Handbook of Basic Clinical Manipulation

Donald Lee McCabe
DO, FACFP, FAPM

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Donald Lee McCabe, DO, FACFP, FAPM

This highly illustrated clinical manual is designed to cover basic manipulation for osteopathic and allopathic medical students and practitioners, chiropractors, physiotherapists, and related specialists. It is a simple, practical and useful guide to the fundamental principles of the osteopathic manipulative practice of manual medicine.

Features include:

- Well-illustrated; a "how-to" book for students learning basic manipulation techniques for treating the structural dysfunctions of disease
- Contains 250 illustrations, which focus on essential manipulation techniques
- An excellent review of basic anatomy on which to base manipulation methods
- An invaluable sourcebook for learning the art of manipulation

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Foreword

The use of the hands to bring about changes in patients is no doubt as old as civilization itself, perhaps older. The practice can be found throughout the world and in all cultures and has been a part of medicine from ancient to modern times. There have been various theoretical constructs and models presented to account for the empirical results obtained by multiple types of practitioners. As with most things, multiple educational systems have evolved and are evolving to contribute to this body of knowledge.

In general, there have been few books produced on manual medicine, as manipulation has come be known, in comparison to other branches of the healing arts. Perhaps even more books have been written to decry the lack of 'scientific evidence' for manipulation than have been written in its defense. The osteopathic community has been somewhat remiss in producing books to fulfill this need. As early as 1927, Leon Page, DO stated: 'There has been no new book on the fundamental principles of osteopathic practice in recent years'. Dr McCabe has done his part to change the situation.

In many ways, Dr McCabe has returned to the roots of osteopathic writing in the production of this book. From the start of the profession in 1892 until the period of the Second World War, the body of osteopathic literature was, in general, produced by the people actually performing the techniques. This resulted in a lack of systematic terminology which continues to the present. Each writer chose descriptive terms which they felt were appropriate to the explanations of their techniques. For perhaps the last 50 years, and especially during the last 30, there has been a movement within the osteopathic profession to codify the language and the treatments described. During this period, many of the books produced have been written by the teachers of technique in the various osteopathic institutions, rather than the practitioners of the art. The book contains elements of both camps.

Dr McCabe has produced a book which will be of interest to a broad range of practitioners within and outside the osteopathic profession because of its readable and practical approach to manual medicine. While it is written by a generalist for generalists it will find a place on the bookshelves of specialists as well as any practitioners who perform manual treatment in their practice. Allopathic, chiropractic, naturopathic, as well as other physicians and physical therapists, should find this book useful because of its simple, straightforward approach.

The book is not intended to be the final word on all aspects of manual medicine but to provide lifelong learners an opportunity to expand their knowledge base with the principles necessary to develop and utilize procedures of their own that benefit the patients in their practice.

Loren H. Rex, DO
URSA Foundation

Part 1

Orientation

1

INTRODUCTION

In almost all cases, patients come to a physician because they are suffering and they are seeking relief from pain and discomfort. The particular diagnosis is generally of secondary importance at the time. Even when there is a specific diagnosis, however, common sense and years of experience tell me that - except in such cases as injury due to accident - it is a rare patient who has an organ with an isolated disease in some limited sense. In reality, every disease affects the whole person.

It is my belief that treatment of most patients' complaints should not be limited to just treating a specific categorical disease. Instead, it is necessary to treat the whole person. Every disease process is set in motion by (and in turn sets in motion) a variety of physical, chemical and psychological events. This is why disease processes affect the whole body, and why, therefore, just treating a particular disease area for symptomatic relief most often leaves something to be desired.

A 'holistic' picture of disease can seem a bit overwhelming; however, it actually brings enormous hope and promise to the physician's role (by 'physician' I mean not only a trained doctor, but any person acting on behalf of another in a healing role, and especially, perhaps, the patient who wishes to assume responsibility for his or her own well-being). This holistic approach means that every disease must have an observable physical manifestation, a departure from the status of health, which can be seen as a way to 'get a handle' on a particular illness. This structural component of the disease process is significant, and I believe it should be addressed as a vital part of treatment. *Manipulation is a manual method of dealinq with adverse structural conditions that reflect less visible components of disease.*

Patients appreciate physicians who see them as people, not just a collection of symptoms representing a particular disease. The 'traditional' view tends to treat specific diseases without regard for the whole person. This approach may be prudent in the practice of certain specialty areas, but not only is that narrower perspective unnecessary, it fails to make use of a wide range of treatment methods and tools. Applying the principles of manipulation often provides a new and easy access to the treatment of disease and the restoration of well-being.

The purpose of this text is twofold. First, it is to help encourage the integration of manipulation into the general practice of medicine and second, to provide a helpful manual for anyone interested in understanding the basics involved in the use of manipulation in improving the total 'wellness' of the organism - physiologically and psychologically.

This book specifically addresses the treatment of altered structural components that reflect disease processes and describes methods for relieving symptoms, signs and underlying disease.

MANIPULATION: AN ANCIENT ART/NEW SCIENCE

Manipulation refers to certain manual procedures for both detecting and interpreting irregularities in the body structure and then applying specific manual maneuvers to restore a more balanced physical structure. The improved structure enhances the body's efforts in re-establishing health.

Historically, the use of manipulation to alleviate pain and suffering is not new. There are references to its use dating back 4000 years in Indo-China; however, in America, it was only in the last century that body structure was considered to be an important component of disease in general. In the late 1800s, a Mid-west physician, Dr Andrew Taylor Still, began to note a correlation between his findings of altered structure in his patients and the value of treating these changes to help patients recover from illness. Dr Still organized a structural system for diagnosing and treating diseases, based on manipulation. Out of his work grew the osteopathic philosophy and the first osteopathic medical school

Dr Still gave the initial impetus for this new form of treatment and the use of manipulation was elaborated by some of his followers. One of Dr Still's students, George Palmer, split off from the then American School of Osteopathy (now the Kirksville College of Osteopathic Medicine and Surgery) before completing his medical education to found a school promoting a specific manipulation which he called chiropractics.

The use of manipulation, with its related structural considerations, has made osteopathic medicine and surgery distinct from the main stream of allopathic medicine. Osteopathic medicine's emphasis is on treating the body, or host, manually to provoke or to initiate the patient's own response to body stresses, which may be in part due to structural derangement. In contrast, traditional (allopathic) medicine has focused on and addressed the disease process, attempting to specifically treat symptomatic factors, principally with medication. The allopathic medicinal approach has been to treat the disease; the osteopathic approach, in contrast, is to treat the person holistically with emphasis on structural considerations. This holistic position includes hygiene in the most comprehensive sense. Both allopathic and osteopathic philosophy have merit; they are not mutually exclusive.

Medical subjects are usually discussed and written about with reference to a specific disease; medical practices are categorized under various recognized specialties. It is no wonder, therefore, that subscribed treatments tend to be specific to the descriptive disease without consideration of the entire person. In this light, from the perspective of allopathic medicine, manipulation has been considered and presented specifically, as a thing unto itself, not as an entire system to be used in the context of total patient care. This is in sharp contrast to the original concept of manipulation, which was to focus attention on the structural reflection of disease in both diagnosis and treatment.

The position subscribed to herein is that manipulation is applied in order to facilitate the host response to disease, by addressing the structural deviations that occur in various diseases as seen in general practice, in order to enhance the biomechanical and biochemical host responses for optimal healing. Manipulation may serve as a preventative measure, since structural changes (lesions) may take place prior to overt or manifest disease.

HOMEOSTASIS: LIFE IN BALANCE

All disease reflects structural, biochemical and psychological imbalance within the body. Schematically, the equilibrium of homeostasis, the state of health, is maintained by a proper balance between these descriptive areas. Disease is a reflection of a body's imbalance of these areas, with one or more of these areas put under stress. When this occurs, the most dominant area of decompensation will generally be prominent as the primary area of stress with the other two areas supplementing the imbalance. If this theory is acceptable, it suggests that treatment may very well be only needed to address the primary decompensation (the disease) since the secondary reactions would appear to be self-correcting once the primary disease system is corrected; however, sometimes this does not happen. In such cases, addressing the structural dysfunction may make the difference in the host's response to medicinal or other treatment.

By improving structure with manipulation, body functions improve, circulation improves, neurovascular tone improves, and organ functioning improves, such as is seen in the immune response. It is understandable that patients usually feel better and more comfortable after manipulation.

Structural alterations have pervasive and specific effects on the body's functioning. These are not simply limited to the musculo-skeletal tissue. Other tissues are affected, too, such as arteries, veins, lymphatics, and glandular and neurological tissues.

Clearly, a bone fracture is a primary structural disease, but there are also biochemical and psychological changes. Similarly, in pneumonia, which is primarily a bacterial-biochemical illness, structural changes occur, such as biomechanical restrictions of the thoracic myofascial contractures (i.e. costal or rib musculature and respiratory diaphragm) and pulmonary congestion, which affect cardiopulmonary function mechanically and biochemically.

Biochemical changes result not only from structural alterations but also from metabolic alterations. Disease of one system can cause regressive psychological changes, for instance, resulting in a patient's loss of individual independence and in his becoming auto-intoxicated.

Osteopathic manipulation, presented herein, can affect the balance of the structural component of the human anatomy in such a way as to trigger a host response, reflectively and associatively, with a subsequent re-balancing of biochemical and psychological components. Thus, the patient has an opportunity to experience once more the full-life restoration of body, mind and spirit.

2

LESIONS

WHAT IS A 'LESION'?

Some patients ask me, 'What's causing my pain? Do I have a bone out of place? Did I pull a muscle?' Perhaps people get the idea that there is simply a bone out of place because there is generally some skeletal or bone/joint correction or adjustment necessary in the treatment of lesions by manipulation, but to say, simply, that a bone is 'out' limits our understanding of what a lesion is. For a bone or joint malfunction to occur, there must be concomitant alterations in all associated structures, including ligaments, fascia, muscles and neurocirculatory structures. A useful analogy is that if one piece in a clock mechanism goes wrong, it affects the entire function of the timepiece.

Physiologically, all healthy tissue must be free to move within the ranges intended by nature. Any restriction in the normal or optimal motion is pathological, and the degree of restriction determines the extent of disease. In short, life is motion. Death is the epitome of restricted motion. When parts of the body are immobilized for too long, there can be atrophy or tissue degradation.

Even in medical circles, when the term 'lesion' is used, reference to articular elements is generally inferred. However, this is too limiting and may be misleading for a fuller therapeutic understanding. For a more thorough understanding, it is necessary to think of all the structures as being in an inter-related complex. Thus, a more comprehensive understanding of the concept of lesions must include considerations of all associated anatomical structures affected by structural decompensation.

Acccording to Dorland's *The American Illustrated Medical Dictionary,* a lesion is any pathological or traumatic discontinuity of tissue or loss of function of a part. Simply put, a lesion is an alteration of structure from the norm.

The American Osteopathic Association defines a lesion as a somatic dysfunction. In osteopathic medicine, an articular lesion is any alteration in the anatomical or physiological relationships of the articular (musculoskeletal) structures, resulting in local and/or remote functional disturbance. An osteopathic lesion is any pathological variation from the normal in the position of soft tissue support and mobility of one or more skeletal structures which originates or registers signs and/or symptomatology or pathology; however, some lesions are non-symptomatic.

These definitions incorporate consideration of abnormal interosseous (bone-to-bone) relationships, with either restricted or excessive motion, abnormal soft tissues (lymphatics, blood vessels, nerves, fascia, muscle, ligaments), as well as both peri-articular and remote tissues. It should be noted, too, that some lesions are non-symptomatic to the patient, i.e. not apparent to the patient.

WHAT CAUSES A LESION?

Anyone can experience a lesion at any time in life, but, in general, time takes its toll. In a world fraught with stresses from gravity, technology and accident, the breakdown of all systems is a fact of life. Some causes of lesions are:

(1) Fatigue: causes increased irritability of myofascial soft tissues.

(2) Psychic tension: aberrant psychic energy shunted to an organ; the psychosomatic factor of cathecting psychic energy to body structures such as muscles or the gut.

(3) Compensation: altered mechanics to offset imbalance.

(4) Direct force: trauma or injury, direct or indirect.

(5) Reflex: a viscero-somatic effect, such as kidney infection causing back pain.

(6) Infection: viral or other bacteriological factors with toxins causing irritability or pain in muscles and nerves.

(7) Thermal: cold draughts, dampness, hot dry conditions.

(8) Exaggeration of motion: exercise or work.

(9) Toxic chemicals: smoke, allergens, alcohol, cleaning liquids, DDT, etc.

Other factors that modify physiological movements and affect the severity of lesions are: gravity; articular facets and joint configurations; bony shapes; and soft tissue limits of fascia, ligaments and muscles.

Lesions may be either primary or secondary. They can manifest themselves acutely, sub-acutely or chronically and may occur insidiously and quietly. An example of the first might be acute torticollis (wry neck) from sitting in a cold draught. Another condition is an acute lower back pain from getting out of bed or bending over to pick something up. The latter may manifest itself by just gradually feeling below par or by finding progressive limitation in some movements where the pain is not obviously caused by an overt injury.

Structural lesions, i.e. altered tissue structure, are manifested particularly in overt disease, but lesions also occur in covert conditions and may be a precursor condition for the inception of overt disease. Thus, the identification of structural lesions contributes materially to understanding pathological processes, so helping in the prevention and active treatment of disease.

A structural lesion (osteopathic) is any structural perversion that produces or maintains functional changes from the norm, reflecting disorder somatically, viscerally, neurally, vascularly, glandularly and psychologically. To better understand the importance of structure in health and disease, it must be appreciated that 'osteo' (as in osteopathy) refers to structure, not simply to bone. The somatic or body effects of structural lesions are demonstrated in motor, sensory and visceral changes, the latter having been documented in postmortem tissue examinations.

The perception and appreciation of specific lesions comes through palpation (the manual practice of diagnostic osteopathic manipulation). Lesions can be detected by:

(1) Altered skeletal structure with alteration of joint motion. Musculoskeletal lesions involve different kinds of joints. There are three types of joints:

   (a) Fibrous joints: contiguous fibrous tissue, little motion, e.g. cranial calvarium sutures, distal fibulo-tibial joint;

   (b) Cartilaginous joints: hyaline cartilage or fibrocartilage disc, least motion, e.g. symphysis pubis, sphenobasilar synchondrosis; and

   (c) Synovial joints: connective tissue capsule, most motion, e.g. elbow, knee, shoulder.

(2) Altered soft tissues:

   (a) Muscle: may be palpated as fibrous, ropey, boggy, jelly-like, rubbery;

   (b) Fascia: may be hypertonic (tight) or hypotonic (loose);

   (c) Vascular: congested, nodular, with a thrill; and

   (d) Viscera: swollen, rigid, ptosed.

STRUCTURE GOVERNS FUNCTION

Normal function is dependent on normal structure. When human structure is altered by stress, whether due to physical, chemical or psychological factors, there is usually acutely increased irritability and edema of soft tissues, which is a sign and/or symptom (if pain is present) of the somatic component of active or incipient disease.

