the defect is covered with a transposition flap

ala, around its lateral attachment and upward onto the lateral nasal wall to about 1 cm medial to the inner canthus. In addition one can use the extended incision of LISTON and NÉLATON or of FERGUSSON. The incision described above is extended downward by means of splitting the upper lip in midline and upward by means of a curved incision below the lower lid. HEATLY, SCHALL and COTTLE have modified these incisions as a lateral rhinotomy by removing the lateral wall of the bony nose. — Splitting the cutaneous and bony nose next to the midline as in the method of LINHART, as derived from an old Hippocratic method, is obsolete today. Of the procedures which swing the entire nose upward toward the forehead, those by CHASSAIGNAC and by VON BRUNS are best known. One severs the skeletal part of the nose straight through, including the septum, with a saw or chisel. But in the method by OLLIER the nose remains connected to the underlying tissue at its lower attachment of the nose. The incision runs straight over the nasal root and bilaterally over the lateral nasal wall to the alar attachment. The bony nose is opened by means of upper transverse osteotomy and lateral osteotomy on both sides and can be swung downward without further severing of the cartilaginous parts. This technique as well has generally

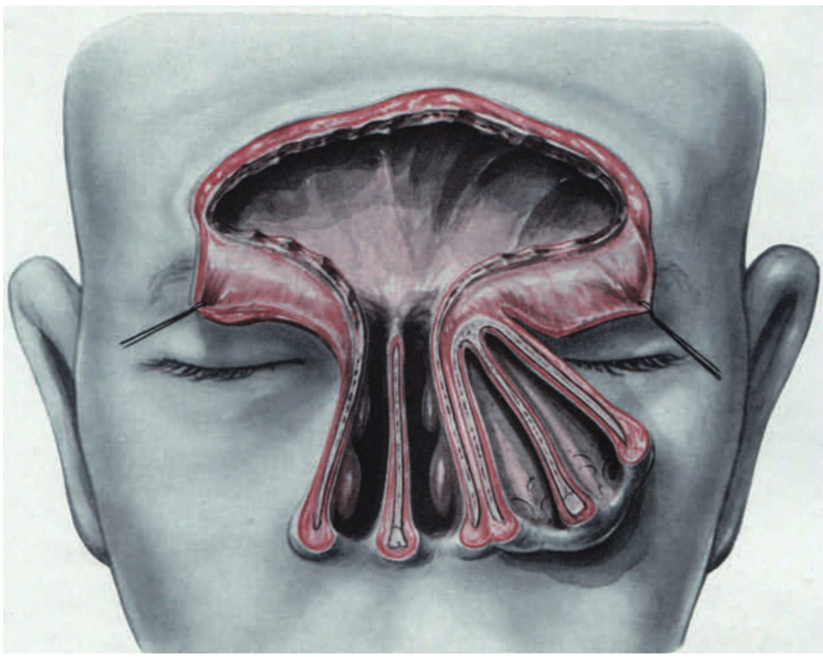


Fig. 512. The entire nasal pyramid is opened by means of bilateral lateral osteotomy as an extended rhinotomy according to BORDLEY and LONGMIRE

been abandoned today in favor of opening the nose laterally. — BORDLEY and LONGMIRE make lateral osteotomies bilaterally, sever the septum at its base and thus can swing the entire nasal structure to the side (Fig. 512). This method was recommended by RÉTHI in 1963 as an approach to the sinus cavernosus in thrombophlebitis. — According to the method of COTTLE the incision runs from the nasofrontal suture medially from the inner canthus to the alar attachment and around it into the nasal vestibule. The bone is mobilized by means of lateral paramedian and upper transverse osteotomies. Thus it can be lifted off with the overlying skin. To avoid disturbing the nourishment, the skin is undermined only slightly. This method provides a wide approach to the nasal cavity.

A particularly difficult problem is presented by *tumors in children* and the plastic repairs made necessary after their removal. In partial and complete reconstruction of the nose in children, the growth of the surrounding organs must be taken into account. Fortunately such surgery on the growing skull is rare. One seldom finds it in medical literature. In 1957 CROSBY reported a case of rhabdomyosarcoma on the nose in an 18-year-old girl. After removal of the tumor replacement surgery of the ala and the adjoining part of the cheek was necessary. W.B. MACOMBER and M. KAI-HSI WANG have given information concerning neurofibromas and nasal gliomas. Facial plastic surgery is also important in the surgical treatment of meningoceles and encephaloceles. The treatment recommended is excision of the cele with immediate closure of the dural defect.

If the tumor has separated the growing bones of the face because of its existence for many years, then repositioning of individual parts of the facial structure should be attempted immediately after removal of the tumor. In the region of the orbit with displacement of the eyeballs, one does best to wait and reposition the structures after growth has stopped, since a considerable degree of spontaneous equalization can occur. Final corrections can be made on the mature facial structures.

2. Repair of defects of nasal floor following tumor removal

Large defects of the nasal floor, usually in connection with cheek and nasal defects, can be covered practically only by means of tubed pedicle flaps. MACOMBER and BERKELEY published a procedure in 1947 in which they closed such an extensive defect with a thick tubed pedicle flap from the neck. The tubed pedicle was rotated into the nasal cavity through the large paranasal fistula which occupied the median part of the cheek, and the end of the flap was then sutured into the defect. The raw surface on the end of the flap was covered in part with a THIERSCH graft. This graft formed the oral lining and was sutured to the palatal mucosa. After detaching the flap at the nasal floor the remainder was used to close the paranasal fistula. We consider covering the flap on the oral side with a THIERSCH graft to be impractical. Since sufficient skin is almost always available in a tubed pedicle flap, one can use this for the oral and nasal epithelization.

One of the three inventors of the tubed pedicle flap, GANZER, tried the method described above for the first time with just these defects (1916). The use of the tubed pedicle flap for treatment of defects on the palate and nasal floor was developed by ROSENTHAL, AXHAUSEN, WASSMUND and others. The reader is referred to the chapter on palatal surgery in Vol. II. With reference to this, the newer method of the abdomino-brachial sandwich flap by CONVERSE and JAYES should be mentioned. It is discussed in the chapter of partial reconstruction of the nose (Fig. 472).

3. Treatment of nasal hemangiomas

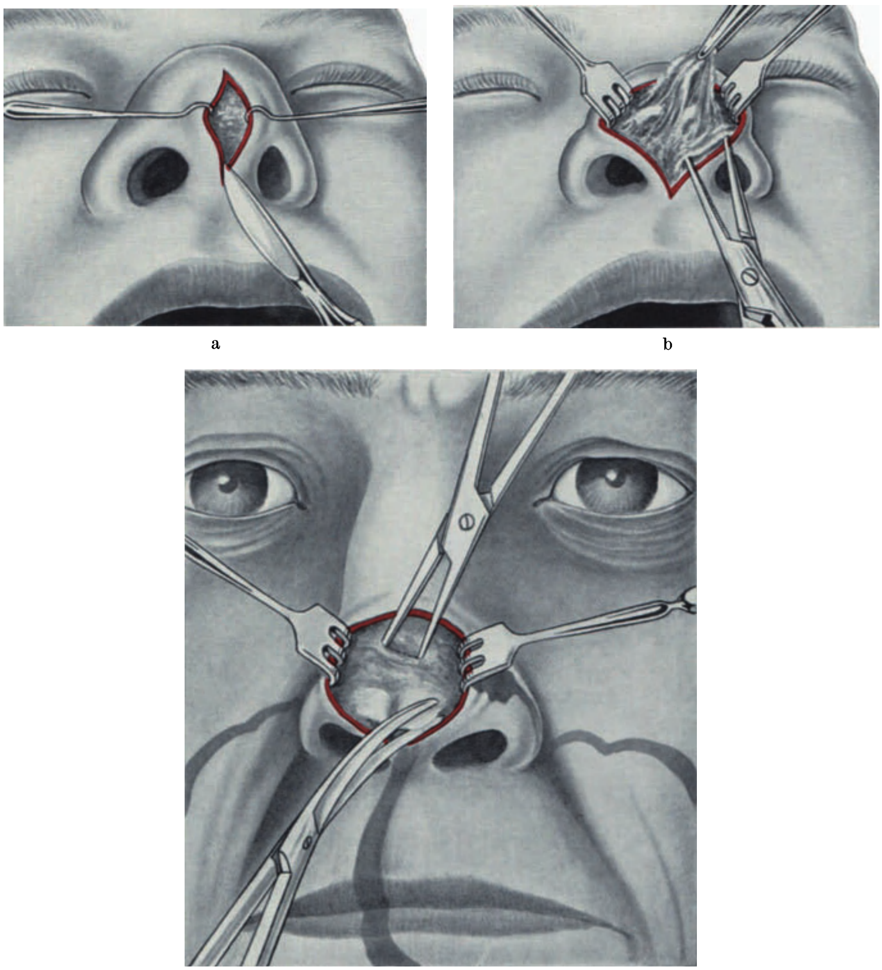
Nasal hemangiomas are usually located on the nasal tip or in the region of the nasal root. They are congenital. Very often they are visible only as a small spot at birth and grow considerably during the first months; at the age of 3 to 4 months they show a certain stagnation of growth. It is recognized as a fact today that most small hemangiomas of infancy and childhood subside spontaneously. In some cases, however, subsidence is slow and in a slight percentage of cases does not occur at all. One can not predict whether the tumor subsides spontaneously or not. Therefore it is in the interest of the patient to treat the tumor, so long as no criteria are present by which one can distinguish between increasing and subsiding tumors. For treatment one may consider X-ray radiation, implantation of radon or Thorium-X, freezing with carbon dioxide "snow", injections with boiling water or sclerosis-producing substances such as sodium morrhuate, and surgical excision. There is still no unity of opinion concerning which method is best.