When a structural lesion is chronic, the surrounding myofascial soft tissues may be found to be fibrous and more rigid than normal and the pain or soreness noted is not usually as great as when the lesion is acute.

For a comprehensive understanding of the pervasive effects of lesions, attention should be paid to the inter-relationships of body systems or parts, particularly the nervous system. The autonomic nervous system reflects the interdependency of various parts of the body: consider the viscero-somatic, somatico-visceral, and somatico-somatic reflexes. Alterations in structure effect somatico-visceral reflexes, causing visceral functional changes that in time lead to organic structural changes. As examples, consider the way in which lower back lesions alter bowel function, or cervical lesions cause headaches or bronchial problems. Due to the continuity of muscles and fascia, structural changes to the lower back can effect structural changes up the central axis, causing lesions in the cervico-occipital area.

To better appreciate structural lesions, a person must learn to perceive variations in tissue textures by palpation. This is accomplished by the repeated practice of palpating tissues. A practitioner must touch and feel the tissues or he or she will certainly not develop discretion and appreciation of the anatomical tissue changes that occur as a result of disease. Information gained by palpation expands a physician's understanding of the disease process. For example, when there is a sore throat or upper respiratory infection, simply observing the person's oropharynx limits a physician's understanding of the disease considerably as compared to a physician who also palpates the neck and underlying soft tissues and finds congestion with adenopathy and myofascial contractures. Also, a physician who just looks at a leg does not gain as much information as one who feels and palpates the leg for evidence of vascular insufficiency, inflammation or the extent of edema, or whether the edema is hydrophilic or lipophilic.

Lesions exhibit asymmetry of form and function, altered range of motion and tissue deviation from the optimal physiological texture. Textural changes may be felt, from a slight bogginess to a coarse fibrousness in myofascial tissues as compared to the normal texture of relaxed forearm muscles, or in the case of articular lesions there may be ligamentous congestive changes altering the normal texture. It is helpful to compare the homologous or contralateral tissues, which may be taken as the norm, such as in testing a lesioned shoulder and comparing it with the opposite shoulder.

Structural changes are either the result of active disease or a condition leading to a further disease process or both. Many lesions are covert and are not appreciated unless revealed by palpatory testing, although some structural lesions are overtly called to attention by pain or discomfort which is noted by patients and called to the examiner's attention.

The role of structure in the treatment of some diseases has been accepted in part by allopathic medicine by the incorporation of physical medicine into practice; however, the allopathic use of manipulation is not with the sophisticated theoretical view as already expressed. Structural treatment with manipulation is generally accepted in some lower back and neck problems, but even here the incorporation of manipulation into the total medical program is often lacking. Those conditions which are treated with manipulation are generally accepted as primary structural problems; however, there are diseases with considerable structural change that are not generally seen as involving structural problems, such as pneumonia, hypertension or gastroenteritis. However, the structural changes play an important part in the disease process and in the host response to treatment. These medical diseases also respond well to manipulation. It must be borne in mind that, as with any treatment modality or prescription, the treatment does not always yield the desired or usual host response. There are some persons who respond very well to manipulative treatment; on the other hand, there are a few patients who do not respond well to manipulation, they are usually persons who do not like being touched.

The most frequent cause of patients seeking medical help is pain. After manipulation is judiciously applied for the correction of lesions, patients usually experience a feeling of relief from pain to some degree and/or have a feeling of well-being, some immediately and others several hours later. This effect may last from a day or more to a few weeks depending on the patient's condition. In the manipulative treatment of some conditions, there are dramatically good results which take a patient from crippling pain to freedom of motion and painlessness. Undoubtedly this feature has materially contributed to patients seeking manipulative therapy. To those of us who have an understanding of the underlying principles of manipulation, it comes as no surprise when patients respond dramatically. Sometimes we forget just how good a person feels after manipulation, so it is recommended that persons who practise manipulation also experience manipulation from time to time. What is necessary in addressing the treatment of a structural lesion is that it is considered as part of the total treatment program for the patient. The treatment may involve only the use of manipulation, or there may also be a need to use supporting medication, such as anodynes, anti-inflamatory agents, muscle relaxants, etc.

The purpose of this text is to facilitate a holistic program for the concurrent utilization of biophysical (structural), biochemical (medicines) and psychological modalities in the treatment of patients with various disorders by general practitioners.

3

PALPATION

Before therapeutic manipulation can be used, tissue discretion and appreciation are needed, and this appreciation comes with increasing experience in palpating body structures. The ten fingers of the hands are unsurpassed for diagnostic and manual treatments. Hands may disclose information about a patient that can be gained in no other way. The information is unique. Observation, auscultation, radiology, myography or thermography alone cannot give the information that palpation may give. There is no other means apart from various X-ray techniques of assessing certain structures other than by palpation. The use of palpation requires tactile perceptive sensitivity of the hands, aided by observation. With the development of the very important sense of touch, a new appreciation is gained of the importance of structure in the detection of lesions for diagnosis and treatment. The use of palpation is applicable to all tissues: skin, fascia, muscle, skeletal, vascular and visceral.

Just as the average person cannot make sense out of braille until he or she has been taught the meaning of the dots and has had repeated practise in feeling the small, raised dots, so it is in appreciating the value of altered structure by palpation. An experienced carpenter can tell what kind of wood he is using just by using his sense of touch on the wood. An experienced tailor or dressmaker can tell what the fabric is, whether it is linen, cotton, silk or wool simply by his or her sense of touch. Likewise, becoming proficient in palpation requires repeated and focused use of the tactile sense. To become well-versed in the talent of manipulation, repeated use of the tactile sense is needed to appreciate the quality of structure and the level of vitality of tissues in health and disease. When palpating or actively manipulating, the operator should maintain tactile discrimination of the affected area as much as possible so as to appreciate tissue changes. The experienced palpator perceives with his hands what the novice has yet to learn.

The proper use of palpation is essential for successful manipulation. The practitioner's hands must be nimble and sensitive in order to be sufficiently receptive to perceive tissue consistency or texture in the neutral or normal state through the range of motion. For instance, when the neck is cradled with both hands, the fingers are used to feel and explore the various levels of structure from the skin right down to the bony anatomy - the cervical spine. The practitioner notes the degree of joint flexibility or restriction while gaining appreciation of the texture, tone and temperature of the muscles, fascia and lymphatics. Attention is paid to areas of congestion (which are tender or painful on palpation) in the soft and/or bony structures. When a muscle is involved in a lesion, the tendinous attachments are at least congested, if not painful to some degree.

In palpatory evaluation of structures, the texture, consistency, resilience, temperature and motion should be determined. Is the structure freely moveable, rigid, fibrous, tender or painful, etc.? It is one thing to touch tissue, but it is more important to sense the *quality.* It is important to *visualize* the anatomy under inspection, palpation or manipulation.

Performing accurate tissue appreciation during palpation requires the development of sensitivity and dexterity of the fingers and hands. In general, 'tissue sense' is best appreciated with the pads of the thumb, index or middle fingers; finger tips are not as sensitive as the pads (Figure 3.1).

Discriminating tactile palpation may discern the following tissue changes:

(1) Superficial palpation:

(a) Skin changes: dry, moist, coarse, fine;

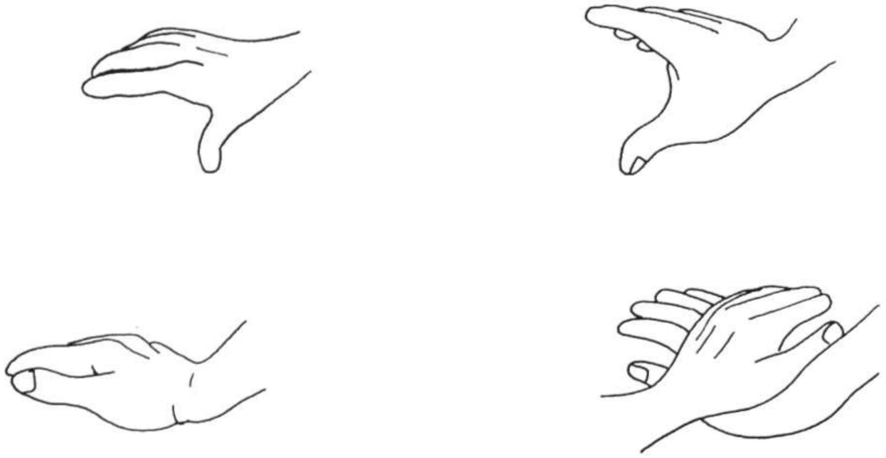


Figure 3.1 Use of fingers and hands in palpation

(b) Superficial muscle and fascia tension: normal, lax or tense; and

(c) Temperature: warm, hot, cool or normal.

(2) Deep palpation:

(a) Muscle and fascia tone: resistant (firm or tense), ropiness, fibrous, heavy or increased density, edematous or normal.

(b) Structural changes:

(i) Interrelationships: flexion, rotation, fixation; and

(ii) Tissue set: motion or the lack of it in visceral organs (congestion, swelling, tenderness), bones, ligaments and tendons (malalignment, edema, resiliency, mushiness, swellings, etc.).

In addition to static examination, any thorough structural examination must include testing of anatomical motion. Abnormal anatomical motion and alignment of tissues are direct signs and symptoms of altered function with or without pain. Generally, with musculoskeletal lesions, there is muscle hyperesthesia (abnormal sensitivity to pain and touch); this may be particularly noticeable at the origins and insertions of muscles (the tendons) and over the associated joint areas

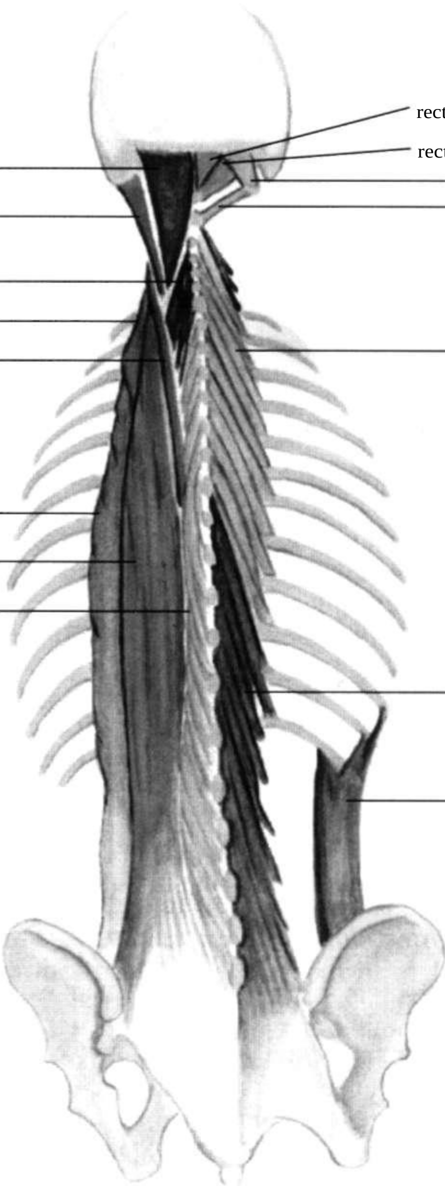


Figure 3.2 The sacrospinalis muscle group

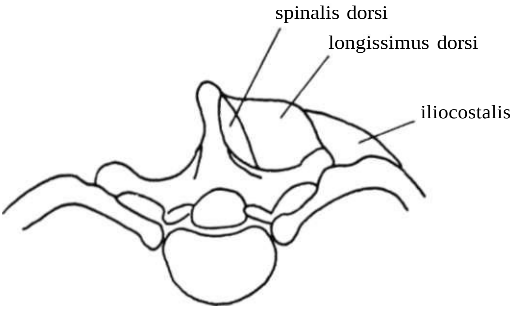


Figure 3.3 Dorsal sacrospinalis

when palpated. Some conditions may be palpated as having laxity of tissues, such as in unstable knee or lower back sacro-iliac conditions.

A good place to practise palpation is on the back (dorsum) of the chest; here lies the large sacrospinalis muscular mass, the large muscular bundles running parallel to the spine. The sacrospinalis muscle bundles extend from the lumbosacral aponeurosis, are attached to the spines of the lumbar and sacral vertebrae, lateral and posterior iliac crest, and the sacroiliac ligaments and extend upwards to the occiput and mastoid processes. The sacrospinalis is illustrated on the left in Figure 3.2: on the right are the deeper muscles lying underneath. The dorsal part of sacrospinalis (Figure 3.3) is composed of the:

(1) Iliocostalis dorsi muscle (laterally);

(2) Longissimus dorsi muscle (intermediately); and

(3) Spinalis dorsi muscle (medially).

The spinalis dorsi muscle lies next to the spine. The iliocostalis dorsi lies over the tips of the vertebral transverse processes and angles of the ribs. The longissimus dorsi lies in between. This is an excellent area in which to develop the ability to discriminate between normal tissue and the various altered tissue textures most commonly encountered.

A standard of normal muscle tension may be established by palpation of the relaxed muscles of the upper and lower extremities (arms and legs) while the person is lying relaxed.

STRUCTURAL CONSIDERATIONS

Some structural lesions may be noted by merely observing the patient 'grossly', that is, by visual observation. For instance, the patient may not be able to stand or sit erect, may walk abnormally or may not be bilaterally symmetrical, with abnormal curvatures. The normal postural set or motion may be altered. In gross postural changes there are obvious structural changes for which there may be compensatory structural changes, as is seen in pelvic imbalance (see Chapter 4, Figure 4.1).

What may be far less obvious are those structural lesions where the gross anatomy is not outwardly marked by these changes, for example, lesions involved with hypertension, lower and upper respiratory disease or visceral diseases. Visceral disease causes musculoskeletal structural dysfunction, such as is seen in the restrictive dorsal musculoskeletal lesions that occur with gastritis, peptic ulcers or gastroenteritis.

Normal structure and proper function are intimately related. As a result, a primary lesion in one area will produce deleterious secondary effects in contiguous and continuous areas of the anatomy. For example, a patient complaining of arm or shoulder pain from bursitis or tendonitis has, at least, structural dysfunction of the shoulder girdle on the ipsilateral (same) side. However, most often there are associated changes in the central axis, i.e. cervical, dorsal and lumbar areas of the spine. Further, there may be restrictions in the proximal radio-ulnar joint at the elbow.

A good rule-of-thumb is to examine both the proximal (closer to the central axis) and distal (further from the central axis) joints in the joint area complained of by a patient.

EXAMINATION AND EVALUATION

All the areas of anatomical dysfunction should be examined and evaluated by palpation before manipulation is given to facilitate the patient's host response to structural stress. It must be remembered that stress underlies all disease, whether biochemical, biomechanical or psychological, and that these factors are mutually dependent on each other. Treating the structural component of disease will reduce the total stress on the patient, which in turn reduces, to some degree, the stress in all other areas.

In performing examination and evaluation, any limits or barriers to normal motion are noted. Motion is tested with both active and passive movements; in the former, the patient makes the motion, whereas in the latter the examiner makes the motions while the patient is relaxed. Sometimes when active motion is restricted, passive motion is not restricted. Palpatory examination and evaluation of a joint area by the testing of motion and identification of any restriction allows for corrective manipulation.

In the course of an examination, patients frequently complain of pain in a particular area. In an accurate evaluation, it is helpful to know the spinal level from which the nerve ennervation derives. Examples of nerve ennervation are illustrated in Table 3.1.

The masseter muscle is ennervated by the first cervical (O-C-l) nerve root, respiratory function is ennervated from tne second cervical

TABLE 3.1 SPINAL NERVE FUNCTIONS

Nerve root	*Level*	*Reduced reflex*	*Area of reduced power*
O/C-l		masseter	masseter
C-2	**C-2**		respiratory
C-4			deltoid and upper pectoral
C-5	**C-4,5**	biceps	shoulder
C-6	**C-5,6**	biceps brachioradialis	biceps wrist extensors
C-7	**C-6,7**	triceps	triceps
C-8	**C-7, T-l**	triceps	intrinsics of hand
L-2	**L-2**	patellar	patella
L-3,4	**L-4**	knee	knee extension, anterolateral thigh and calf medial muscles
L-4	**L-4**	Achilles	
L-4,5	**L-5**	none	dorsiflexion of lateral calf and great toe
L-5, S-l	**S-l**	ankle	plantar flexion, lateral foot, back of calf (gastrocnemius)
S-l	**S-l**	plantar reflex	
S-2,3	**S-2,3**	anovisceral and genital	

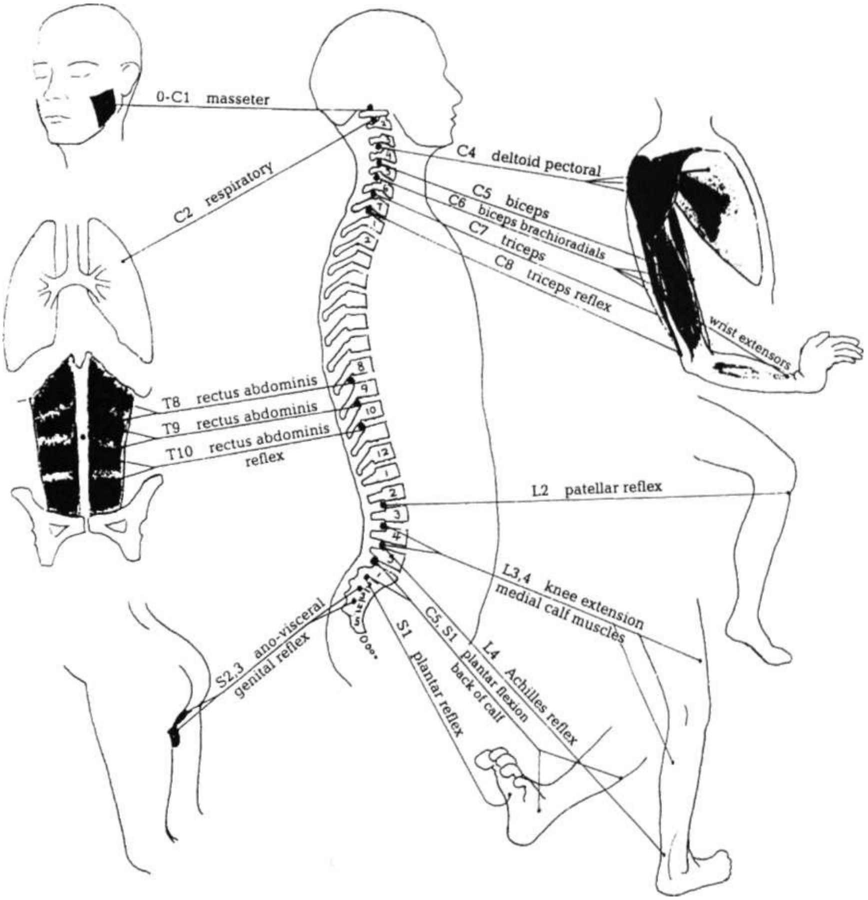


Figure 3.4 Spinal reflexes for somatic and visceral responses. O = occiput; C = cervical (neck); D or T = dorsum or thoracic; L = lumbar (lower back); S = sacral

(C-2) nerve root, anterolateral knee extension and thigh and calf muscles are ennervated from lumbar nerve roots at L-3,4 (figure 3.4). The patellar reflex is ennervated from the L-2 nerve root and the Achilles reflex from the L-4 nerve root.

Cervical spondylolethesis, aplasia (lack of development) of the vertebral arch, is usually at C5-6 or C6-7, and may present with extremity weakness and muscular atrophy or withering. Lumbar spondylolethesis, a developmental defect of the vertebra allowing forward slippage, usually involves L-5 and S-1 or L-4 and L-5. Lumbar intervertebral disc disease may cause peripheral pain and weakness.

Previously, the importance of somatico-somatic, somatico-visceral, and visceral-somatic reflexes were mentioned as giving a rationale and understanding to the structural aspects of osteopathic philosophy and the importance of structure was emphasized in the treatment of disease with the use of manipulation. During manipulation there is stimulation of the somatic tissue which sends impulses to the central nervous system in the spine, which in turn emits impulses to somatic or visceral tissues of the same segment and/or to segments above and below that level.

RADIOLOGY IN STRUCTURAL EVALUATION

X-ray studies can be valuable in examination and evaluation because they may reveal structural abnormalities which cannot be discerned by palpation in structural analysis. In general, lower back problems should have postural X-ray studies (the person stands with feet about 10 inches (25 cm) apart for sagittal and coronal films). Lumbar films will not only rule out such things a spondylolethesis and congenital defects, but will also give information on the effect of gravity on the spine, for example, whether there is a true anatomical short leg, the status of the sacral base plane and other important information such as degenerative vertebral and disc changes.

Another area for X-ray documentation is the cervical spine, where X-ray films will disclose the curvature of the spine and whether degenerative diseases of the spine are present. In cervical inertial injuries, studies of the upper two cervical segments are important for evaluation in order to determine if there is cruciate ligament or tectoral damage or muscular splinting; this is shown by malposition of the odontoid process of C-2 and an altered cervical spine curve.

4

BASIC STRUCTURAL ANALYSIS

For a physical examination to be complete a structural analysis is necessary. Amongst the gross observations that can be made, the first group are weight-bearing (Figure 4.1). The patient's gait, posture, and stance should be observed. Is there a limp, a wide gait, erect posture, etc.? Are the extremities equal in rotation and length? The front and back should be checked and the symmetry or asymmetry of shoulders, pelvis and set of the head observed. From the front it should be noted whether the head is held in the normal neutral position, and whether the shoulder or pelvic girdles are symmetrical by comparing the heights of the scapular acromioclavicular joint levels and the symmetry and comparative levels of the iliac crests, femoral trochanters and the anterior superior iliac spines. From the back it should be noted whether the pelvic base plane is level or not, whether there is a scoliosis or asymmetrical vertebral/paravertebral muscular tension and development, whether the shoulder girdle is symmetrical with equal scapulae and whether or not there is any scoliosis, lordosis or kyphosis (Figure 4.2). Observations should be made of how the patient sits down, how he sits and the posture.

The non-weight bearing observations include the following:

(1) Have the patient lie supine and observe how this is done. A person with moderate to severe back pain will lie down from a lateral approach.

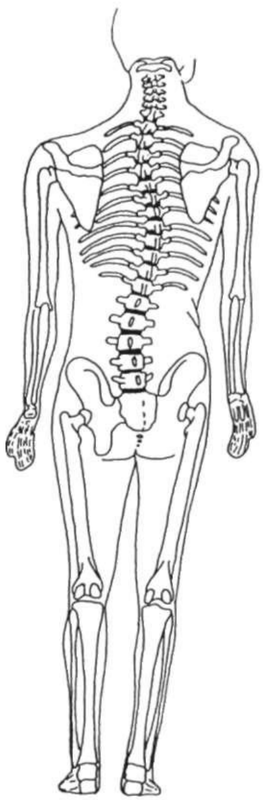


Figure 4.1 Gross structural alterations

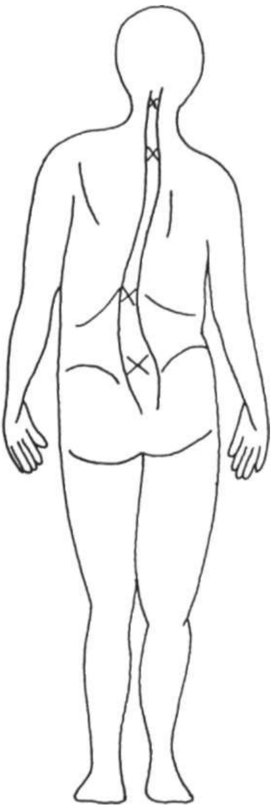


Figure 4.2 Crosses mark the axial stress areas

(2) Check the leg lengths (Figure 4.3) by comparing the medial malleolli of the ankles, the anterior superior iliac spines or nodules, and for pubic tubercle alignment. A posterior sacroiliac rotation causes a functional shortening of that extremity.

(3) Observe the external rotation of the lower extremities. Is each foot at a 45° angle from the midline, i.e the normal relaxed pose (Figure 4.4)? Check the acetabular motion in each hip joint for external rotation by using the 'sign of 4' maneuver by flexing the thigh and knee, then abducting the knee: internal rotation is checked by adduction of the flexed knee.

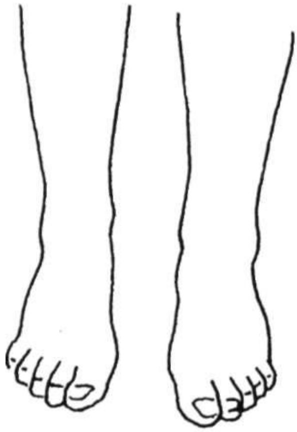


Figure 4.3 Leg length check

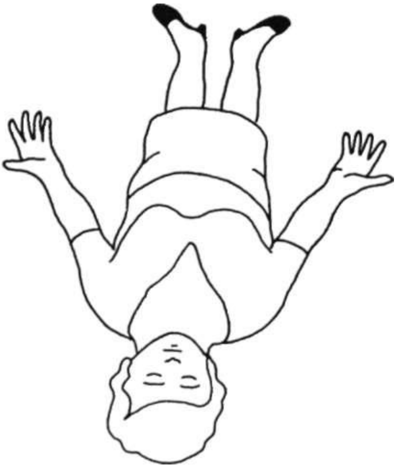


Figure 4.4 Checking the 45° angle of the feet; patient supine on the table

(4) Check the anterior lumbar ligaments by deep palpation through the relaxed abdomen (patient's knees flexed with feet resting on the table) and check the viscera, costal arch and ribs.

(5) Compare the arm lengths by approximating the thumbs in the midline with the extremities extended (Figure 4.5). Anterior shoulder girdle rotation causes extension of the ipsilateral upper extremity.

(6) Check the neck motion and cervical soft and bony tissues. With lesions, there is tenderness or pain at the tendon attachments to the bony structure.

(7) With the patient prone, check the hip rotation externally and internally by flexing both lower extremities at the knee and abducting and adducting the extremities (Figure 4.6). Do both sides and check the sacroiliac landmarks.

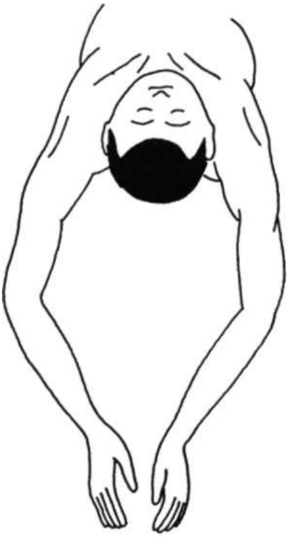


Figure 4.5 Arm lengths

Figure 4.6 Prone testing for acetabular and sacroiliac motion (posterior left sacroiliac lesion)

(8) In all areas, check for ligamentous tension and restrictions of motion. Compare bilaterally the soft tissue masses of the sacrospinalis in all areas, the lumbodorsal transition, the set of the scapulae, the curvature of the spine and the tension of the lumbar ligaments. Using springing intermittent lumbar pressure on each lumbar spine and interspinous ligament, progressively check the lumbar ligamentous tone and integrity. Using the index and second finger, exert downward pressure on the lumbar spine at each level to determine ligamentous tone, and using the fingers check for soft tissue edema. In disc disease, lumbar pressure or percussion on the spine may evoke radicular pain such as sciatica and/or deep vertebral pain. Check the sacroiliac ligaments while bearing down with pressure to elicit the underlying ligamentous tone and whether or not there is soft tissue edema. Check for sacral motion by rocking the sacrum. Remember that in testing joint motion, the motion created is not large.

5

MANIPULATION

The purpose of therapeutic manipulation is the manual handling of the patient's anatomy to bring about an improvement in structural relationships, with an improvement in physiological functioning, both biochemically as well as biomechanically. Structural dysfunction involves defective and/or restricted motion. In health, all tissues have motion: in disease motion is restricted. Successful manipulation at least reduces restriction of motion, pain and discomfort, and at best establishes normal motion.

Manipulation directly affects the structural relationships of bones, ligaments, fascia and striated muscles. Active soft tissue manipulation affects fascia and muscles, whereas the skeletal techniques directly affect the joints and ligaments. Muscles attach by origin and insertion to two bones by extending across a joint area. When a muscle contracts, the origin tends to be stationary so that the muscle contracting action is towards the origin attachment.

Corrective manipulation may be done with: *direct force* against the resistance; *indirect force* away from the restriction; or by *exaggeration* of the resistance.

Activating forces may be extrinsic, intrinsic, or both. *Extrinsic force* may be applied in a number of ways, such as:

(1) High velocity, low amplitude thrust;

(2) Low velocity, high amplitude as a lever action;

(3) Articular pressure without a thrust;

(4) Gravity;

(5) Fascial tension or torsion; and

(6) External supportive measures such as pads, lifts, straps, tape, etc.

Intrinsic forces, that may be used separately or in conjunction with the extrinsic forces, are those that occur in normal body activity such as the respiratory motion or the motion used in muscle energy techniques. During exhalation the curvatures of the spine increase and the extremities rotate internally: in inhalation, they rotate externally. At the end of exhalation there is a physiological relaxation throughout the body that is useful in breaking the inherent restrictive tissue barrier and/or patient resistance to joint lesion correction; therefore, the end of exhalation is an optimal time for applying external force to free a joint restriction.

When direct force is used against a lesioned joint, kind consideration must be given to the supporting affected tissues. If the patient is properly positioned and relaxed and the angles and planes are proper and visualized, usually no great force is required to correct a joint lesion. Correctional forces are parallel to the joint surfaces. The character of the force (thrust) should be somewhat of a sudden tap or nudge with a follow-through. Thus, the velocity would be high with low amplitude. Timing for the thrust is important and just prior to active correction, direct the patient by saying 'relax' and simultaneously giving a low velocity thrust or nudge. The optimal time is when exhalation facilitates patient relaxation, immediately before corrective force is delivered. Not infrequently when a patient has been properly prepared with soft tissue manipulation and positioned for correction, adjustment or correction occurs when the patient relaxes at the end of exhalation or when fascial tension is exerted with the locking procedure. Sometimes there is an audible 'popping' or a joint release sensed by the operator. Hearing a joint 'pop' is not necessary for lesion correction, but patients have pleasure in hearing a 'pop'.