Hemangiomas in infants occur twice as often among females than among males. There are many types of hemangiomas. For the sake of simplicity they can be divided into two groups: Hemangioma simplex and cavernous hemangioma. The hemangioma simplex involves only the skin and the subcutaneous tissue. It occurs congenitally or appears just after birth and grows slowly. The second type, cavernous hemangioma, consists of cavernous tissue with many blood-filled, interconnected cavities. It occurs congenitally, but has a more infiltrative character of growth and is not restricted to the skin and subcutaneous tissue. In contrast to naevus flammeus (hemangioma simplex), which seldom affects only the nose, a fresh cavernous hemangioma reacts very well to *radiation therapy* and in most cases subsides. However ugly scars with fine contractions, pigment changes, teleangiectasias and other damage often remain after the therapy. With incompetent radiation therapy of the hemangioma, skeletal changes, i.e. growth disturbances, can occur in the cartilaginous and bony nasal structure. The more or less obvious scars occur if the radiation affects deeper layers of skin, partially the subcutis. — Treatment with carbon dioxide "snow" has practically been abandoned today. Electro-coagulation is still used by some authors. Here there is the danger of destroying the surrounding tissue at the same time. Cauterization is used only rarely today. Treatment with gamma rays, radium, radon, and X-rays is not without danger when used in early infancy. It has been shown that growth of the underlying cartilaginous and bony structures can be retarded. Decades later one can recognize damage to the growth of the lower lateral cartilages especially.

Experiments according to WYETH with *injection of boiling water* into hemangiomas have been made on the nose as on other areas of the face. Superficial hemangiomas react best to this therapy. They are made to shrink and about half a year later can be excised. This method of treatment has proved suitable especially for more extensive hemangiomas and for lymphangiomas of the lips and of the oral mucosa. Ordinary water or normal saline can be used for this. When making the injection the surgeon wears cotton gloves over the rubber gloves, and the syringe is covered with rubber to protect the surgeon's hands from burns. The boiling water is drawn from a container into the syringe and is injected immediately into the hemangioma at various points.

Instead of boiling water one can use a sclerosis-producing substance. Many Americans use 5% *sodium morrhuate* (MACOMBER and WANG). LEWIS mixes the 5% morrhuate 1:2 with procaine solution and adds hyaluronidase (150 units). In 1957 he described a very good cosmetic result with this injection in a cavernous hemangioma of the nasal tip in a small child. OWENS and STEPHENSON also reported on good results with sodium morrhuate in 1948. They also combined this therapy with later excision of the shrunken tissue. — The success of the sclerosing process is that the surgical treatment is less radical. Sometimes smaller excisions can be made without rotation of large flaps. MATTHEWS also recommends this combined procedure for many cases. MACOMBER and WANG reported on a larger hemangioma at the nasal root and on the lateral wall of the nose in a $2^1/_2$ month old infant. A good result was obtained by means of eight injections of 5% sodium morrhuate at 6 week intervals, without additional surgery. — In suitable cases, we (R. MEYER) inject a solution of *quinine-urethane*, but not in the region of the nasal tip and the alae. — OLSEN uses small doses of *Varex* or *Varicocide* as preoperative treatment. He makes the injections four times at 4-week intervals.

During the injection of the sclerosis-producing substance, external pressure should be exerted on the hemangioma to prevent possible embolism and to counteract overly rapid diffusion of the substance injected. Pressure must be continued for about 1 hour. — After this treatment there is considerable swelling for 2 days. Special caution is advised where cartilage lies under the skin, e.g.



a b

c

Figs. 513a—c. Dissection of a hemangioma of the nasal tip. a Medio-columellar incision. b Blunt dissection in the columellar part. c Separation of the tumor above the lower lateral cartilages. The perichondrium and cartilage must not be injured by the scissors

at the alae or at the nasal tip. Only very small doses should be injected here. Otherwise too much interstitial pressure can create skin necrosis and cause the cartilage to die. Therefore one repeats the injections often at 1-month intervals, as MATTHEWS and others recommend.

Boiling water coagulates the protein and thus the tissue shrinks. Injection of substances causing sclerosis results in an inflammatory thrombosis with secondary sclerosis and atrophy. Injections can be made into the cavernous spaces of the hemangioma as well as in the surrounding tissue and at the base of the tumor (MACOMBER and WANG).

In only a few cases is a really good result obtained on the nose with injection therapy. Because of the contracture, an inadequate cosmetic result is obtained. Therefore plastic surgery must follow after about half a year. For cosmetic reasons we have completely abandoned injection therapy of hemangiomas on the nasal tip and choose surgery by itself.

For *electrocoagulation*, a thin needle is used on the insulated electrode. The needle is inserted directly into the tissue of the hemangioma. We believe that it is difficult to determine the correct intensity for coagulation. Better cosmetic results can probably be obtained by careful surgical removal of the tumor.

Opinions vary as to *when the hemangioma should be removed surgically* and whether the cosmetic result can be improved by means of previous coagulation. Especially in case of a tendency toward growth of the tumor, some authors recommend early resection without previous therapy (DENECKE, JEREMIAH, and others) or with previous sclerosis therapy (STEPHENSON and others). Other authors (BLACKFIELD and colleagues) recommend waiting 2 to 3 years until the surgery is made easier after possible spontaneous subsidence of the tumor. According to MACOMBER surgery is indicated in case of the following hemangiomas:

1. Larger tumors, sometimes after previous radon therapy.
2. Tumors which grow quickly and bleed readily.
3. Tumors which ulcerate readily.
4. Tumors which disfigure the face due to great difference in color.
5. Tumors which have not reacted to other methods of treatment. — We essentially agree with these indications.

Surgical removal of subcutaneous cavernous hemangiomas of the nose is done with as much protection of the skin as possible. Often the tumors are in the region of the nasal tip. In such cases we proceed with exposure of the nasal tip by means of a medio-columellar incision (Fig. 513) or with an incision of RÉTHI (Fig. 124) or of ŠERCER. After décollement of the skin, the subcutaneously or intracutaneously situated hemangioma is released by means of careful dissection. This procedure is naturally better with subcutaneous hemangiomas than with cutaneous ones. With the incision of RÉTHI it is recommended to extend the incision at the rim of the vestibule laterally. This way the skin of the nasal tip can also be released and swung upward, so that the entire extent of the tumor is exposed. Bleeding is usually not profuse and can be controlled easily. The tumor is carefully scraped from the underlying cartilaginous and connective tissue. It is best to use a thin, sharp spoon or with a very thin curette, which are among the instruments used in modern ear surgery. The perichondrium of the lower and upper lateral cartilages must be protected when possible to prevent growth retardation. The lower surface of the skin is also scraped evenly so that nothing of the bluish tumor tissue remains. Then the skin flap can be replaced. Some skin can be excised laterally and on the caudal end of the columella flap, so that the skin flap which is too large after removal of the tumor fits on the underlying tissue. Such a procedure is possible only if the hemangioma is located subcutaneously and appears blue through the skin. This is not possible with an *intracutaneous hemangioma*. In such cases we excise the skin containing the hemangioma and cover the defect with a flap from the neighboring area, with a rotation or advancement flap, or with a free full-thickness skin graft. When using this procedure, we make sure that the defect is made symmetrical. The importance of symmetrical covering with full-thickness skin grafts for esthetically good results on the nose ("esthetic unit") is pointed out again and again today (GONZALES-ULLOA, CLEMENTSCHITSCH). Since the split skin graft obtained with the dermatome becomes yellowish or brownish with time, the full-thickness skin graft is generally preferred today. But it is sometimes difficult to choose a donor area for a full-thickness graft with the same or similar pigmentation as the region of the nose. The retroauricular region, the supraclavicular region and the inner aspect of the upper arm are suitable for this. We consider the use of a forehead flap unsuitable for covering a large skin defect after excision of a hemangioma of the nose, as TRAUNER suggests. For such cases we prefer WOLFE-KRAUSE flaps, fronto-temporal pedicled flaps, or, if possible skin advancement from the neighboring area. — *Entirely superficial hemangiomas* can sometimes be treated with the fraise (dermabrasion, see p. 453). — *Lymphangiomas* are treated in the same way as hemangiomas.

C. Appendix

I. Rhinoplasty in children

Details concerning the indication of surgery of the external nose and on the septum in children have already been given in respective chapters, such as those about septum surgery, nasal fractures, and nasal malformations. In the section about harelip nose there was also information concerning additional surgery for infants and children. Basically, surgery on the nose can be done from earliest childhood, but the indication for this is essentially dependent upon the functional necessity of the surgery. Because of the results of a nasal obstruction, surgical creation of unimpaired nasal breathing in infants and small children is a particularly important therapeutic measure. Performing such surgery early enough and at the appropriate time protects the organism from serious physical and mental damage. A list of all disadvantageous results of congenitally or traumatically caused obstruction of nasal breathing in infancy and childhood is to be found in a compilation by NEUBERGER and elsewhere.