Techniques of manipulation are directed to soft tissues (myofascial) and rigid (skeletal) tissues. In the latter, attention is paid to the articular involvement. Methods of manipulation involving these areas may use direct action of velocity techniques, indirect methods of twisting myofascial techniques, or by dynamic functional techniques, i.e. counterstrain techniques which sometimes incorporate trigger points. Quite naturally more than one technique is often used in lesion reduction, such as passive soft tissue relaxation by stretching, active muscle energy exaggeration and velocity thrust.

When manipulation is applied with respect for the tissue set, there is almost never any untoward effect obtained. Judicious manipulation is a very safe form of therapy with no toxic effects and no complications. It can be said that the host response to manipulation is positive, with an ensuing feeling of improvement, which undoubtedly accompanies the improved physiological functioning.

Therapeutic manipulation must not be restricted to dealing only with the skeletal system, even though skeletal descriptive terms may be used for reference. Manipulation involves attention to skin, fascia, muscles, tendons, ligaments, lymphatics, nervous tissue, arteries and veins, as well as skeletal systems. Clinical manipulation is dynamic and full of motion, which may not be conveyed by the static didactic descriptions.

Manipulation at the skin level is referred to as 'superficial lymphatic drainage'. Manipulation at the skin level is really working with the superficial fascia and may be best understood by an example. A middle-aged women had a menisectomy of her right knee. She was suffering considerable pain on the second post-operative day and the prescribed narcotic pain medication was not allaying her severe knee pain from her orthopedic surgery. Frequently 'bone' or orthopedic pain is not effectively relieved by even narcotic or non-steroid anti-inflammatory agents. I looked at her knee and it was swollen, with tight-skin from the local edema and the pain was easily aggravated by movement of the knee. Obviously, the local circulation was impaired. Manipulative treatment consisted of lightly stroking the skin, starting at the knee and extending the stroke up the thigh past the mid-section. This procedure was carried out over the medial, anterior and lateral aspects of the thigh. After no more than 5 min of this form of manipulation (superficial lymphatic drainage), the edema receded and the pain was remarkably abated to the point that deeper soft tissue manipulation was tolerated for further decongestion and reduction of the tension in the myofascial elements of the thigh. The severe pain was relieved by the improved circulation and drainage of the area. No further manipulation nor strong pain medication was required for her comfort.

Deep manipulation is used most frequently for bones, muscles and deep fascia wherein joint function and alignment are altered. Myofascial manipulation is applied when tissues are hyper- or hypotonic. In the former condition the muscles may feel ropy, fibrous, tight and contracted. In the latter condition the tissues feel boggy, swollen and/or lax. Hypertonic myofascial tissues usually respond by relaxation to pressure applied perpendicularly for several seconds repeatedly or to pressure applied constantly for half to one minute and then released. Boggy tissues usually respond well to a stimulatory type of digital slow vibratory motion, starting superficially and progressing to the deeper tissues with kneading.

Manipulation may take advantage of 'trigger' points. These points have been described by Jones and Chapman. Chapman's lymphatic ganglionic reflex foci may be palpated with the finger tips as small foci about the size of a pea in fascia anteriorly and posteriorly. They can be noted superficially in the soft tissues. Using the middle and index fingers together is efficient in applying a stimulatory technique for a few moments. Trigger points are not quite the same as Chapman's points, but trigger points are similar in that they have a reflex effect on tissue response. They may have constant pressure applied, after which a decongestion and release of tension may be noted. In the course of palpation and manipulation, an 'educated' finger can find these points. Treating trigger or Chapman's ganglionic points is easily incorporated into the total manipulative treatment.

An example of using Chapman's reflex and trigger points may be useful. A patient hospitalized for severe angina was suffering from an attack of angina. A narcotic could have been ordered to relieve his pain, but I decided to use soft tissue manipulation. He was orthopnic (had to sit up to breathe). I found his left pectoral area contracted and tender with a small congested area laterally below the clavicle, as well as a second intercostal congestion medially. I decongested these areas with soft tissue techniques and he stated that his sharp pain was relieved. I then had him lie prone in bed and loosened his dorsal and cervical myofascial structures. Afterwards, he stated that he was free of pain and that this was the first time in 7 years that he was able to lie flat and be comfortable in bed.

Manipulation of the rigid contiguous skeletal system with muscles, tendons and ligaments requires appreciation of the functional anatomy involved (muscles, fascia, ligaments and interstitial tissues). Various manipulative techniques are used in bringing about musculoskeletal and associated tissue improvements. These techniques will be presented below, with anatomical illustrations.

Manipulative techniques primarily directed at making joint alteration are as follows:

(1) Velocity:

(a) High: high and low amplitude;

(b) Low: high and low amplitude; and

(2) Exaggeration.

Soft tissue techniques that complement or supplement those given above are:

(1) Muscle energy:

(a) Active;

(b) Passive;

(2) Stretching;

(3) Inhibiting; and

(4) Stimulating.

Soft tissue manipulation technique varies according to the set of the soft tissues. In general, myofascial soft tissue manipulation starts with exerting a force with a momentary hold and is followed by release to relax the hypertonic restrictive tissues. The hold should be maintained long enough to produce some relaxation of the elements when it is done in a non-stimulatory manner. Using a digital stimulatory technique, of course, is different and requires a more rapid application of the fingers against the soft tissues.

In clinical practice, various techniques are combined and these are sometimes determined by the patient's tissue response during treatment. For example, in treating the cervical spine, the operator may find that direct high velocity action is not efficacious because of tissue resistance and/or patient complaint of pain, so a stretching action may be followed by a springing action with a final gentle low velocity thrust. This may not elicit full mobilization, so further soft tissue treatment is needed after which a gentle thrust may gain the lesion release. An operator must be discrete so as not to force the tissue response too far and cause irritability of the tissues. Sensitive fingers will be perceptive of this.

Procedures directed at normalization of soft tissue structure other than by manual manipulation include:

(1) Exercises;

(2) Position procedures;

(3) Traction;

(4) Mechanical manipulation;

(5) Braces and supports;

(6) Thermal and sonics;

(7) Electrical muscle stimulation; and

(8) Ultrasound.

Before applying skeletal manipulation, it is usually important first to prepare the soft tissues by soft tissue manipulation, then to position the patient specifically for the maneuver to be used, and finally to apply the corrective forces in the proper direction, i.e. sagittal to the joint. The force used to bring about tissue change should not exceed the limits of tissue acceptability or else insult to the tissue occurs. However, there is one exception to this and that is when manipulation is carried out under general anesthesia to break up joint adhesions and fibrosis of articular and periarticular tissues.

THE ART OF MANIPULATION

Just as other branches of medicine are based on scientific facts and objective consideration of the facts, manipulative practice is also based on scientific facts. The basis and rationale of manipulation is well grounded in scientific principles; however, the application of manipulation in the clinical setting is an art, just as it is in other disciplines of clinical medicine.

The manipulator's attitude, poise and sense of rhythm are important in patient contact. Manipulation is much like shaking hands in that the shakee's hand perceives about the shaker. The shaker's affect is reflected in the handshake and a person perceives information through the sensitive hand. Cognitive handshaking is executed as an intellectual function, but it is appreciated affectively. The art of hand contact expresses an affective component that is understood by the patient. The air and attitude of the manipulator is reflected during manipulation.

The way a manipulator handles the affective component of the patient is very important for it is unconsciously translated somatically by the manipulee. Myofascial tension splints a joint area, so interfering with and blocking corrective manipulation. Being relaxed or tense materially affects the quality and outcome of manipulation.

Manipulation may be carried out in any position in order to accomplish the objective of improving structural relationships. Most commonly, manipulation is executed with the patient lying relaxed on a treatment table. After testing the patient and positioning the patient for correction, the manipulator should apply his palpating hand or fingers to the area to be affected in order to appreciate the tension of the tissues and joint status, the joint motion or fixation, and the set of surrounding tissues. Successful manipulation is enhanced by the operator spatially imaging the area in lesion and the effect of manipulation structurally. The manipulator must decide whether a simple stretching technique or an active thrust or both is to be used. Judgment as to which should be used comes with developing 'tissue sense'. Most active corrective techniques can be made into stretching techniques by avoiding the active thrust and simply holding a constant pull or pressure on the area for a few moments. This may be all that is necessary to effect tissue release with joint mobilization. Joint mobilization frequently occurs with the physiological relaxation of joint areas at the end of exhalation. Sometimes, by applying traction as a positive force, or simply by using the weight of the patient under the pull of gravity, the same release may be accomplished.

A patient's body should be perceived as a living, pliable, flexible and mobile structure which can be moved in any direction that Nature intended with the limiting structures of muscles, ligaments, fascia or bone. These limitations must be respected during manipulation in order to avoid tissue injury. For example, the neck is designed to be freely mobile in flexion, extension, rotation, side-bending and in combinations of these basic movements, but the normal and abnormal limits must be appreciated. The neck should rotate bilaterally to 90°, extend to approximately 45° and flex as limited by the chest. Any limitation of motion means that there is a somatic dysfunction. To re-establish normal motion and function, the anatomical structures must be 'normalized'. If a person has torticollis, the obvious structural change depends on contractures of the Sternocleidomastoideus and the Scaleni on the side to which the head is rotated. There are associated changes with contractures and congestion of the deeper soft tissues (muscles, fascia, ligaments and lymphatics), the vertebrae and shoulder girdle. To correct the problem, all the implicated, deranged anatomy must be 'normalized' with relaxation, decongestion and realignment. Corrective manipulation should not be persistently forced. The manipulator should only do as much as the tissues will accept and should wait for improvement before trying again at the next manipulative treatment time, which may vary from a short time to several days.

A manipulator should move in rhythm with the patient's movements in exacting corrective actions. Sometimes, the manipulee may mean to be relaxed, but if the operator senses some tension, he should say 'let yourself relax' and immediately give the corrective force as the manipulee relaxes. This technique is effective.

The hands are important in appraising the tissues. The thumb and index finger pads, either alone or being reinforced by the other hand, may develop considerable sensitivity and dexterity in ascertaining tissue conditions during palpatory examination or during active treatment (Figure 5.1). The index and middle fingers are also used to evaluate tissue. While doing active correction, the fingers should be used to perceive the joint movement and periarticular tissues changes. Not uncommonly, the audible 'popping' is not heard and sensitive fingers over the area may perceive the 'correction' release.

A proper setting for manipulation means a situation where the patient and operator can be relaxed, otherwise there will be active muscle splinting which interferes with smooth manipulation. A

Figure 5.1 Manipulating hands

treatment or examining table for manipulation is the choice of many who manipulate. Sometimes a stool may be used, and there are times when manipulaton may be carried out with the patient standing, but usually a manipulation table is ideal. A table facilitates the patient's relaxation, which reduces tissue resistance. When corrective manipulation is carried out, I say again that it is important to have the patient relaxed. If the patient is-not relaxed, the soft tissue splinting materially interferes with corrective forces and this may cause undue and even harmful insult to the tissues. The physiological exhalation release should be utilized to the pleasure of both the patient and manipulator because less force is needed for correction and the patient perceives a sense of relief that is not felt if the patient is tense, when he may in fact experience pain.

Some manipulators perform little or no soft tissue treatment before making an anatomical adjustment. Others have recommended that effective normalization of soft tissue eliminates the need for skeletal mobilization for further anatomical adjustment, because the natural healing process will complete the 'correction'. However, most patients accustomed to manipulation feel more confident that positive changes have been made when they hear the classic 'popping' sound. In general it is wise to prepare for active correction of skeletal lesions by giving soft tissue manipulation, not only to heat the tissues but also to reduce the restricting congestion or tense fibrotic tissue before active mobilization is performed. This is particularly important in the use of high-velocity techniques; however, as in all medicine there are exceptions to the rule.

It is not necessary to hear a noise or 'popping' for correction or movement to have been created in a joint. The object of manipulation is to improve structural relationships, not to make a noise. The classical 'popping' is just a frequent side-effect of the motion created. Most often the 'popping' occurs with an active thrust; however, a joint sound accompanying motion may occur with exaggeration or stretching techniques which result in a joint release after fixation has occurred at the lesion fulcrum. For example, when the left hand's first metacarpo-phalangeal joint is used as a fulcrum on the cervical spine, while the right hand cradles the head in side-bending with slight flexion down to the point of lesion (the fulcrum point), a locking occurs. Simply exaggerating the physical force is often all that is necessary to cause a release of the restricted joint area, i.e. without any thrust, and a joint sound may be audible. Another example in which a joint sound of 'popping' may occur without a thrust is when the patient is in the lumbar lateral position (position for the 'lumbar roll') with the upper of the two lower extremities hanging off the table (ancillary use of gravity), and the manipulator grasps the calf or knee, pulls the leg downward and away from the table to a point of resistance and springs the leg downward (traction), when the release of a restriction in the lumbar column may be noted. Sometimes this occurs simply by positioning the patient when the patient relaxes. Often physiological release is obtained by specifically positioning the patient and having the patient take a deep breath and then exhale fully. In active soft tissue treatment, as in manipulation of the sacrospinalis of the dorsum, the procedure becomes both diagnostic and therapeutic because restricted joint lesions are sometimes mobilized during sturdy soft tissue treatment, when joint motion is noted under the fingers with or without an audible 'popping'.

Age is not a limiting factor for using effective manipulation, however, creative discretionary adaptation must be carried out.

A GERIATRIC CASE HISTORY

An elderly woman of 90 years consulted me for the somatic complaint of progressive back pain. She had already seen several physicians who had simply prescribed either anodynes and/or non-steroidal anti-inflammatory agents. She had been told that she was old and should try to adjust to her limitations. This patient was not satisfied and sought more answers.

A history revealed that she had suffered from very little disease until the last several years. For a person to have gained 90 years means that her health must have been fairly good throughout the past years.

Findings included normal pulse, blood pressure and temperature but her posture showed kyphosis arcuata and her ability to walk was markedly impaired, requiring the use of both a walker and assistance from her companion. Her stance was wide with her steps unsure. The skin was typical of the aged, thin and wrinkled with a loss of subcutaneous fat. Her eyes were glassy but otherwise clear and responsive. Hearing loss was partial. The chest was auscultated with cardiopulmonary signs within the norm. The abdomen was soft to palpation without pain or mass. Extremities were within the norm for her age, except that there was a +1 leg-ankle-foot edema. Extremity reflexes were not remarkable.

Further structural examination of this lean, small-framed woman revealed limitation of extension of the upper extremities with contracted and fibrous dorsal myofascial soft tissues. The neck was notably lordotic, modified by the dorsal kyphosis, with the associated limitations of motion. Percussion of the vertebrae did not elicit any deep or superficial pain. The lower extremities had about 50 per cent full range of motion without radicular pain.

Her blood chemistry findings were within the norm. The complete blood count revealed a mild anemia. The urinalysis was normal.