In the case of trauma at birth, *the septal cartilage is usually crooked* and thus the dorsum as well. This can be adjusted easily either manually or with instruments. If prenatal intrauterine traumas are present, there is usually deviation of the entire bony pyramid. This can not be adjusted manually. According to KIRCHNER this deviation decreases during the first 3 months of life. We have never been able to observe this. In case of marked deviations one should undertake open or, if possible, closed reduction at the age of 3 to 6 months with the patient in light general or local anesthesia. Slight deviations or deviations which do not affect the function can be put off until the age of 3 to 5 years. Of course such deviations which are slight in childhood can increase with growth so that septum surgery before school age becomes necessary. As mentioned in the chapter on septum surgery (see p. 117), this surgery must be done with all possible protection for the cartilage. Above all no unnecessary resections should be made. One should make incisions, transpositions, and sometimes reimplantations of pieces of cartilage. If the deviation of the septum is only in the region of the vomer, the surgery should be put off as long as possible, so that the zone of growth is not injured (see p. 7). If the vomer is also deviated along with the septum, then one should overcorrect by basal infracturing and immobilization with packing. The packing should retain the septum in the corrected position longer than on the adult. Deviations in the lower, anterior part of the septum, as well as luxations, should be corrected early if possible. Especially with this correction cartilage should never be removed. In early childhood one can make a partial septum correction and then at the age of 16 make a correction with the customary cartilage and bone resection. GOLDMAN recommends his surgical procedure for septum reconstruction in case of deviations in adults for corrections in children as well. He resects only a small strip of cartilage behind two struts of cartilage in the septum.

If there is a *recent fracture of the nasal bones*, it must be treated regardless of age. If possible, the reduction should be done by the closed method (see p. 207). Some authors, such as Goldman and Galanti, advise against reduction of the bones in nasal fractures before age 16. We do not agree with this view. If we can not make immediate external reduction manually or raise the depressed nasal wall by means of an instrument guarded with gauze, then we wait at least 3 weeks and perform open reduction. After décollement of the skin on the nasal wall, a Walsham forceps is introduced through an intercartilaginous incision to bring the fractured nasal bone into the correct position. Depending on the age of the child, this is done in local, light general or insufflation anesthesia. The fingers can be used externally to adjust the nasal dorsum while one makes the inner reduction with the Walsham forceps. After this the nose must be packed for at least 2 days and an external plaster dressing applied for 1 to 2 weeks.

Malformations with obstruction of nasal breathing must also be corrected at an early date in children by means of plastic surgery. This is important for the further growth of the nose, for the development of the maxilla, and for the prevention of functional disturbances of the nose and the sinuses, such as disruption of the sense of smell or chronic sinusitis. The relief of nasal obstructions in such cases is a preventive against middle ear diseases and eliminates speech disturbances (rhinolalia clausa). According to Lefkon the cartilaginous septum can be dislocated from the vomer as a result of trauma. This can cause a retardation of growth of the maxilla and result in malocclusion.

It should not be forgotten that inferiority complexes can be prevented by earliest possible correction of congenital or acquired deformities and defects of the nose in children. With more pronounced deformities of the nose, however, only temporary surgery is possible at first and the definitive correction must be made when the patient is mature. Early surgery for prevention of psychic disturbances is important especially between 13 and 16 years of age. We have had to resort to cosmetic surgery like hump removal in patients in this age group. But these cases are rare. If there are no special circumstances, such cosmetic operations as hump removal, narrowing of the tip, shortening or narrowing the nose, are not made before the age of 18 or 20. Saddle noses, which cause stronger psychological complexes, can sometimes be corrected as early as 12 to 13 years of age. Use of autogenous material is recommended. In compound saddle noses one must line the dorsum several times at intervals of a few years. One can begin this as early as age 10. We have done this a few times with good success. In the first operations we have used plastics (acrylate or polyethylene), in order to use autogenous cartilage or bone in the definitive operation (see also p. 162). — Naturally in a rhinoplasty in children one must protect all of the tissue which can be used in a later plastic operation, as Petterson has also pointed out.

Seltzer made an interesting experiment for the prevention of congenital hump formation in children. Using a nasal brace he tries to suppress the beginning formation of a hereditary hump in a child 8 to 9 years old. The brace is like that of Joseph, but has a central pressure pad in addition to the lateral ones. This central pad presses vertically on the dorsum. At first the parents apply it to the child for 20 minutes daily, then gradually longer, up to 3 hours. This method is allied in principle to the perverted bone growth of Chinese feet and Indian flat heads. The value of this method will only be revealed later.

II. Treatment of wounds; dressings

In the region of the nose, the surgeon should use atraumatic suture technique with the appropriate atraumatic suture material. For atraumatic suturing one can use "Perlon", nylon, polyethylene, Teflon, Orlon, fine silk, and fine steel wire. For information concerning suture technique the reader is referred to the textbooks on general and plastic surgery (HEGEMANN, KAZANJIAN and CONVERSE, SANVENERO-ROSSELLI, MAY, MCGREGOR). 7/0, 6/0 or 5/0 material is used in sutures on the nose or the rest of the face. The sutures are made 1 to 2 mm from each other and are tied without strong pull. The sutures are left in place 4 to 6 days if no particular tension is present in the tissue. In closing wounds along the straight line, we prefer the intradermal suture of HALSTED and leave the sutures 6 to 10 days. When closing the donor site of a skin flap on the forehead or cheek, one can even remove the sutures before 4 days, if one supports the wound by butterfly strips of adhesive tape. One can make hourglass-shaped adhesive tape strips and apply them to the skin on both sides of the scar so that the thin part of the "bridge" is pulled taut over the scar. In the USA these ready-made strips are available as "Band-Aid surgical closures" (butterfly) or "Steri-strips". If possible the skin is grasped only with fine dermal hooks and not with forceps. We use the recent, refined technique as developed in recent years especially by BORGES, MARINO, MCGREGOR, CRIKELAIR, GONZALES-ULLOA, COLOMB and NEWMAN.

In corrective rhinoplasty we seldom suture the *vestibular rim incision*. Suturing is required at the end of an operation if the incision borders do not adapt easily by themselves. The same applies to the intercartilaginous incision. On the other hand, both incisions are sutured in all cases where a graft or an alloplastic implant has been inserted into the nasal dorsum. This way the juxtaposed tissues can not slip against each other.

Along the *transfixion incision* one makes 1 to 4 2/0 or 3/0 mattress sutures. In cases in which the columella has been reinforced with a cartilage graft or is to be repositioned forward (hidden columella), the transfixion incision is sutured with atraumatic material bilaterally. These sutures are removed after 5 to 12 days. If there has been septal surgery at the same time, by means of a separate unilateral mucosa incision as by KILLIAN and not through the transfixion incision, one makes 1 or 2 2/0 or 3/0 nylon mattress sutures at this more posteriorly placed incision. — The mattress sutures at the transfixion incision are primarily for determining the position of the columella and the tip. Thus the moment for their removal is determined by the desired height and position of the columella and tip. If one has the impression that the columella already has been raised too much, one can remove the transfixion sutures 4 to 8 days after the operation. This facilitates a quicker and more pronounced lowering. But if one wants to delay the postoperative lowering of the columella, which in any case occurs to a greater or lesser degree, then the mattress sutures can be left longer, for 2 to 4 weeks.

As in correction of harelip nose, in which the upper lip has also been corrected, suture lines are right next to the nostrils. Such sutures can be covered with a sterile liquid plastic dressing in order to protect the wound from maceration due to nasal secretions. This "*liquid skin*" can either be applied in viscous form with a metal spatula or it can be sprayed from a pressure can. The material is an acrylic acid derivative. The dried film can be lifted off together with the cut sutures when the sutures are removed. With advancement flaps and with free grafts the liquid skin is not used so that air may reach the sutures.

For *packing* the nasal cavity and the vestibules we use petrolatum gauze. In cases in which the nasal bones have been repositioned medially after osteotomies, the nasal cavity is packed very loosely, so that the realigned bones are not spread apart again. If there has also been surgery on the septum, only the inferior nasal passage is packed firmly. The nasal vestibules should be completely filled with petrolatum gauze so that the alae and nasal tip can be pressed against a relatively firm support by the external dressing to achieve the desired form. The bilateral packing acts as shaping counter-pressure. In English-speaking countries vaseline gauze or vaseline-petrolatum gauze is used. A few also use Gelfoam and oxycel, aureomycin gauze, or gauze saturated with vitamin B ointment for packing.

Before packing one can insert a plastic tube bilaterally along the nasal floor in order to spare the patient the unpleasant feeling of a stuffed nose and to retain nasal breathing in spite of the packing (Greven). In certain cases we place aureomycin dressing tape on the outer or inner lining which has been replaced with Thiersch grafts or with full-thickness skin grafts, especially with composite auricular grafts. This tape protects the graft. This dressing gauze has a good, somewhat elastic consistency and adapts itself to the shape of the mucosa walls. — "Telfa" dressings of polyester plastic film with absorbent cotton are suitable for covering fine sutures.

We consider the application of a tight *adhesive tape dressing* an important phase of rhinoplasty. It is supposed to help accentuate the shape of the nose during modelling. Aufricht holds the nasal tip firmly with two 1 cm wide adhesive tape dressings. Fomon and Goldman apply multiple narrow strips of adhesive tape across the dorsum and around the tip. Our adhesive tape dressing is similar. We begin by applying 1 cm wide strips tightly across the nasal root almost to the canthus. Application of these horizontal adhesive tape strips is continued downward, toward the tip like roof tiles. The strips are cut longer and longer and thus extend farther laterally toward the cheek. Sometimes the nasal dorsum is lined with cartilage grafts and increased height is desired by means of pressure from the dressing. Then one applies the strips loosely at this point on the dorsum and tighter above and below the desired prominence. It seems especially important to emphasize the slight supratip depression by means of the adhesive tape dressing. This is done by pulling the adhesive tape strip tighter at this point. A few strips are applied laterally from one nasal wall to the alar attachment of the other side so that they cross each other over the columella and somewhat depress the medial part of the ala against the resistance of the vestibular packing. This way one obtains the proper form of the nasal tip and can immobilize the scored lower lateral cartilages in their new shape and curvature.