Surprisingly, she had had no recent X-rays, so X-ray studies of her dorsal and lumbar spine were ordered on her initial visit.

The frail, elderly patient wanted comfort and more freedom from her restricted life. What could be done to make her life better? She wanted relief, so I treated her according to my findings of the first visit. Treatment was soft tissue manipulation of the spinal and para-spinal soft tissues followed by gentle soft tissue manipulation of the spinal areas (lumbar, dorsal and cervical) with the patient in the lateral recumbent and supine position. This was accomplished by placing the patient on her side, flexing her lower extremities at the knees and hips and then side bending the lumbar spine by raising and lowering the legs. The dorsum was approached by having her sit on the side of the table, crossing her arms so that each hand cupped the opposite elbow and placing her forearms on my chest (Figure 5.2). I then reached around her torso to apply a resisting fulcrum of my hands paraspinally, so that by pulling with my hands and resisting with my chest, her dorsum was hyperextended serially as my hands progressed up or down her dorsal spine, exerting a springing action. The neck was manipulated with the full passive range of motion after

Figure 5.2 Rib-springing/stretching

superficial and deep soft tissue manipulation.

On her second visit she did not need as much assistance to walk as previously and the edema in her lower extremities had decreased. X-rays revealed osteoporosis, old compression fractures of two lumbar and two dorsal vertebrae, some disc degeneration, and mild hypertrophic osteoarthritic reactions.

Despite marked degenerative changes noted on the X-rays, I assured her that something could be done to improve her condition (just how much remained to be seen). It is important to review laboratory and X-ray findings with a patient and at the same time to present them in such a way so as to not create anxiety, but rather to alleviate any anxiety and misunderstanding about the disability and the pathological findings. Along with this, a rational and logical treatment program is explained for correcting and ameliorating the abnormal conditions. This patient was slow to understand some of the explanations because of her hearing loss, but she was alert and did appear to comprehend. It is important for the patient to have some understanding of the problems so that co-operation can be obtained.

Treatment consisted of manipulation, as carried out previously, to improve the structural components. The signs of biochemical deficit, the osteoporosis and degenerative arthritis, were treated with calcium orotate, multiple vitamins and minerals (many people by the age of 50 are mineral-deficient). Since she did not want to take any drugs because they had not helped her in the past, I did not prescribe any, even though a prescription of a non-steroidal anti-inflammatory agent would have been in order. The anemia was treated with crude liver, vitamin B12 and B complex intramuscularly. Injection assures delivery because in an elderly person the gastrointestinal tract has poor absorption. Conjugated estrogen was added to this injection for anabolic effects and to facilitate calcium utilization with respect to the osteoporosis (today progesterone would have been added to the combination).

On the next visit she was clearly more stable and could walk with only one-handed assistance. The breadth of her stance had narrowed and her gait had improved. Her eyes had lost the glassy appearance and there was no longer any edema of her lower extremities. With a smile she remarked that she was 80% better.

Of course this patient will never be cured, but she can be given a treatment program to greatly reduce the pain and suffering from her degenerative aging conditions. This case illustrates the importance of structural conditions in the management of a geriatric case and of customizing manipulation for somatic dysfunctional improvement.

A PEDIATRIC CASE HISTORY

At the other end of the life-cycle, i.e. infancy, manipulation may also be applied in medical conditions. This example is that of an infant, hospitalized for pneumonia. The infant was placed on standard medicinal treatment of appropriate antibiotics and fluids, but the child had a steadily increasing fever. I was called to attend the infant when the temperature reached over 105°. Since the internist had applied all medicinal aspects appropriately, I could only think that one modality of therapy was missing, i.e. manipulation. I applied general soft tissue manipulation to the full length of the spinal area, followed by gentle thoracic lymphatic pump. Within 5 h the infant's temperature was down to 99°. The attending nurse was amazed. After 24 h the infant's temperature rose to 102°. Again manipulative treatment was administered as described above. Within 5 h the infant's temperature was 97+°, and subsequently remained afebrile. Within a day the temperature stabilized at the norm and the child was discharged a few days later.

By applying the added modality of manipulation for the total care of the patient, a positive dramatic response was seen in the patient. The time and effort to carry this out was only a matter of minutes.

These two cases illustrate that the fragile elderly and fragile very young patients may have the benefits of manipulation to enhance the body's response to disease, but manipulation must be applied according to structural limitations and circumstances. High velocity or 'popping' techniques were not applicable in these two cases described above. Also, it should be noted that the manipulation was part of the medical treatment program.

The manipulative prescription must be judiciously carried out. Sensitive, 'educated' fingers readily discern tissue restrictions and the response to therapeutic manipulation.

Part 2

Clinical manipulation

This section covers basic manipulation techniques for various areas of the body, showing how to improve structural integrity for optimal body function. As stated previously, it is important to understand the anatomical structures involved in the manipulative process, so some anatomical review and diagrams are included to either call attention to, or refresh the memory of the operator regarding the skeletal, ligamentous, fascial and muscular tissues involved with various manipulative procedures. It is important to understand basic anatomy and the effects of manipulative forces.

6

HEAD REGION

ANATOMICAL REVIEW

The skull rests upon the spinal column or axis by the occiput resting on the atlas, the first cervical vertebra. The skeletal frame of the head consists of the cranial bones (Figure 6.1). The cranial bones are not rigidly interlocked and fixed. Skull bones have motion from neonatal life to rigor mortis. This should not be surprising in that all living tissues move. The sutures, the junction lines of the cranial bones, are

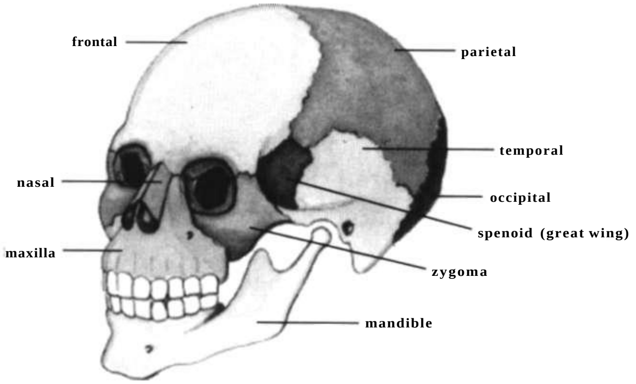


Figure 6.1 Cranial bones

serrated with cartilaginous fibrous connective tissue interposed, except for the tempomandibular joint which has a synovial capsule and disc. Motion of the cranial bones is not so obvious as with the other skeletal bones of the body, except for the tempomandibular joint.

The skull bones can be divided into two groups:

(1) *Cerebral cranium,* consisting of eight bones: occipital, two parietal, frontal, two temporal, sphenoid and ethmoid; and

(2) *Visceral cranium,* consisting of 14 bones; two maxillae, two zygomatic, two nasal, two lacrimal, two palate, two inferior conchae, vomer and mandible.

The bone count of 22 does not include the middle ear bones, i.e. two incus, malleus and stapes.

To appreciate cranial bone motion, the sense of touch must be gentle and sensitive. With a little practice, a person can learn to palpate a hair under a sheet of paper. After developing the sense of touch to that degree, palpation can disclose conditions that are not obvious to the naked eye. As in other parts of the body, if motion is impaired, there are untoward signs and symptoms, which may be expressed in the body proper, such as in asthma or other kinds of respiratory disease. The motion of the cranial bones affects motion in the sacral complex. There is a connection between cranial bone motion and sacral motion, at least via the meninges and longitudinal ligaments. Both ends of the spine have complementary motion. During the respiratory cycle the sphenobasilar symphysis (joint) elevates slightly with inhalation into the flexion position and then lowers during exhalation into the extension position.

WG, Sutherland, DO was the first to observe the importance of the bevelled sphenosquamous joint motion and integrate it into a respiratory mechanism concept. He coupled this cranial motion (Figure 6.2) with sacral motion. The cranial respiratory motion has a counter-

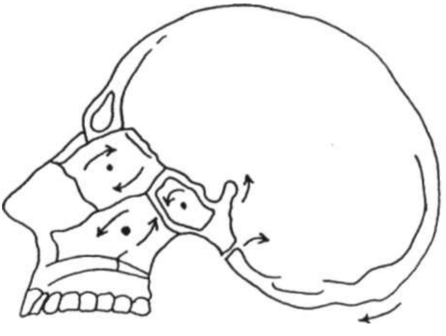


Figure 6.2 Cranial motion

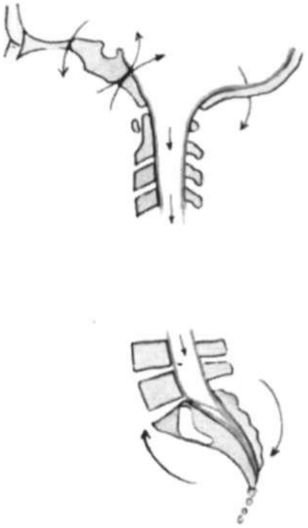


Figure 6.3 Craniosacral motion in inhalation (flexion)

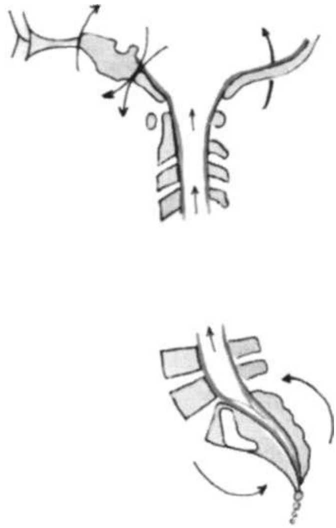


Figure 6.4 Craniosacral motion in exhalation (extension)

part in the sacrum which moves in unison with that motion, so it is important to include evaluation of the sacral function in cranial considerations. The functional movements of the sacrum must be within the norm, i.e. flexion, extension and rotation (Figures 6.3 and 6.4).

The craniosacral connection is by means of the continuous dura mater which creates a closed hydraulic system lining the inside of the skull and continuing down the spinal canal to the sacrum. Particular meningeal attachment is at the basilar occiput, C-3 and S-2.

Stress, such as is caused by inertial injuries with whiplash to the neck and lower back and axial structural lesions, may cause a disturbance of the normal cranial and lumbosacral action. Cranial manipulation addresses the altered and restricted cranial bone function.

The tempomandibular joint (TMJ), unlike the other cranial joints, allows for considerable mobility and has a disc within the capsular ligament (Figures 6.5 and 6.6). The joint is more than a simple hinge joint because there is more than a single radius of motion wherein circumduction is allowed. Movements allowed are hinge, gliding and limited rotation.

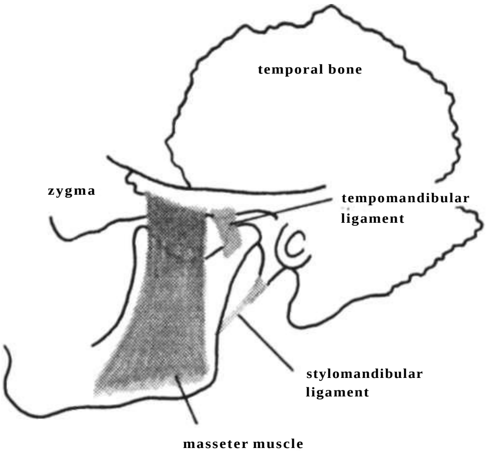


Figure 6.5 The tempomandibular joint

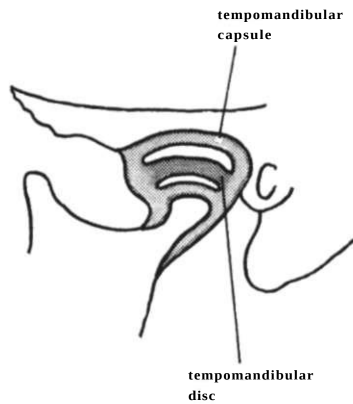


Figure 6.6 The tempomandibular joint capsule and ligaments

GENERAL ASSESSMENT OF CRANIAL BONE MOTION

The cranial impulse assessment, reflected in joint motion, is made using light touch while applying multiple finger contact on the principle bones of the cranium. When general cranial restriction and tension are perceived, there are some techniques to free the restrictions. There are many cranial assessment and manipulative techniques. Only a few basic techniques will be given here.

Assessment techniques
The posterior or vault hold:

(1) Patient supine with operator's forearms resting on table.

(2) The finger pads are gently placed, as illustrated (Figure 6.7), on either side of the head for fine tactile perception and detection of cranial motion.

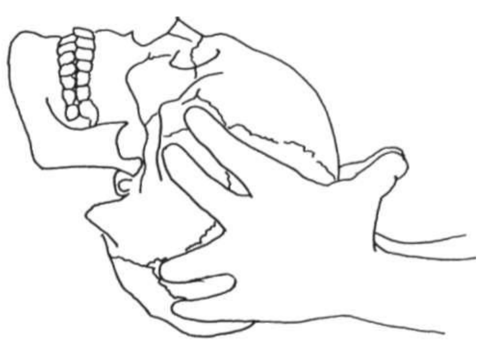


Figure 6.7 The posterior cranial hold

Figure 6.8 The anterior cranial hold

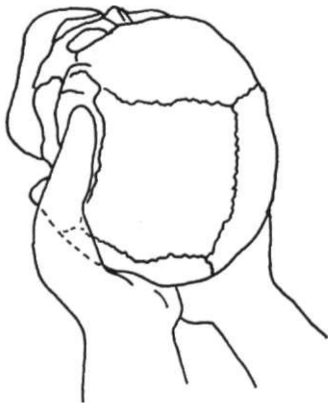


Figure 6.9 Cranial suture opening

(3) The little finger pad is placed on the lateral squamous part of the occiput.

(4) The fourth finger pad is placed on the parietal posteroinferior angle and temporal mastoid.

(5) The middle finger pad is placed over the anteroinferior angle, with the tip of the finger touching the temporal zygomatic process.

(6) The index finger pad is placed on the greater wing of the sphenoid bone.

(7) The thumbs are brought together, forming a base for finger flexors.

The anterior hold:

(1) The lower hand cradles and holds the occipitosquamous area (Figure 6.8) so that the finger tips are on opposite occipital angles with the hyothenar and thenar on the near occipital squama.

(2) The upper hand is placed over the frontal area (Figure 6.8), making contact only at the two external surfaces of the greater wings of the sphenoid, avoiding pressure on the frontal bone.

Both the anterior and posterior holds assess the cranial base.

CRANIAL MANIPULATION

General suture opening

(1) The patient is supine. The operator's hands are supine, cupping the head posteriorly (Figure 6.9) with the thenar eminences at

the mastoid portions of the temporal bones and the thumbs pointing towards the external orbital process of the frontal bone, covering the superior part of the temporal bone at the tempo-parietal suture.

(2) With very controlled gentle finger pressure, follow the cranial relaxation, maintain the same pressure and impede the expansion phase.

(3) With the relaxation phase exert a very light force.

(4) With the ensuing expansion, use gentle pressure to counteract the motion.

(5) Repeat until a general release is noted.

Occipital pump

The operator cups the patient's head posteriorly with the pads of the index and middle fingers in the digastric notch behind the mastoid and the heels of the hands touch the parietal eminence area (Figure 6.10). With the patient breathing deeply and slowly, the operator follows with a few cycles.

(1) The index and middle fingers initiate traction with the beginning of relaxation.

(2) Index and middle finger outward traction is initiated during the relaxation phase.

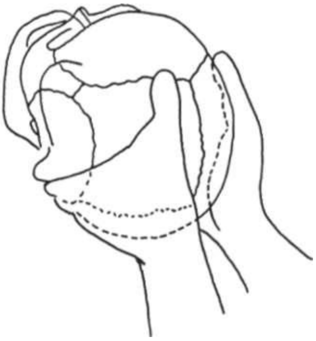


Figure 6.10 Occipital pump

The occipital pump technigue is used to improve cerebral circulation, especially with respect to the fourth ventricle, and to improve respiratory or pulmonary function.

Temporal rotation technique

Gehin (1987) recommends that the alternating rotation of the temporals be used after the occipital pump. This technique is to normalize the expansion of the cranium by rotating the temporal bone.

(1) The thumb and index finger grasp the temporal zygomatic arch (Figure 6.11).

(2) The ring and little fingers secure the mastoid process.

(3) The occipital squama is cupped with the other hand, placed transversely.

(4) During the expansion phase, the occipital hand asserts gentle pressure bringing flexion to it. In synchrony, the right hand moves the process caudally and laterally while the little and ring fingers draw the mastoid process posteriorly and medially for external rotation.

Figure 6.11 Temporal rotation

(5) The opposite movements are carried out with the hands for internal rotation.

This is a variation of the temporal rotation technique:

(1) The patient is supine and relaxed.

(2) The operator's hands are supine with the fingers intertwined and the hands cup the occiput and upper cervical spine and the occipital squama.

(3) The thumbs are placed parallel to the anterior border of the mastoid processes with the thenar eminences contacting the mastoid part of the temporal bone.

(4) Alternating movement is induced by the index or middle fingers, and one index finger is rolled alternately on top of the other at the second cervical vertebra, which acts as a pivot.

(5) The passive thumbs move in an arc, taking the temporals with them.

(6) A symmetrical balance of temporal motion is restored before ending the procedure.

Temporal respiratory pump

This is a variation of the above technique and is similar to it, except that the index and middle fingers are placed on the external surface of the mastoid processes, instead of being in the digastric notch (Figure 6.12). This spreads the temporal squama.

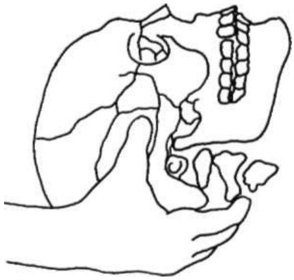


Figure 6.12 Temporal respiratory pump

(1) Gentle pressure is exerted on both mastoid processes. The patient's breathing will slowly have a larger excursion.

(2) The bilateral pressure is then released and the process repeated a few times.

Ethmoid sinus drainage

(1) The patient is supine. The operator's cephalic hand palms the frontal bone with the thumb behind the external orbital process and the other fingers spread over the opposite lateral face with the ring finger securing the zygoma and the index finger on the frontal process of the maxilla (Figure 6.13).

Figure 6.13 Sphenoid ethmoid sinus drainage

(2) With the other hand, the index finger is introduced into the mouth and the pad/tip is placed on the cruciate suture of the palate at the junction of the hard and soft palates.

(3) The cephalic hand draws downward in external rotation while the internal finger presses the palate cephalad and anteriorly towards the root of the nose.

(4) Both hands reverse the action during the relaxation phase.

A variation of this technique is to place the index finger at the cruciate suture between the maxillary and palatine portions of the hard palate, while the thumb of the other hand is placed on the base of the nose (Figure 6.14). The pressure motion of the index finger as transmitted

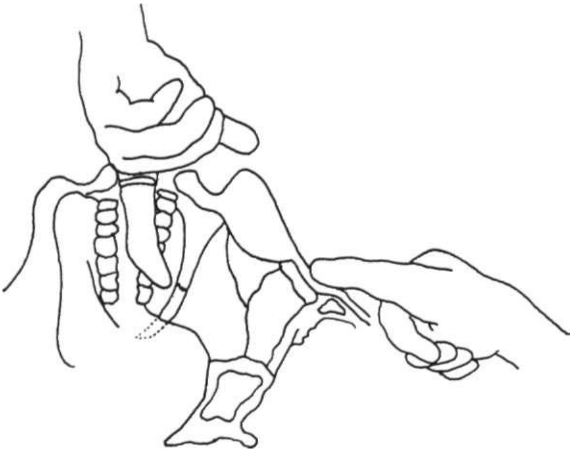


Figure 6.14 Variation of vomer ethmoid drainage

through the vomer is felt by the thumb, an alternating pressure is applied by each of these fingers and motion is felt accordingly to create freedom of motion.

Sphenoidal sinus drainage

This is similar, but the cephalad hand is used to control the sphenoid by the thumb and index or middle finger spanning the frontal bone to lie on each side at the external surface of the greater wings of the sphenoid (Figure 6.15). During the cranial expansion motion, the sphenoid hand draws in flexion, while the oral finger opposes the thrust of the vomer at the cruciate suture with pressure towards the sphenoid body, followed by relaxation to the neutral position.

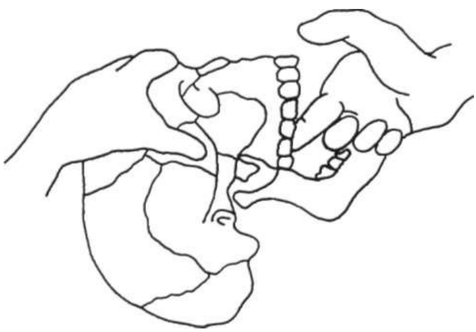


Figure 6.15 Sphenoid ethmoid vomer drainage

Figure 6.16 Opening the nasal fossa

Nasal turbinate treatment

Using the little finger, covered with a finger cot, insert it into the nare and gently separate the septum from the impingement of the turbinate bodies. This improves nasal ventilation and drainage by opening the nasal fossae (Figure 6.16). Of course the nares may be dilated with a nasal speculum and the turbinate bodies treated with a cotton-tipped nasal probe soaked in a nasal shrinking solution, such as Afrin™. Both methods treat structural changes.

Tempomandibular joint assessment

When the tempomandibular joint is in lesion, the patient may complain of difficulty in chewing and of crepitus on jaw motion, as well as pain and discomfort. So it is necessary to evaluate how the patient opens and closes the mouth. Is the action symmetrical? Does the chin open and close vertically and in the mid-line? Put the little finger of each hand in the external auditory canals and compare, then feel the motion as the patient slowly opens and closes the mouth. When in lesion, there is palpatory pain over the joint and crepitus may be appreciated during joint motion. With a little pressure this procedure may be used as a corrective treatment. In posterior tempomandibular joint lesions, the patient may not be able to open the mouth fully. The condyle is inhibited from normal anterior gliding. An anterior lesion is characterized by a jerky opening of the mouth, frequently with pain as the condyle slides forward and the chin deviates to the opposite side of the lesion. It is also necessary to assess the mechanics of the neck where associated lesions are found.

Figure 6.17 Anterior tempomandibular joint technique

Tempomandibular joint corrective manipulation

Anterior lesion technique

(1) With the patient supine, the operator's hand is placed on the corresponding side of face so that the fingers approximate the chin and the base of the hand anchors on the zygoma (Figure 6.17). The operator controls the head with this hand.

(2) The other hand is placed over the other side of the face so that the fingers grasp the angle of the jaw and lower edge of the mandible ramus.

(3) Forward motion of the hand causes the mouth to open and the ramus hand exerts forward pressure.

(4) When maximum forward glide has been reached, upward pressure along the ramus towards the joint is applied to impinge the disc at the thin central portion by the condyle to the temporal bone.

(5) Finally a passive closure of the jaw is made by the chin hand, which exerts pressure towards the opposite side causing posterior gliding of the condyle which then impinges the disc on the opposite side.

(6) If there is incomplete restitution, the procedure is repeated.

Posterior lesion technique

(1) First correct the position of the temporal bones by spreading each from the parietal.

(2) Mobilize the mandible by grasping the mental symphysis with the fingers, while having the patient relax the jaw (Figure 6.18).

(3) Move it gently in all directions while pressing on the lower molar teeth in a rotary action; this frees the masseter and buccinator muscles.

(4) Pull the jaw forward to relax the hypoglossal tissues below.

(5) Shift the thumbs to the medial side of the rami as far back as the molar and wisdom teeth, thus pushing the mandible down and use a transverse motion for further mobilization.

Figure 6.18 Buccal posterior technique

Direct external tempomandibular technique

(1) Press the pad of the thumb firmly against the meniscus of the tempomandibular joint just in front of the ear canal; and

(2) Slowly open the jaw while holding the cartilage back. This reduces the 'popping' jaw.

Tempomandibular problems involve more than the local condition. There are also cervical and frequently dorsal lesions involved and these must be treated.

7

NECK REGION

ANATOMICAL REVIEW

Anteriorly the neck extends from the manubrium and clavicles to the jaw and posteriorly from the first thoracic vertebra to the occiput.

Neck landmarks

These are illustrated in Figure 7.1 and consist of:

(1) Transverse process of C-l: half-way between the angle of the jaw and the tip of the mastoid process;

(2) Hyoid: at the level of C-2;

(3) Thyroid cartilage: at the level of C-4; and

(4) Cricoid process: at the level of C-6.

The sternocleidomastoideus and the trapezius insert in the superior nuchal line between the inion protruberance at the midline of the occipital bone and the mastoid process of the temporal bone. The hyoid acts as a common attachment point anteriorly for numerous muscles in the mid-portion of the neck.

Superficially, the lateral muscles, noted by contour, are the sternocleidomastoideus over which spans the platysmus (Figure 7.2) from the lower edge of the jaw to the superficial pectoral fascia and the trapezius.

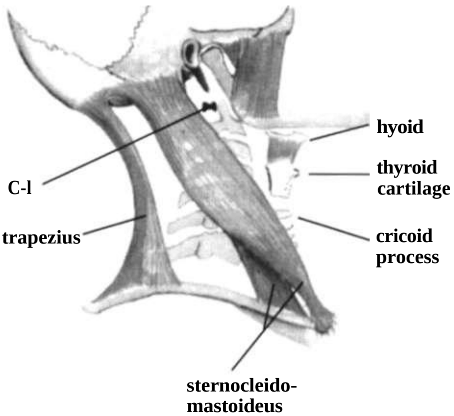


Figure 7.1 Neck with anatomical landmarks

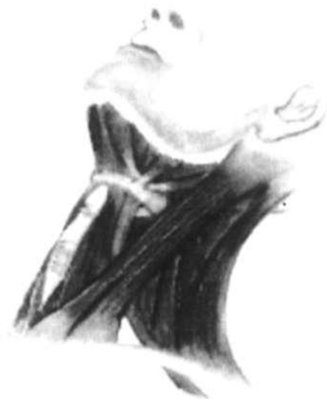


Figure 7.2 Superficial muscles under the platysma

Anterior muscles

Under these more superficial muscles he the scalenus anterior, medius and posterior. The scalenus anterior originates from the anterior tubercles of the 3rd, 4th, 5th and 6th transverse cervical vertebral processes to insert in the first rib. The medius arises from the costotransverse lamellae of the lower five transverse processes to insert behind the subclavian groove of the first rib. The posterior scalenus arises from the posterior transverse process tubercles of C-5 and C-6 to insert on the second rib.

Between the scalenus anterior and scalenus medius he the cervical and brachial nerve plexes (Figure 7.3). The *cervical nerve plexus* is formed by the anterior primary divisions of the upper four cervical nerve roots and lies under the sternocleidomastoideus and on the levator scapulae and scalenus medius muscles. The *brachial plexus* is formed by the anterior primary division of the lower four cervical nerves and passes between the anterior and middle scaleni muscles (Figure 7.4). In brachial neurodynias, this plexus area may be palpated as painful. First rib lesions as well as vertebral lesions may be part of the associated structural dysfunction.

The deep anterior vertebral muscles are: rectus capitis anterior, rectus capitis lateralis, longus capitis, longus colli, intertransverse anterior and intertransverse posterior.

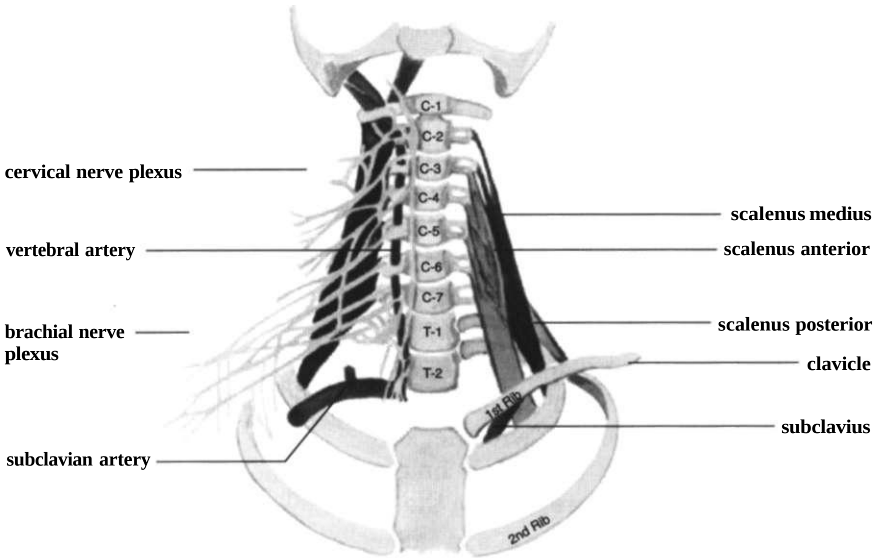


Figure 7.3 Cervical and brachial nerve plexes

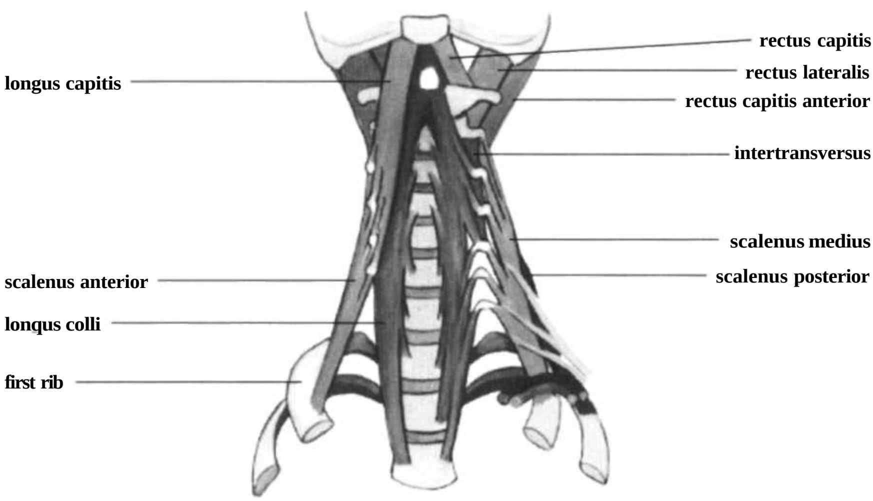


Figure 7.4 Deep anterior cervical muscles. Origin of the scaleni muscles at the cervical transverse processes. The anterior and medial scaleni insert on the first rib. The brachial nerve plexus passes between them. The scalenus posterior inserts on the second rib

Posterior muscles

Figure 7.5 shows the superficial posterior cervical muscle attachments. The deeper muscles frequently become tense and congested, thus causing vertebral lesions. Biomechanical dysfunction may be relieved by soft tissue and skeletal corrective manipulative techniques.