Converse applies the adhesive tape strips as Aufricht does. Fomon pinches the adhesive tape strip running across the anterior part of the columella a little and cuts off the surplus fold. A second, smaller adhesive tape strip is applied over this point. When we apply adhesive tape strips and small wrinkles occur in the tape near the nasal tip, we also cut them carefully from the strip at their base and apply another shorter strip over the cuts.

Very many procedures and materials are used for *fixation* of the newly modelled, reduced, or straightened nose. Trendelenburg, who paved the way for treatment of deflected nose in 1889, immobilized the corrected position of the nose by means of packing and a truss-like support. Joseph constructed a *nasal brace* with adjustable padded arms for retention of the straightened or narrowed bony nose. This device is still in use by several surgeons. Safian constructed a similar brace. In 1947 HERBERT published an original construction. A wire structure fixed to a forehead band presses against a plaster cast on the nose. In 1954 the Russian, RADZIMIRSKIJ, described a device like that of JOSEPH. This is a forehead band to which levers with pads are attached medially on either side. The pads press against the lateral nasal walls and can be adjusted in any desired position by means of screws. In addition there is a third lever at the sagittal level which has a rubber-guarded clamp at its lower end for fixation of the septum. More complicated nasal retention devices for use after fractures are mentioned or described in the chapter on nasal fractures.

Dental stent is a very common material for the external nasal dressing. This was also used by JOSEPH. AUFRICHT, BARSKY, BERSON, SELTZER and FOMON have particularly advocated its use. According to AUFRICHT, the stent is lined with flannel (Fig. 514), fitted to the shape and size of the nasal dorsum and fixed to the forehead and

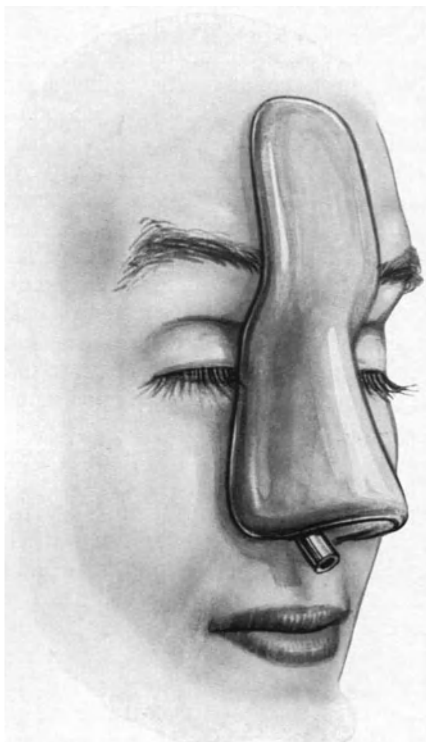


Fig. 514. Nasal splint made of stent (dental compound)

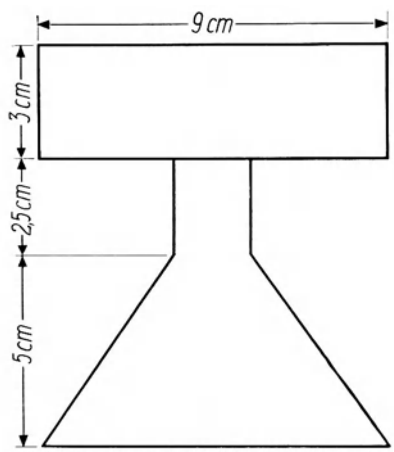


Fig. 515. Measurements for making a metal nasal splint

cheek with adhesive tape strips. FOMON places the stent on a linen cloth or felt and cuts out the desired shape. BARSKY covers the stent with a soft metal splint which is supposed to increase stability. Similarly, CONVERSE places the stent on a linen cloth and covers it with a soft metal splint.

Some authors use *metal splints* without a base of stent. Aluminum is particularly a well-liked material for such splints (BIENIAS, BROWN, MCDOWELL, SANVENERO-ROSSELLI, GALTIER, FARINA, and others). Until a few years ago we also used stent, aluminum, or combined aluminum splints as external nasal dressings. Aluminum splints can be cut to size easily from a plate with plaster shears and can be pressed into shape with no difficulty (Fig. 515). If the aluminum splint is not lined with stent, cotton, felt, or flannel is placed underneath it as padding. But in spite of this padding we have experienced decubital ulcers over the alae or on the lateral walls of the bony nose. For this reason we have given up use of the aluminum covering. The reason for the decubital ulcers was that we narrowed the already well-fitting splint by means of lateral pressure in order to increase the lateral compression of the repositioned nasal bones. F. Smith also used a copper splint, while Ashley and King made the nasal splint out of tantalum. May places half of a cork on either side of the nose and fixes the two pieces with adhesive tape. In the correction of deflected nose he uses only one piece of cork.

Many surgeons apply *plaster cast dressings*. Like the stent and metal splints, these dressings extend from the glabella over the dorsum to the nasal tip (Fig. 261). McIndoe and most English surgeons, as well as Herlyn, Lenz, and Wieland use plaster. A plate of 7 to 10 cm wide Cellona plaster dressing is made with 5 or 6 layers. The proper shape for the glabella and nose is cut from this. The plaster cast should cover the nasal pyramid and be supported on the forehead. The nasal tip is usually held with a second, thinner strip of plaster, which leaves the nostrils mostly free. The plaster adapts well to the new nasal shape. — Hauberrisser makes a thinner plaster dressing without support on the glabella. It is padded with sponge rubber. He extends the plaster dressing laterally over the cheek and fixes it with bands around the head. — We always use the plaster dressing after correction of deflected nose, wide nose, and hump nose with median repositioning of the nasal bones. Three strips of 7 or 8 cm Cellona are used. Each strip has 3 or 4 layers, depending upon the thickness and firmness desired. The first strip is placed vertically on the dorsum to just above the nasal tip. Its lateral edges are folded over at the transition of the nose to the cheek and medially to the canthus. The second strip is folded lengthwise so that it is only 3 to 4 cm wide. This covers the lower side of the nose, the nasal tip, the columella and a part of the nostrils. The third dressing strip is narrowed by means of folding where it will cover the glabella. The lower part of this strip covers the first two strips with its full width.

In our opinion the plaster dressing should always rest on the glabella (Fig. 261). Therefore we never do without the third strip which extends to the glabella. This keeps the plaster from wobbling after a few days. The trimmed and folded parts of the dressing are placed in water for the proper time and are dried off somewhat with a cloth just before application. While the plaster sets, the dressing is pressed lightly against the nose. If necessary slight lateral pressure is exerted on the nasal bones in order to increase the narrowing of the bony part of the nose. In the correction of deflected nose, the pressure is slightly greater on one side in overcorrection while the plaster sets. When the plaster is cool and firm, it is fixed in place with adhesive tape strips. We apply a plaster dressing in the case of nasal fractures as well, even if they are injuries in which the nasal bones had to be immobilized with wire.

For cases of corrective rhinoplasty in which no particular lateral pressure should be exerted on the nose, we make a splint of Plexidone, a *polymerized plastic*. The plastic is available as a powder and two liquids. The firm dressing is made by mixing the proper amounts of powder and the two liquids in a small bowl to form a dough. The dough is spread on the nose which is covered with strips of adhesive tape as soon as it can be kneaded and no longer is sticky. It is warm because of the polymerization. The plastic dough is spread evenly so that it is about 0.5 cm thick. In a few minutes the yellowish mass becomes firm and temporarily reaches a temperature of 40° C. Then it becomes very hard and has the advantage of being much lighter than a plaster dressing. When the splint is firm and again cool, it is fixed in the same manner as the plaster dressing with two to three strips of adhesive tape.

After 2 to 4 days the petrolatum gauze packing is removed from the nose. This must be done very carefully. The tip of the packing is grasped with a hemostat (Kelly clamp) and is pulled out slowly. At this time one can renew the sometimes bloody lower part of the adhesive tape dressing which fixes plaster or plexidone cast to the surrounding skin. *Removal of the entire dressing* after 1 week is recommended. In the case of deflected noses it should be left in place about 2 weeks. To remove it, one carefully lifts the splint and all of the adhesive tape attached to it away from the nose starting at the top. The nose and the surrounding area are scrubbed with benzine and the boric acid ointment is applied to the nostrils to counteract crust formation. The patient is instructed to apply ointment to the nostrils daily.

We recommend that patients who have has a lateral osteotomy and infracturing of the bones abstain from eating hard foods during the following 2 weeks. Griesmann even advises against biting with the front teeth during the first 6 weeks, until consolidation of the surgical nasal fracture has taken place. The lateral osteotomy interrupts the transfer of the chewing force to the glabella and the region of the forehead. This is temporarily disadvantageous for the tension relationships of the nasal and maxillary bones.

III. Pitfalls and complications in rhinoplasty

Like all surgery, esthetic rhinoplasty has its danger. Textbooks can sometimes give the impression that the best results can be obtained with the first attempt. But the experienced surgeon knows that retouching is often necessary and must be done carefully and with long consideration. Great demands are placed on esthetic operations, and sometimes non-professional people with no knowledge of the problems judge the result. In other surgery, the complications are often determined by the character of the disease, but in plastic surgery the patients are almost always in good health. The *general surgical risks* due to cardio-vascular disease, bleeding tendency, diabetes, etc., which are present in many surgical operations, have practically no importance for plastic surgery. If such a basic disease is present which could influence the operation unfavorably, surgery is rarely done. In spite of this, such complications sometimes occur and can not be avoided even with the greatest caution.

Often the patient *demands* too much and expects something from a cosmetic operation which can not be offered to him. One is then obliged to inform him about all possibilities of disappointment before the operation. But it can happen that an operation does not produce the desired and expected result. Then it is important for the surgeon to determine the cause of the inadequacy. The *importance of physiognomy* for the indication of rhinoplasty was mentioned in the introduction. It should be emphasized again that disregard of physiognomy increases the mistakes and the dangers.

In textbooks on plastic surgery there is relatively little detail concerning the dangers of surgery. Joseph also mentions hardly anything about the complications. Nowhere does he write that it is sometimes necessary to operate on the nose two or three times. On the other hand, some contributions concerning mistakes and pitfalls in rhinoplasty have been made by Dufourmentel, Safian, Berndorfer, Cohen, Lenz, Levignac, Haas, and Grignon.

One of the most common complications is overly slow absorption of *postoperative edema*. In general, swelling of the nose gradually decreases during the second week after surgery, i.e. after removal of the dressing. After 2 weeks the swelling is only slightly visible. Usually there is still slight swelling of the lower lids while suffusion at this point has ceased. The nose then has a certain stiffness. At this time it cannot yet be wrinkled, and the mimic musculature of the nose and its immediate vicinity is still inactive. If there has been more than normal bleeding during the operation, or if there is bleeding afterward in spite of a well-fitting dressing as a result of injury to a large blood vessel, then the swelling subsides more slowly. Reduction in swelling is also retarded by small infected hematomas and pustules on the nasal tip and on the dorsum, small necroses of bone splinters and foreign body reactions to grafts. If sinus infections are present, no corrective surgery should be made, unless there is indication because of obstructed nasal breathing. Surgery should then be done with antibiotic protection using doses higher than normal. Still we have observed stronger swelling and slower reduction of swelling in such cases postoperatively.

Rasps can be used improperly, or bone splinters can be left behind if the area of operation is not suctioned thoroughly after hump removal or after narrowing of the bony nasal structure. When this happens, sometimes *traumatic periostitis with later hyperostosis* occurs, especially in the region of the lateral osteotomy and the glabella. X-ray therapy in such periostitic edema and callus formation has been suggested by GOLDMAN and CERRI; we do not consider this to be suitable. More extensive callus formation must sometimes be removed in a later operation, after 1 year at the earliest.

As in all septum resections anterior and posterior *endonasal bleeding* can occur in rhinoplasty. When this happens, packing for a longer period of time is necessary. In extreme cases of bleeding from the vomer a BELLOC tampon of the nasopharynx is sometimes necessary. In addition transmaxillary ligature of the internal maxillary artery as by SEIFFERT can be indicated in the case of recurrent bleeding or in corrections after recent injuries. — The injection of hyaluronidase is mentioned in the chapter on preoperative preparation. We have observed no obvious reduction of bleeding tendency or of swelling with such injections. Therefore we have abandoned the addition of hyaluronidase in the anesthetic solution. Instead, in cases of increased swelling, we sometimes inject small subcutaneous doses of hyaluronidase postoperatively. It is injected in the region of the lateral nasal walls and the lower lids next to the nasal dressing. Otherwise we give routinely α-chymotrypsin in all cases in which postoperative swelling is expected, as mentioned above. To reduce the postoperative bleeding tendency vitamin K, vitamin C and other bleeding retardants are given.

In cases of *postoperative swelling of particularly long duration* we have also tried infra-red treatment, as recommended by ERSNER and ALEXANDER. No marked results have been observed by us with this therapy. ERSNER and ALEXANDER ascribe prolonged postoperative swelling to hypothyroidism and give thyroid extracts in such cases.

With swelling of long duration the skin on the dorsum and nasal tip can become *reddish or bluish* due to altered blood circulation, especially in the region over the cartilage. This discoloration is especially subject to changes in weather. Discoloration is much more pronounced in winter than in summer. Thus it is advisable to do the surgery during spring or summer rather than fall or winter in the case of patients with particularly poor blood circulation. In the case of noses which have undergone surgery several times, such local circulatory disturbances are particularly apparent. Normally the surgically treated nose assumes its permanent shape after 6 to 8 weeks and shows almost no more traces of swelling. In rare cases infiltrative swelling can still be present on the nasal dorsum after months. Then fibrous tissue is formed which must later be removed surgically. In the experience of SAFIAN such undesirable late swelling is observed in 8% to 10% of the cases. Among other things NUERNBERGK blames oral foci with lymph gland obstruction for prolonged swelling after nasal operations. He recommends counteracting this obstruction with small doses of ultrasonic treatment, massage, etc.

It is not so rare that patients suffer a blow on their surgically treated nose somewhere after removal of the dressing and thus impair the good result because of *secondary traumas*. For this reason the patients should be forbidden to participate in certain sports for a few weeks.

Particular attention must be given to the *consistency of the nasal skin* as well as in secondary corrections. Sometimes the skin is *very thin* and has little subcutaneous fat, especially in the region of the nasal tip. In such a case very careful handling of the underlying structures, especially the upper and lower lateral cartilages, is indicated. Postoperatively the skin is likely to become even thinner and reveals every irregularity and asymmetry of the underlying structures. In just such cases as these one should make no excision on the arch of the lower lateral cartilage. If it is necessary, excisions should be made only very sparingly and in the region of the medial crus. The method of LIPSETT (see p. 93) is also to be recommended here. In such cases it is sometimes better to do the modelling of the lower lateral cartilage by means of the eversion method (see p. 84) rather than with the luxation method (see p. 81). This way the lower lateral cartilage remains intact along its caudal border. One must also be very careful when using subcutaneous cartilage grafts if the skin is thin. As LENZ has also determined, the tip can change shape during the weeks following the operation as well as after several years. Thus on the basis of experience one must predict what extent of excisions is compatible with the consistency of the skin. At the end of the operation the tip should be somewhat shorter than one actually wants it to be, because postoperative thickening of tissue in the region of the dome is to be considered

The *thick skin over the nasal dorsum and tip* can also create problems. This skin does not always adapt readily to the newly modelled bony and cartilaginous structure. It is not elastic enough to adapt completely to the new shape, especially in the tip region. Sometimes fat, spongy tissue adapts particularly poorly over the nasal tip. If one has to reduce a very large, thick and long nose with spongy skin, one must clearly inform the patient that a later correction may be necessary.

In cases like this, one sometimes tries to press the nasal skin into the new shape and to retain it with tight packing of the nasal vestibules, a firm adhesive tape dressing and a plaster cast. When this is done there is danger of *small decubital ulcers caused by external pressure of the dressing* on the alae and nasal tip. These ulcers are usually not dangerous since they almost always disappear after a few weeks without leaving visible scars. Treatment with hydrocortisone ointments is required. The danger of causing such pressure ulcers can be reduced by lining the plaster dressing with cotton (HAAS). The more recent elastic adhesive tapes are accompanied by a certain danger of skin necrosis as a result of the stronger pull when they are stretched tightly. It is better not to use them with postoperatively corrected noses. A small circumscript skin necrosis can also occur in the region of the medianward repositioned nasal bones after correction of wide and hump noses. The position of such necroses can remain visible for years because of slight bluish discoloration. Thus too much pressure from the dressing should be avoided, whether it is of plaster, plastic, metal, or stents. Small skin necroses can also occur where small skin flaps are rotated at the lateral alar attachment or at the base of the columella. This happens if the flaps have not been sutured carefully enough, if the skin flaps are too narrow, or if drainage tubes press against the small flaps. Pressure necroses are also possible with the fixation of the BELLOC tampons, which are fastened with threads tied in front of the columella. This danger can be avoided by appropriate padding.

Sometimes after a few weeks there is slight hyperpigmentation of the skin in the region of the lateral nasal wall, especially medially to the inner canthus. Such hyperpigmentation can also occur later in the crease of the lid. The patient then complains of rings around the eyes. According to McGregor and his colleagues this occurs more often among brunettes with olive-colored skin.

According to Safian three unsuspected changes can still occur several weeks after a properly performed rhinoplasty even if a good result has already been obtained. These changes are swelling on the nasal dorsum, drooping of the nasal tip, and irregular retraction of the alar rim. Grignon rightly calls these late changes "uncontrollable complications" (pitfalls). Swelling on the nasal dorsum has been discussed above (see p. 446). The *extent of subsequent drooping of the tip* varies. It is determined by the contraction of the scar in the membranous part of the septum and the pull of the lip muscles during speaking and laughing. Thus the musculus depressor septi, mentioned in tip surgery (see p. 101), is important here. To prevent postoperative drooping of the tip, slight overcorrection during the operation is required. It may be that one must again raise the tip which has moved too far downward postoperatively. In the secondary operation, however, one may no longer over-correct, since less surplus and still stretchable tissue is available.