Sub-occipitally, under the superficial trapezius lie the splenius and semispinalis colli, the splenius and semispinalis capitis, and the levator scapulae. When involved with neck lesions, the levator scapulae has palpatory pain at the insertion on the scapula.

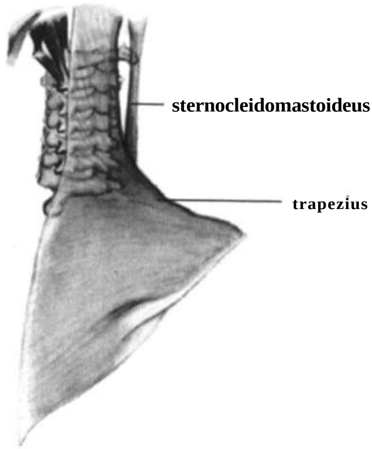


Figure 7.5 Superficial posterior neck muscles

The deeper muscles suboccipital to this transitional area are illustrated in Figure 7.6 which shows the vertebral artery piercing the transverse processes via the foraminae, the muscular and ligamentous attachments of C-l and C-2, and the major muscular overlay. The deeper short suboccipital muscles are the rectus capitis major and minor, and the rectus obliquus superior and inferior (Figure 7.7).

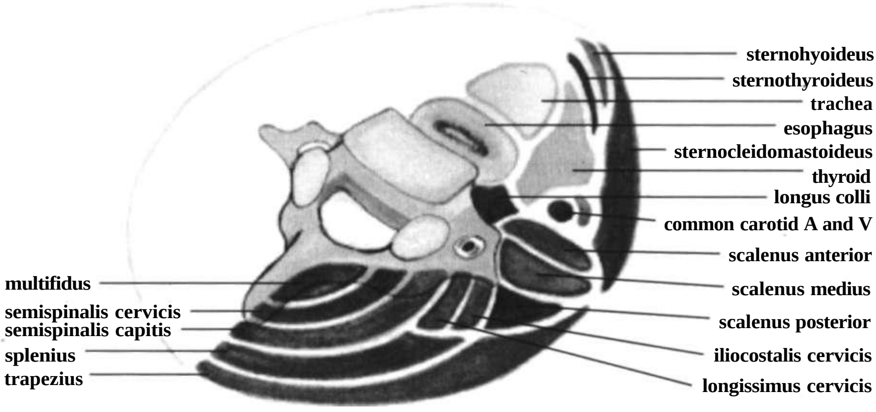


Figure 7.6 Transverse muscle schematic at C-6

The deeper posterior long muscles of the neck underneath the trapezius are: splenius capitis, splenius colli, semispinalis capitis, semispinalis colli and the levator scapulae. Figure 7.8 shows the longer muscles spanning into the upper thoracic area for tendinous insertion on the ribs and tranverse processes; consequently, cervical structural problems must take into consideration at least the upper thoracic anatomy in addition to the immediate cervical area.

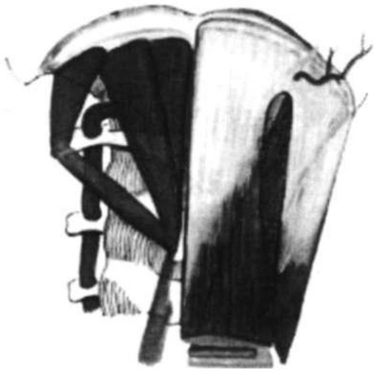


Figure 7.7 Suboccipital cervical structures

Muscle origins from the occipital bone span the occipito-atlas connection to attach to transverse and spinous vertebral processes and ribs. Therefore, functionally, one must consider both the occipital and thoracic areas in treating neck problems. The neck relationship should be considered in shoulder girdle lesions. The levator scapulae has tendon origins from the dorsal tubercles of the transverse processes of the first four cervical vertebrae

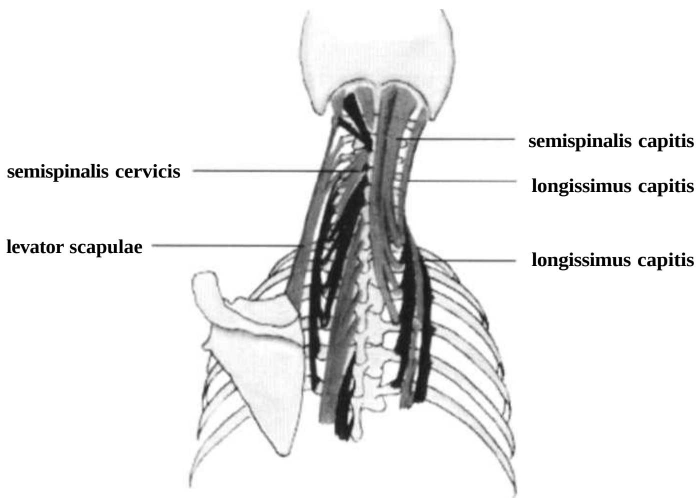


Figure 7.8 Deep posterior cervical long muscles

between the splenius cervicis and scalenus medius muscles and inserts by tendinous attachment to the vertebral border of the scapula at the supraspinous fossa. Once again this shows the interrelationship of more than one region.

CERVICAL SPINE STRUCTURE AND MECHANICS

There are seven cervical vertebrae. The *atlas* or C-l, the first cervical vertebra, has superior facets facing upwards and slightly backwards with a sulcus-like surface allowing rotatory and rocking movements of the basilar occiput resting upon it (Figure 7.9).

The second cervical vertebra, the *axis,* with its odontoid process is unique (Figure 7.10). The odontoid process acts as a stabilizing and pivotal pin around which the atlas moves. The C-l and C-2 complex with the occiput allows for about the first 40-45° of cervical spine rotation. The basilar occiput, C-l and C-2 should be considered together because of the unique action of this bony and ligamentous complex as a synchronous unit. The occiput-atlas-axis skeletal system is bound and stabilized by ligaments. The odontoid process is held forward in the atlas away from the spinal cord by the transverse ligament of the cruciate ligament (Figure 7.11). Corrective manipulation of these two cervical segments should be carried out only after lower cervical lesions are corrected to reduce lesion resistance.

The remainder of the cervical vertebrae, C-3 to C-7 (Figure 7.12), are similar to each other structuraUy and functionally with the superior facets facing upwards, backwards and laterally; C-7 is a transitional vertebra and has some characteristics similar to T-l. All cervical transverse processes are distinct from other vertebral transverse

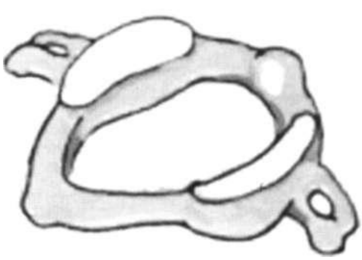


Figure 7.9 The atlas vertebra

Figure 7.10 The axis vertebra

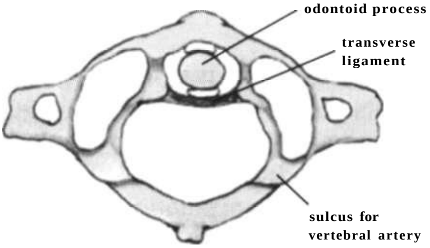


Figure 7.11 Superior view of the atlas showing the odontoid process C-2 held forward by the transverse ligament

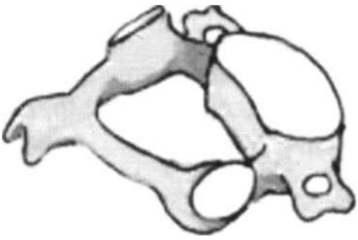


Figure 7.12 A cervical vertebra from the C-3 to C-7 section

processes in that they have hiati for the passage of the vertebral artery. The lower cervical vertebral (C-3 to C-7) superior articular facets are directed upwards, backwards and laterally and glide over the lower counterfacets above, horizontally in a great arc. The motion is a smooth gliding action.

There are four gliding cervical articular vertebral motions (Figures 7.13 and 7.14): two simple, i.e. extension and flexion; and two complex, i.e. extension-side-bending-rotation and flexion-rotation-side-bending.

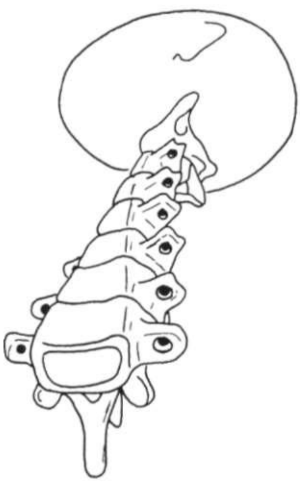


Figure 7.13 Rotation

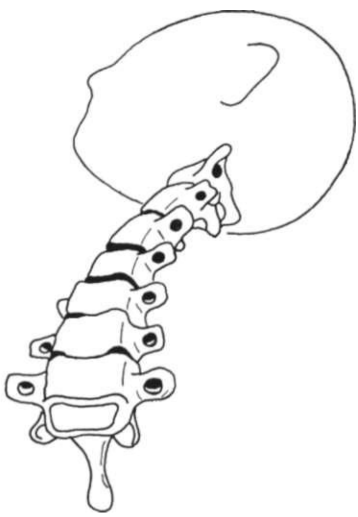


Figure 7.14 Rotation and extension

CERVICAL LIGAMENTS

Cervical ligaments are vulnerable to traumatic inertial injuries. Particular attention should be paid to the hgaments of the occiput, C-l and C-2. The anterior longitudinal ligament is injured not infrequently by whiplash or inertial injuries to the cervical spine of the neck should not have active velocity manipulation, perhaps only soft tissue manipulation and then only after careful evaluation. Testing for injury is important, and this must include the cruciate complex (Figures 7.15 and 7.16).

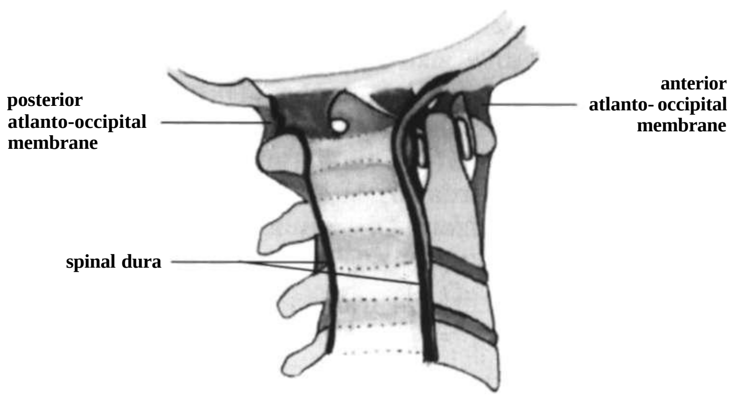


Figure 7.15 Cruciate ligamentous complex: sagittal view

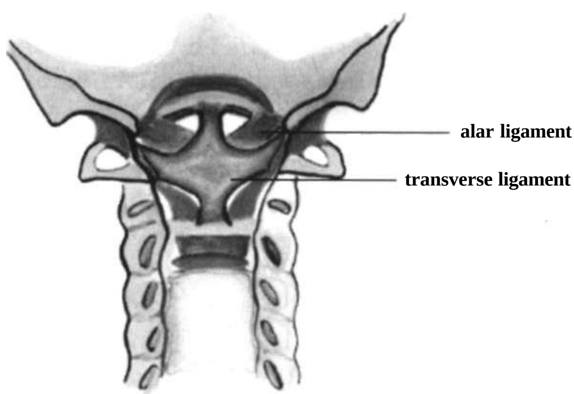


Figure 7.16 Cruciate ligamentous complex: coronal view

TESTING

Gross and superficial considerations

The following observations should be made. Is the head and neck posturally symmetrical as seen from the front and back? Are the muscles and other soft tissues bilaterally symmetrical or equal? How is the alignment? With the neck in slight flexion, the landmark structures in the anterior midline should be checked from above downwards: the hyoid bone body (level of C-3), the thyroid cartilage (level of C-4), cricoid cartilage arch (level of C-6), lower cartilaginous rings of the trachea and the thyroid. Laterally, check for brachial nerve pain by palpating between the anterior and medial scaleni muscles.

Deeper cervical ligamentous-muscle-skeletal considerations

The posterior tissues are checked with the patient supine and/or sitting.

(1) Check for ligamentous and joint lesions with deep palpation;

(2) Check myofascial tone, periarticular edema and tenderness;

(3) Determine vertebral set: transverse processes; spinous processes; facet prominences (C-2 to C-7); and functional motion, active and passive; and

(4) Press or percuss each vertebra posteriorly; pain indicates damage.

The upper two segments should be considered in conjunction with the occiput, for they function together. This is one of the most vulnerable parts of the spine and is responsive to the function of the entire spine. The cervical spine should be tested with the patient supine.

(1) Test for rotation with the spine in moderate flexion; static rotation is to the side in lesion.

(2) Test rotation with the spine in moderate extension; rotation is away from joint fixation.

(3) Palpate the C-l transverse process tips (between the mastoid process tip and the angle of the jaw) bilaterally and feel whether C-l slides from side to side.

(4) Put the occipital condyles in extension by tipping the head back to lock C-l, then check for motion by shifting of your body weight. Check the rotation by mild rotation to the right and to the left.

(5) Test the atlanto-axial integrity (Figure 7.17) by pressing up or lifting the posterior vertebral arch while the patient is supine. This tests the ligamentous tectorial membrane. If damaged, there may also be vertebral artery injury (inertial injury damage).

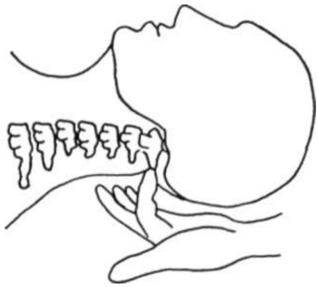


Figure 7.17 Atlanto-axial testing

When testing the cruciate ligament complex with slight cervical flexion, there may be dramatic symptoms such as a feeling of a lump in the throat, peripheral tingling in the upper extremities, sweating or occulogyrus. If there is suboccipital edema, the patient may lose consciousness, thus indicating transverse ligament damage.

(1) Tectorial membrane testing: use mild cervico-occipital traction, then add slight flexion and extension. Symptoms of damage include nausea, fuzziness and loss of consciousness.