Irregular contraction of the alar rim is the third undesirable postoperative change pointed out by Safian. In our experience it is a less common complication. It is to be assumed that it can be avoided if the incision at the vestibule is not made too close to the border, especially in the region of the "soft triangle" of Converse at the dome (Fig. 1). Small tears at the vestibular rim and particularly in the region of the "weak triangle" can occur as a result of improper procedure during décollement of the skin over the lower lateral cartilages. Small contractions are also possible because of later scarring of these tears. It is important that décollement is done with as little trauma as possible by means of spreading the scissors blades ("manœuvre de Lagarde", Fig. 101). Dufourmentel has also pointed out the importance of precise décollement. — According to the suggestion of Safian contraction at the alar rim can be eliminated by means of incision at the vestibular rim and implantation of a thin, triangular cartilage graft.

Postoperative infections occur most often in the columella, particularly in the puncture channels of the mattress sutures along the transfixion incision. Actual furuncles on the columella may form from these. If sutures were not removed and checked accurately, such suppuration can be observed at the base of the columella. This is caused by infection of remaining bits of suture material. Secondary sinusitis due to packing of the nasal cavities rarely occurs.

In the case of *autolysis of cartilage grafts in the nasal dorsum*, the abscess must be aspirated several times. After aspiration smaller foci of breakdown again form on the dorsum. These must be removed again by aspiration or by incision from the intercartilaginous fold. With time so much reactive connective tissue is formed at the point of autolysis that the defect is completely filled again and no depression occurs. — *Bone sequelae* can sometimes be observed on the lateral nasal wall in corrections after accidents. They can cause prolonged suppuration. — According to Tessier danger of necrosis of the columella is supposed to be caused by repeated reinforcement of the columella with implants made of plastic or alloplastic material. Tessier has observed cases in which the columella was much deformed by this procedure.

If the skin over a healed implant is under too much tension, *thinning of the skin over the end of the implant* can be observed over a period of time. In such cases the implant should be removed before perforation of the skin with later scar formation takes place.

A relatively common poor result after rhinoplasty is slight *supratip curvature* in the region of the "weak triangle" of CONVERSE (Fig. 1). After complete reduction of the nose a fibrous hump occurs just above the tip, the "*parrot nose*" of SARNOFF and LENZ. This is a result of inadequate technique. To prevent this, after removal of the nasal hump one also removes a strip from the septal cartilage just above its lower anterior angle. The surplus subcutaneous tissue can sink into this recess. LIPSETT even recommends cutting a small notch in the cartilage at this point (Fig. 98). As well as the overly high septal cartilage, the cause of the postoperative parrot's beak shape of the nose may also be due to a promince of the tip cartilage which has been insufficiently proportioned with relation to the new profile (HAAS). At the end of the operation there must be a slight depression just above the nasal tip. This is determined by the lower lateral cartilages and subsequently fills with connective tissue. If at the end of the operation one leaves a straight dorsum just above the tip, then a hump is unavoidably formed with fibrous tissue due to the lateral compression of the dressing. This hump is very difficult to eliminate after removal of the dressing. It is even necessary to emphasize the slight depression just above the nasal tip by means of tight, horizontally placed, 1 cm wide adhesive tape strips. Careful application of the adhesive tape dressing is very important. One must avoid formation of too large a dead space in the "weak triangle" of CONVERSE or in the depression of LIPSETT due to the dressing and the packing. This is especially true if thick skin is present which adapts itself poorly to the underlying tissues. GRIGNON calls such subcutaneous dead spaces nests of surplus connective tissue reactions. — Sometimes one must correct the "parrot nose" $^1/_2$ to 1 year later by removing fibrous tissue from the "weak triangle" through an intercartilaginous incision. This can be done as out-patient surgery.

If too much is removed from the cartilage arch at the nasal tip and from the caudal border of the septal cartilage, the so-called "*crow's nose*" ("nez en bec de corbin", see p. 94) results. The nasal tip is pulled too much toward the lip, and the lip is pulled too far forward. The result is that the columella is too short. This mistake can be eliminated by reinforcing the columella with a cartilage strip (batten) (Fig. 122).

According to WALTER and HAAS a *slight postoperative supratip saddle*, in the "weak triangle" of CONVERSE (Fig. 1) and retraction of the columella are due to overly radical removal of the maxillary spine during septal correction.

Another source of mistakes is *poor adaptation of the columellar skin to the septal skin* in the region of the membranous septum during closure of the transfixion incision. The columella must be fixed absolutely symmetrically, either by means of mattress sutures or by suturing the edges of the incision bilaterally. One must be sure that the columella remains in an advanced position and is not pulled inward to the same level as the alae.

Too much cartilage can be removed in the region of the arch of the lower lateral cartilages in the nasal tip. As a postoperative correction a cartilage graft should be implanted. A curved piece of auricular cartilage is most suitable. After exposing the lower lateral cartilage from a vestibular rim incision and after severing the medial and lateral crura, one inserts the auricular graft into the resulting gap. The graft is then sutured at the caudal border of the lateral crus.

A relatively common mistake is *too much resection* not only at the angle of the lower lateral cartilage but also *of the corresponding vestibular skin*. The inner lining in the lower part of the nasal vestibule must be absolutely saved. This way no cicatricious contraction occurs at the transition from the alae to the nasal tip. Such contraction causes the ugly appearance which the French call "*nez chirurgical*", the Americans, "*pinched nose*". This danger is present especially with the use of the methods of SAFIAN, JOSEPH, GOLDMAN (see pp. 87, 89), and other similar methods. In these methods with complete severing of the vestibular skin and the lower lateral cartilages at the transition between the medial and lateral crus, it is recommended that one also remove the vestibular skin over the cartilage excision. One must be absolutely sure that the edges of the wound edges are sutured together after the excision of the strip-shaped piece. This way no open raw surfaces occur in the vestibule which in many cases would lead to deforming retractions. This danger hardly exists when one shapes the lower lateral cartilages after exposure using the luxation method (see p. 81) or better, using the eversion method (see p. 84). — The excision of vestibular skin and mucosa in the region of the upper lateral cartilages presents practically no danger, because retractions can hardly occur there.

COHEN and LEWIN have particularly studied the cicatricious *adhesions in the region of the vestibules* which occur after plastic surgery of the nose. In addition to obstructing function these adhesions can also have the disadvantage of bringing movable parts such as alae, tip and columella into an undesirable, cosmetically ugly position by means of cicatricious contraction. These authors emphasize that the occurrence of these adhesions can easily be avoided if one makes it a rule to leave no uncovered surfaces at the end of a rhinoplastic operation. Such raw surfaces should always be covered immediately with small flaps from the neighboring area. If that is not possible, free grafting of oral mucosa, THIERSCH grafts, or a full-thickness skin graft from the retroauricular region serves the same purpose. Synechias develop especially at raw surfaces opposite each other in the dome of the vestibule. Such synechias can also occur *between the septum and the lateral nasal wall* after rhinoplasties. We too follow the principle of COHEN for their correction. They are not just excised and the raw surfaces held apart by means of ointment packing until gradual epithelialization takes place, but they are covered immediately with free grafts or with flaps from the neighboring area. LEWIN also recommends free skin grafting with fixation by means of packing and mattress sutures. Like COHEN we have also had good results with two-layered composite auricular grafts for inner lining of the vestibule at the defects.

Slight *asymmetry* of the alae can be corrected during a later stage by means of an intranasal V-Y advancement. After extensive décollement of the skin asymmetries of the nasal tip and the anterior part of the columella can be corrected by means of implantation of a narrow triangular cartilage graft between the medial crura of the lower lateral cartilages.

With less practiced surgeons it sometimes happens that a *small laceration or tear occurs on the ala* because of accident or carelessness with the knife, scissors, or saw. This wound must be sutured with the finest suture material at the end of the operation.

In the much-used procedure of STRAITH, which has also been adapted by GOLDMAN and FOMON, the medial crura of the lower lateral cartilages are separated from the lateral crura, are straightened and sutured together. In this method *ugly prominences* which look like horns can occur *on the nasal tip*. This applies particularly to noses with thin skin. The defect can be eliminated by means of implantation of a round or oval cartilage graft. This is placed flat under the skin of the tip. Sometimes the lower lateral cartilage must be severed for raising and lengthening the nasal tip. In such cases, as mentioned in the chapter on tip surgery, a strip of cartilage (batten) is implanted in the columella anyway (see p. 95), in order to prevent a pinched nose. Sometimes is necessary additionally to insert a cartilage support in the columella as well as a round cartilage graft in the tip, after FOMON and SILVER (see p. 95).

Inadequacies can occur on the bony nasal structure due to poor *shaping of the nasofrontal angle* after hump removal. It is then sometimes necessary to remove a piece from the frontal bone as well with the chisel or with the LUER forceps. The bony border at the site of hump removal must naturally be smoothed with the rasp. — It still happens that narrowing the nose by means of paramedian osteotomy and median realignment of the bones is omitted after hump removal. The "*open roof*" occurs because of this, accompanied by the complaints which have been described by COTTLE (see p. 50). If the hump removal has been too extensive, one should not be afraid to reimplant a cartilage graft from the excised material at the end of the operation.

Because of poor fracturing of the nasal bones mobilized by means of osteotomy, a *thin bony ledge at the nasal root remains unbroken* and juts out. This is more likely to happen with the manual technique than with the procedure using the WALSHAM forceps. The spur must be removed with a forceps. Otherwise the prominence of the unbroken bony strip becomes clearly apparent after swelling has subsided, and the infracture must be repeated. If *no transverse osteotomy has been made* at the nasofrontal suture, the medially placed nasal bones can gradually spring back lateralward postoperatively so that they must be refractured later.

For the lateral osteotomy many authors make a second, small separate incision quite laterally in the intercartilaginous fold at the edge of the piriform aperture. They do not connect it with the first intercartilaginous incision. They think that a *stenotic ring between the vestibule and the nasal cavity* could occur because of lateral extension of the first incision. We have never experienced this using one intercartilaginous incision bilaterally. We can imagine, however, that adhesions are possible if the incision is made too far laterally and too close to the border of the plica nasi, i.e. at the caudal border of the upper lateral cartilage. A pocket is made toward the cheek by means of blunt dissection with an elevator. The proximal end of the saw blade of the bayonet saw or the RAGNELL saw can be placed in this pocket during the lateral osteotomy.

One should wait at least 6 months or a full year if possible before making a *postoperative correction*. It is important to explain to the patient before the first operation that a correction may be necessary and that it is not always possible to obtain a satisfactory result during the first operation. If small technical mistakes have been made, one must recognize these and definitely recommend postoperative correction to the patient. It should be emphasized that in most cases the inadequate results of rhinoplasty are not the result of technical mistakes, but depend on the vagaries of this delicate surgery. Similarly the surgeon can not be held responsible for an imperfect result if no obvious mistakes have been made, like leaving behind remnants of pledgets, or making careless postoperative treatment. If the patient withdraws himself from the required postoperative treatment, then he himself is responsible for a possible bad result.

In secondary corrections one must give extensive local and nerve-block anesthesia, since the tissue is much more sensitive. In addition the anesthetic does not diffuse thoroughly due to scar formation. Secondary procedure which affects the entire nose, including the bony structures, must sometimes be done under general anesthesia. In the case of slight asymmetries of the bony nose the entire osteotomy and infracturing must always be repeated. Bleeding is also more profuse than in the primary operation. Thus media which reduce blood pressure are in order. Postoperative infections occur much more easily in secondary surgery than in primary procedure. Antibiotic protection is mandatory. Subsidence of swelling also takes longer than after the primary operation. As mentioned above, discoloration of the skin is likewise more common and more pronounced. In the secondary operation it is important that one keeps to the anatomical conditions, even if these are no longer easily visible. This applies especially to the region of the lower and upper lateral cartilages, where it is often difficult to determine whether cartilage or fibrous scar tissue is present.

Keloid formation represents a serious complication in rhinoplasties in which an external incision was necessary. Such operations are correction of harelip noses and other nasal malformations and in replacement surgery. It is not always enough to know the tendency of the patient toward keloid formation. It is known that keloid formation can restrict itself to certain parts of the body. Thus, for example, in spite of a keloid-free abdominal scar a keloid can form in the rhinoplasty and vice versa. In case of patients with a keloid tendency one naturally operates only with inner incisions if possible. — Keloids seldom subside without treatment. If they do, this happens only very slowly. It would lead too far to discuss keloid treatment in greater detail here; keloid treatment also lies within the sphere of the dermatologist. We use X-ray radiation and combine it with local injections of hydrocortisone.

IV. Other nasal diseases in their relation to plastic surgery

1. Rhinoplasty in lupus vulgaris

The problem of reconstruction of defects due to lupus has already been discussed for the most part in the sections concerning anterior stenoses and atresias and nasal tip reconstruction (see pp. 251, 365). Smaller superficial defects can be repaired with full-thickness skin grafts after Wolfe-Krause.

Before reconstructive surgery after lupus one must be certain that no more lupus-infected tissue is present. One must take biopsies, and for safety treat the patient with vitamin D_2 combined with streptomycin and isoniacin. We have also used this treatment in our cases in collaboration with dermatologists.

During Dieffenbach's time, C. Bunger (1833) was the first to restore the nose of a woman suffering from lupus using free skin grafts. By 1932 treatment of lupus had still not attained the high degree of success that it has today. At that time Kilner warned against premature excision of active lupus tissue. He reported cases with extensive excision of inactive cicatricious areas, skin areas with radiodermatitis, and covering raw surfaces with pedicle flaps or with free skin grafts. Thanks to chemotherapy surgical areas are free of lupus much sooner today, and the results of plastic reconstruction are respectively better. In 1957 Rees published several cases of lupus of the nasal tip which he had corrected with large forehead flaps. He described a forehead flap midway between the horizontal forehead flap and the scalping flap of Converse (Fig. 486). In another case he used an acromio-pectoral tubed pedicle flap of Gillies. In still another case he covered a complete defect of the nose in the border region with an epithesis.

In some cases simultaneous presence of carcinomas is observed. In 1957 Griffith reported 57 cases of lupus vulgaris which were cancerous and all of which were treated surgically. Most of them affected the nose. The reconstruction of the nose was done for the most part by means of pedicled forehead flaps after excision of the carcinoma into the normal tissue. In the case of smaller defects on the columella, tubed pedicle flaps from the "snuffbox" ("tabatière") on the back of the hand were used (Fig. 390). Along with other methods, GRIFFITH used the scalping flap method of CONVERSE. — According to the experience of NEWMAN and BEN-HUR composite grafts only heal poorly or partially in noses which have been affected by lupus.

2. Abrasion and scarification in diseases of nasal skin (dermabrasion)

Abrasion and scarification can also be used in rhinoplasty. The use of rotating instruments for treatment of skin diseases goes back to the Berlin dermatologist, KROMEYER. He recommended three types of instruments. The circular or cylinder knife has as its cutting edge the rim of a hollow cylinder. The disc knife has the rim of the round disc as its cutting edge. The third type is the drill or the fraise, whose usually spiral cutting surfaces or teeth are more or less diagonal to the axis of rotation, so that they do not cut but rather scrape (E. KROMEYER, quoted from SCHREUS). SCHREUS modified the technique by introducing high-speed motors with rotation speeds of over 30,000 rpm. We use this fine method of treatment for removing scars on the nose and for planing acne scars. This method of planing should not be used on fresh acne with irratitive processes. We also use the method for the correction of beginning rhinophyma, for the elimination of dust tatooing after accidents and explosions, for the elimination of teleangiecstasias and to treat very superficial hemangiomas. In the case of dust tattooing we remove the entire skin and resurface the area with a full-thickness skin graft. Now and then smaller border areas, which could not be removed for certain reasons, must be treated later with the electric fraise. The planing procedure is an excellent aid which permits some improvement after extensive reconstructive surgery. For this reason the reader is referred to the treatise by SCHREUS and the bibliography contained in it.

Even before this a similar procedure for planing the skin was used in the USA. Instead of fraises, garnet paper was used. MCEVITT introduced it for treatment of acne scars and calls the method "sandpapering". A method of planing using brushes was later worked out by COURTIN and ELLER. Brushes have the same advantages as fraises, but they remove the material to be planed more slowly than fraises. Since they are particularly well suited for planing large surfaces, COURTIN uses them especially for treatment of the face.

3. Treatment of paraffinoma of nose

Injection of paraffin (see also p. 170) was still used often 30 years ago to fill depressions on the nasal dorsum. After such treatment later damage developed in the form of tumor-like granulomas, so-called paraffinomas. These diseased areas can be palpated as very coarse and are usually clearly defined in relation to their surroundings. The skin over them is as a rule more or less irritated and red and has livid discoloration. It can hardly be moved. The skin is very sensitive and sometimes broken by secondary infection. WIELAND and MUNDSCHENK reported in 1956 on a serious case of paraffin granuloma in a 70-year-old patient. 50 years before, the patient had been treated for saddle nose with a paraffin injection under the skin. For 50 years the substance apparently was tolerated in the subcutis without reaction. Mechanical irritation is supposed to have caused excessive growth. Because of its strong infiltrative tendency, this growth had to be termed malignant. The woman died from the tumor.

Often noses have to be recorrected after a paraffin injection dating back 20 or 30 years. In such cases we advise the patients to have the paraffin enclosure replaced with a bone or cartilage graft. Replacement is done by means of extensive décollement over the dorsum through the bilateral intercartilaginous incisions which are joined to the transfixion incision at the border of the septum. The paraffin enclosures have usually shrunk to small balls and can be removed easily. They are not generally fused to the surrounding tissue. The surrounding connective tissue is cicatricious and should also be removed completely. The resulting defect is best filled with an autograft. Often the skin over the paraffin enclosures is humpy due to scars. After removal of the paraffin these humps must be smoothed by means of excision with a scissors from within the pocket formed by the décollement. Sometimes the skin is thinned too much by this or it is affected by the paraffinoma as far as the surface. In this case one resects the endangered part and resorts to one of the methods of reconstruction mentioned earlier.

V. Epitheses

In spite of the great progress of plastic surgery, larger defects of the middle part of the face occur after tumor removal, excision of lupus tissue, or after trauma. They still have to be replaced with plastics in certain cases for the most diverse reasons. To be sure, the region of indication for epitheses has grown smaller and smaller during recent years, but there will always be a small number of patients who must be provided with epitheses either temporarily or permanently. — Today there is no longer any distinction between the terms, facial epithesis and facial prosthesis. KUKULIES termed the replacement which is held by eyeglasses or by a palatal plate an epithesis. The replacement which is inserted into the defect and which has a close connection to the adjoining parts of the face due to a particular means of attachment he calls a prosthesis.

The attempts to correct maimed faces artificially reach far back into history. Destroyed noses are said to have been replaced with plaster noses among the Asians. Artificial noses were also found on Egyptian mummies. Artificial noses were made of wax or balsams by the Chinese. Emperor Otto III wore an artificial nose made of gold. AMBROISE PARÉ judged the possibility of a rhinoplasty very skeptically. He recommended nasal prostheses of metal, enamel and paper which he attached to the head with wire. In 1875 BARDELEBEN described a nasal replacement of wood. After the beginning of the 20th Century, a mixture of gelatine and glycerin was used for nasal prostheses (SALAMON, SPITZER, BERCOLWITSCH, quoted from ZÜHLKE and SEIDEL). This material was the first to have the desired properties, elasticity, and capability of being colored well. Its durability was limited, since the material changed with dampness and warmth. Epitheses of latex, as advocated primarily by the Americans (BULBULLIAN, BARSKY, BLAIR and BROWN, CLARKE and others), showed inadequate durability and stability toward weather. In the latex method the liquid, prevulcanized latex rubber, was poured into the plaster mold and heated to 70°C. It was then allowed to cool very slowly so that it did not change shape (BARSKY). Formerly dentists often dealt with the problem of cosmetic prostheses and epitheses, because of their particular knowledge in the field of the suitable materials. HENNING, a chemist, painter, and sculptor, was the first to make a large number of excellent facial masks. He gave the patient a mold. With this the patient was able to make the epitheses himself out of a wax-like mass. The composition of this elastic epithesis compound was kept secret by him. SPITZER was the first to describe a technique which made possible routine manufacture of epitheses.

As an ideal solution elastic epitheses were sought. For a long time they were made according to the gelatine method, and they sometimes still are today.

But with the improvement of plastics, the trend is toward this material. Today the requirements of the material for epitheses are: durability with long use; resistance to influence of weather, tissue fluids and secretions; and simplest possible manufacture. In addition there is the desire for elasticity, but it has become apparent that both the firm and elastic epitheses have disadvantages. With the introduction of *hard plastics* like acrylic materials into the production of dental prostheses, these plastics were also used to make epitheses, primarily because they showed durability and were tolerated by tissue. However they are nonelastic and therefore difficult to attach and show inadequate closure along the borders. WEISSKOPF used the plastic, Tiacryl, an acrylic acid derivative. But this plastic likewise has the disadvantage of being firm. Over a period of time it also changes color. The epithesis then appears somewhat darker and stands out from its surroundings. — With firm epitheses one usually sees a thin crevice at the borders of the defect between the epithesis and the skin of the neighboring area. In this respect the gelatine epithesis is better than the firm plastic one. *Soft plastics*, however, have superseded gelatine epitheses. First *polyvinyl chloride*, which has high elasticity, was tried as a soft plastic. The polyvinyl chloride paste was shaped elastically like rubber. Basically the ideal condition was approached with an elastic epithesis which was quite similar to the skin. But the softener which was originally added during manufacture irritated tissue. This skin irritation was avoided later after use of a different softener discovered and tested by WEIKART. Recently *vinyl chloracetates* (Skin-Tex, Dicor A-S 79, Epidone and Flexi-Derm) developed in the United States have been recommended. The inadequate durability of color of these materials was balanced by WELLINGTON by means of a stabilizer. — RITZE reported on the plastic, *Plexiderm*, which remains soft and the results achieved with it. Plexiderm is durable, tolerated by tissue, resistant to heat and cold as well as to moisture and secretions. It adapts elastically to the shape of the face and does not disturb the facial expression. But it is said to become bleached due to secretions. Shaping it is relatively easy. A plaster model is made in the usual manner and from this a negative of the nose to be replaced is prepared. The plexiderm is colored to match the skin tone of the patient and poured into the negative mold to form the epithesis. Corrections can be made afterward. — Newer materials for epitheses are constantly being developed. Such substances are the plastic *WE 35*, tried out by DIETRICH and RITZE, and *WE 50*, which was publicized by ROSENTHAL, ZÜHLKE and SEIDEL. WE 50 is a mixed polymerisate on the basis of acrylic substances. Its elasticity is due to a non-volatile internal softener. *WE 60* was developed from WE 50 and differs from it in that it has a loose internal structure which is enclosed within by means of a soft, compact layer. Because of this the weight of the epithesis is reduced and the pliability is increased. Saliva is said to yellow this material which is otherwise resistant in structure and color (STOIBER).

Molds are made in the same way for gelatine and for plastic epitheses. First an *impression of the face* is made in plaster or another material. Plaster produces adequately accurate impressions. But ZÜHLKE and SEIDEL recommend using silicone rubber. It is supposed to be more elastic and is said to reproduce more accurately the fine indentations which undermine the defect borders. These indentations are said to be important for holding the epithesis in place later. DIETRICH recommends Zelex as an impression material. It is supposed to reproduce all slight unevennesses very precisely. DIETRICH stabilizes the impression by means of wire screen embedded in the plastic compound. A layer of plaster can be added to a more extensive impression. — The impression is now prepared for making a plaster model, the *positive*. To make the impression more resistant, it is painted with an alcohol-base shellac. Then it is greased with liquid paraffin and dusted lightly with talcum powder. This makes it easier to separate the positive from the impression. The positive is made by pouring plaster into the prepared impression. After the plaster has set, the impression and the positive are separated. Sometimes one does not succeed in separating them immediately, but the procedure may be aided by carefully tapping the impression from the side with a wooden mallet. — The *future epithesis is modelled in plasticine* or in wax on the positive. Plasticine is preferable to wax because it can be shaped more easily. When shaping the model, one must be sure not to make the nostrils too large. — The positive with the plasticine epithesis is now greased with liquid paraffin and dusted with talcum to prepare it for making another plaster mold, the *negative*. The positive and the plasticine episthesis are now covered with a layer of plaster a few centimeters thick. After this has set, the positive and negative are separated. The epithesis model of plasticine or wax is now removed. When the positive and negative are placed together, a cavity is formed which corresponds to the desired shape of the epithesis. The cavity is then lined or filled with the plastic or gelatine substance to make the epithesis.

The compound for *gelatine epitheses* consists of gelatine, glycerin and the proper coloring. One can also add a bit of woodworking glue. 100 g glycerin are brought to a boil in a water bath. Then 50 g colorless gelatine, which has been soaked in water, is added. When the gelatine is completely dissolved, one adds small amounts of the color to the boiling mixture. The color has been dissolved in a little water. The entire process is done with constant stirring. One adds a little opaque white, then carmine red, and finally a little light ochre, if the skin tone is brown. It is very important that the color of the mixture is exactly the same as the skin color of the patient. To give the impression of superficial skin vessels one can add a few strands of red wool fibers with the color. — It is not necessary to make the mixture stiffer, but this can be done with woodworking glue. If this is desired, one soaks 15 g of it for 24 hours so that it becomes soft and adds it to the boiling mixture while stirring before adding the color. — The prepared, colored mixture is poured as hot as possible into the shellacked, greased, and powdered negative, and the positive which has been similarly prepared is quickly pressed on top by hand. In cooling the mixture soon becomes firm; therefore one must work quickly. — Since the mixture prepared according to the formula above is naturally too much for just one nose, one can save the excess for making further epitheses. The mixture becomes liquid again when heated. — Before one takes the epithesis from its mold, it should be placed for about 1 hour in a cool room or in the refrigerator. When separating the positive from the negative, one must again tap the molds lightly from the side with the wooden mallet. The epithesis may have protruding edges which may be trimmed with scissors. In order to make it appear matte like the surface of the skin, one can powder it.

To make *plastic epitheses* it is necessary to embed the plaster positive and plaster negative in an incubator. Both parts must be clamped together in a press after being filled with the plastic and kept at a constant temperature in an incubator or in a water bath during the hardening process. The plastics are prepared according to the manufacturer's directions. It would be too much here to go into details, especially since new and improved plastics are always being found. Detailed descriptions about making plastic epitheses are those by Zühlke and Seidel, Dietrich, and Paschke.

Gelatine epitheses must be renewed often, since the compound contains water and as a result dries out. But the patient learns easily to mold epitheses and to apply them to the defect.

When coloring plastic epitheses one must make sure that the color corresponds to the lightest part of the skin. After polymerization the plastic can be darkened, but not lightened. After the polymerization has ended, the plastic must cool slowly. It should be removed from the mold when the mold is completely cool. The parts of the epithesis which will lie against the skin are polished to make smooth contact possible. With hard plastics this can be done only with fraises and sandpaper.

As an adhesive various authors suggest Mastix (Mastisol), tincture of benzoin and household cement. More recently quick dressings with a plastic base have been used. The last is applied in small strips at several points on the epithesis.

Many epitheses of the nose are attached to the frame of a pair of eyeglasses. When the defect cavity connects with the oral cavity, attempts are made to join the epithesis and the dental prosthesis by a suitable means such as a snap or a pin and socket. KAZANJIAN and CONVERSE show the possibility of attaching epitheses by means of a hook to the bridge of the eyeglasses over the glabella. A tongue-shaped projection of the epithesis rearward rests on the nasal floor.

Sometimes the application of nasal epitheses must be combined with surgical measures, e.g. if the defect extends far into the cheek or also includes the upper lip. One must replace at least the border defect and above all the lip defect by means of flap rotation from the neighboring area before an epithesis can be applied. In 1947 KAZANJIAN described an example of combining an epithesis and surgery.

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General

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Rhinoplastic procedure

Corrective rhinoplasty. Bony nasal structures

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Saddle nose

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Appendix

Rhinoplasty in children. — Dressings.
Other nasal diseases. — Epitheses

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