(2) Alar ligaments: these should be tested with the patient sitting (Figure 7.18). Support the patient's head with one hand while the other hand tests C-2 by side-bending and rotating the head and C-2 moves accordingly unless there is ligament damage. Both hands may be used to suppport the head and control the motion.

(3) Accessory ligament: this is tested in the same way as the alar ligaments but without side-bending (Figure 7.19).

Figure 7.18 Alar testing

Figure 7.19 Alar and accessory-testing

(4) Vertebral artery testing: with the patient's head beyond the end of the table (Figure 7.20), the integrity of the vertebral artery of the lower cervical segments is tested by cervical traction with flexion of the spine at C-7. The cervical spine is then extended, side-bent and rotated.

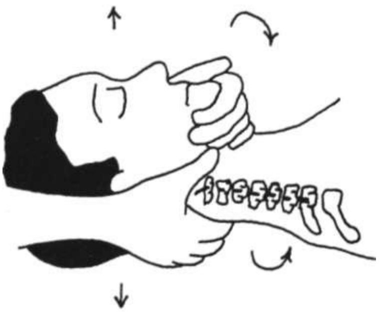


Figure 7.20 Vertebral artery testing

(5) The posterior articular columns should be palpated deeply and the range of motion tested, noting any pain, congestion and fixations.

Lesion conditions other than those caused by traumatic action also result in signs and symptoms. During testing of the cervical spine, altered tissue and function are readily determined. Periarticular congestion brings increased irritability to the approximate associated tissues, causing contractures that impair motion and circulation. Torticollis is a gross example of a lesion causing both myofascial and skeletal dysfunction. Sinusitis causes less obvious myofascial and skeletal dysfunction but lesions are discernable on palpatory evaluation. When soft tissue is palpated as abnormal, there are musculoskeletal lesions. When carrying out soft tissue and musculoskeletal manipulation, it is important to be sensitive to the tissue response. Lesions of the axis on C-3 are common, usually in flexion-rotation-side-bending. Lesions of the atlas-axis should not be corrected until the lower segments are corrected. C-3 is often the key to successful adjustment of the above segments.

CERVICAL SOFT TISSUE PALPATION AND LESIONS

Before active velocity corrective techniques are used, soft tissue treatment should be given to not only appreciate tissue set but also to decrease tissue resistance by relaxing the soft tissues. By first performing soft tissue manipulation, the force needed for active velocity corrections is markedly reduced. Generally, the soft tissues are examined with the patient lying supine on the examining table and the operator either sitting or standing at the head of the table. Both hands are used simultaneously for making complex movements while eliciting the tissue status. The palpating fingers may note superficial and deep muscular and fascial altered tone, periarticular congestion, increased tendon irritability, altered skeletal mechanics, etc.

Each side of the neck should be grasped with a hand simultaneously (Figure 7.21) and each hand should palpate superficially and deeply to check for tissues altered by congestion, contractures, hyperesthetic edematous ligamentous attachments and fascial tone. During the assessment, the operator should move the neck in various directions to test for restrictions. When soft tissue is palpated as abnormal, there are musculoskeletal lesions. Lesions of the axis (C-2) on C-3 are common, usually in flexion-rotation-side-bending. Lesions of the C-l/C-2 (atlas/axis) should *not* be corrected until the lower segments are corrected. When checking the tissues, do one side at a time so that a patient does not get the feeling of being choked. Check the soft tissues, muscles and fascia, with both active and passive motion. Then go deeper and use the finger tips to check the posterior articular facet columns.

Figure 7.21 Approach to cervical soft tissue palpation

Palpation of an articular lesion

With the patient supine, 'walk' the fingers of each hand up and down the posterior articular facets and alternately move the cervical spine in various subtle directions with gentle pressure on a fulcrum finger (Figure 7.22). Pain, edema and tenderness indicate a lesion, as well as restricted motion and/or altered positioning.

When the finger finds an articular area congested and restricted, the area is rocked from side to side gently to tease the joint in order to decongest the area (Figure 7.23), after which active correction of the lesion may be accomplished without much force using musculoskeletal velocity techniques.

Figure 7.22 Palpation of an articular lesion (1)

Figure 7.23 Palpation of an articular lesion (2)

CERVICAL MANIPULATION

Cervical myofascial or soft tissue techniques

Chin-occiput traction

Cup the chin and occiput for myofascial traction, pull to the limit, and then exert a gentle slow springing action (Figure 7.24). The head may be slowly rocked alternately forwards and backwards.

Figure 7.24 Chin-occiput traction

Cervical rotation

Between the hands of the operator (Figure 7.25) the patient's head is rotated to the limit and a gentle springing action is applied slowly to stretch the tissues, with or without holding in extreme rotation until release is noted.

Figure 7.25 Cervical rotation

Figure 7.26 Forearm fulcrum traction

Figure 7.27 Lateral traction

Forearm fulcrum

One forearm is placed under the cervical column perpendicularly with the palm of the hand on the table (Figure 7.26). With the other hand the patient's head is rolled back and forth while some upward pressure with traction is exerted by slightly lifting the forearm, using the hand as a fulcrum.

Lateral traction

Cradle the posterior neck with both hands and exert intermittent traction, moving the neck in an alternate lateral motion (Figure 7.27).

Counter-lateral traction

From the lateral position, the physician places his cephalad hand over the frontal area (Figure 7.28). The other hand reaches over and fingers the lateral cervical masses and exerts intermittent traction while the cephalad hand is used to resist.

Figure 7.28 Counter-lateral traction

Suboccipital traction

The operator's finger tips are used as a fulcrum under the soft tissues of the cervico-occipital area while the operator's forearms are resting on the table (Figure 7.29). Gentle pressure and traction are exerted intermittently slowly through the fingers.

Figure 7.29 Suboccipital traction

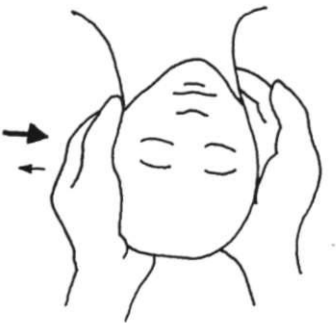


Figure 7.30 Side-slipping

Side-slipping

The patient's head and neck are grasped bilaterally with both hands so that the finger tips are on the lateral masses and the neck is pushed from side to side (Figure 7.30). The fingers progressively move up to and down over the lateral masses.

Counter-pressure springing

The index knuckle with the second metacarpal of one hand is used as a fulcrum for springing the cervical column behind the posterior facet pillar while the other hand supports the head from the occiput forward, and controls the spinal side-bending, rotation and extension (Figure 7.31). The motions of the hands should be synchronized in opposition, exerting tension and relaxation to various levels of the cervical spine. With the springing actions, joint mobilization may occur with the progressive pressure and counter-pressure of the hands.

Figure 7.31 Counter-pressure springing

Platysma stretch

Cup the head with one hand rotating away and light extension, while the other hand exerts myofascial tension downwards and away. This can be done with the subject either lying down or sitting (Figures 7.32 and 7.33).

Figure 7.32 Supine platysma stretch

Figure 7.33 Sitting variation

MUSCLE ENERGY TECHNIQUE

Muscle energy technique (MET) is a kind of soft tissue manipulation that avoids high velocity manipulation, yet improves or corrects lesions. MET contrasts with active velocity correction techniques where the patient remains passive while the operator does all the active manipulation. In MET the patient participates by actively using muscles to counter the locked-in holding position by the operator, and the action is a hold/release maneuver, usually repeated three times.

MET cervical technique

(1) With the patient supine, the operator grasps the head and rotates the cervical spine down to a locking point at the lesion. Rotation is away from the side of the lesion (Figure 7.34).

Figure 7.34 MET cervical technique

(2) The patient is instructed to voluntarily try to turn his neck and head slowly in the opposite direction from the operator's resisting force.

(3) The action is repeated three times and the patient then relaxes.

MUSCULOSKELETAL MANIPULATION

Velocity techniques
The patient is supine.

Occpito-atlantal techniques

(1) The physician places the thumb and index fingers of the right hand posterior to the C-l arch with the thumb on the side of the lesion (Figure 7.35). The fingers support the cervical area in slight extension. The left hand is placed across the forehead, and the cervical spine is side-bent to the right. The corrective force is synchronized between the forehead exaggerating the motion of rotation and side-bending suddenly against the thumb as a fixed fulcrum.

(2) The physician cups the patient's chin and rotates it to the right with slight side-bending to the left; the other hand applies pressure to the occiput using the heel of the hand (Figure 7.36). With 'locking' attained, a sudden mild force is exerted with the heel of the left hand in the direction of the opposite orbit.

Figure 7.35 Occipito-atlantal technique (1)

Figure 7.36 Occipito-atlantal technique (2)

(3) The physician cups the patient's chin and rotates the head away from the lesion, resting the head on the forearm (Figure 7.37). Rotation is away from the lesion and side-bend towards the lesion with slight extension. The left metacarpo-phalangeal eminence of the other hand is placed posterolateral to the posterior arch of the atlas and a gentle thrust is made towards the opposite eye.

Figure 7.37 Occipito-atlantal technique **(3)**

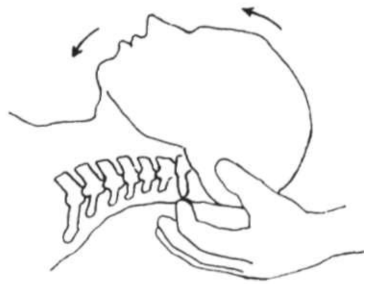


Figure 7.38 Ligamentous technique

Ligamentous technique for correction The tip of the operator's index finger presses upwards against the C-l posterior arch tubercle to anchor C-l anteriorly (Figure 7.38). The patient tips the head forwards without flexing the spine. Point of balance or 'locking' is noted and held while the patient breathes. Release usually occurs at the end of exhalation.

Atlanto-axial techniques

For a rightside lesion:

(1) The physician cups the patient's chin with the left hand, with the patient's head resting on the forearm (Figure 7.39). The physician's right index finger is posterolateral to the posterior arch of the atlas and the thumb is on the ramus of the mandible, Rotation of both hands is performed counter-clockwise simultaneously with exaggeration of the lesion. (Note: the hand cupping of the chin is not to jerk, rather to assist a gliding force of correction).

Figure 7.39 Atlanto-axial technique

(2) The cervical spine is rotated to the left with the temporal bone resting on the palm of the operator's left hand (Figure 7.40). The cervical spine is in a neutral position as above. The first index metacarpal is placed behind the right lateral facet mass (the

Figure 7.40 Cervical rotation technique

Figure 7.41 Illustration of the hold on the transverse processes of C-2

lesion) and the left hand is placed on the patient's left mandibular ramus with the fingers towards the chin, and the left hand exerts a sudden left rotation.

Cervical techniques for C-2, the axis

(1) One hand is placed under the patient's head.

(2) The hand is flexed at 90° and the transverse processes of C-2 grasped between the thumb and middle finger to immobilize C-2 (Figure 7.41).

(3) The thumb and middle finger are placed *between* C-l and C-2 (Figure 7.42).

(4) The crown of the head is grasped with the other hand and the occiput is rocked about the atlas. Enough pressure should be used to move the feet.

(5) If motion is not attained, the suboccipital muscles should be relaxed and the process repeated.

Figure 7.42 C-l/C-2 technique

Ligamentous technique

Frequently atlanto-axial (C-l/C-2) lesions are secondary to atlanto-occipital (C-l/occiput) lesions. The same technique is used as for C-2, the axis, but the fulcrum pressure of the index finger is on the posterior process of C-2 (Figure 7.43).

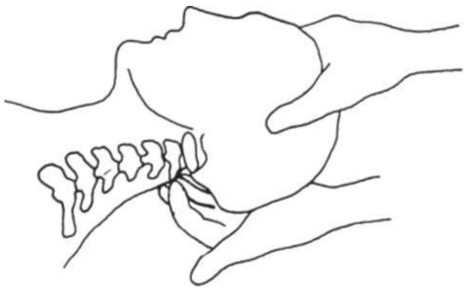


Figure 7.43 Ligamentous technique

Figure 7.44 C-3 to C-7 technique

Cervical techniques for C-3 to C-7

An example of this might be a left 4th lesion, palpated with a side-bend and rotation to the right.

(1) Place the first metacarpo-phalangeal eminence of the left hand posteriorly and below the C-4/5 facets, firmly against the convex side (Figure 7.44). Side-bend to the left by the action of the right hand and at the same time thrust up and across on the compact articulation. This separates the facets.

(2) Hold the same area with the right hand and place the same part of the left hand to the back of and a little outside the facet on the left side. Press forward somewhat, side-bend more to the left, then thrust slightly downwards, across and under, while the right hand is increasingly separating the right articulation. Separate the facets on the concave (right) side, move the body to the right and approximate the facet of C-4 on C-5 on the left side. Never place the hand which is holding opposite to the thrust, above the vertebra to be thrust.

(3) The physician is at the head of the table and places his index finger at the articular pillar of the lower of the two vertebrae in lesion (Figure 7.45). With the other hand he rotates the cervical

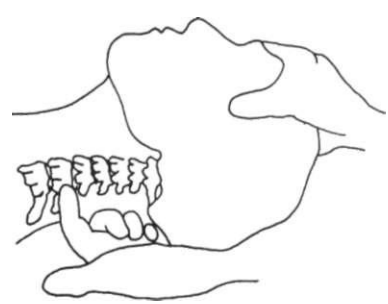


Figure 7.45 Ligamentous technique

column away from the lesion, with side-bending towards the lesion to the point of 'locking'. Exaggerate the rotation and resist with the fulcrum point of the other hand.

As a variation, use the first or index metacarpo-phalangeal eminence as the fulcrum.

Ligamentous technique This technique is described for a rotation-side-bending lesion. The articular process of the upper vertebra on the side of the lesion is held in that direction with a finger tip (Figure 7.45). On the opposite side, a finger tip is placed similarly on the vertebra below, under the inferior facet (Figure 7.46). The patient moves the shoulder on the convexity side caudally to separate the facets. The patient holds his breath, inhalation favoring motion with flexion-rotation lesions: exhalation with extension favors internal rotation lesions.

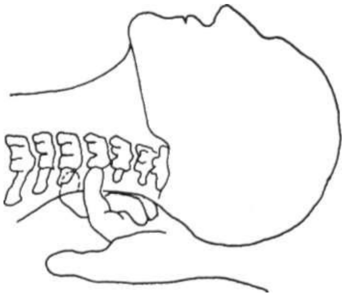


Figure 7.46 Rotation-side-bending lesion technique

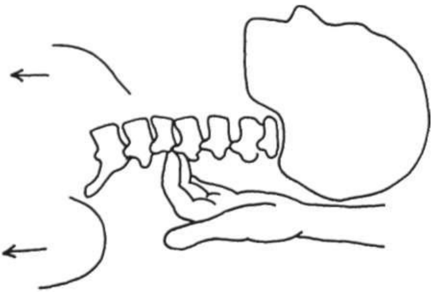


Figure 7.47 Flexion lesion technique

Flexion lesions The articular processes of the upper of the two vertebrae in lesion are held by the operator's finger tips in the plane of the facets. The patient lowers both shoulders caudally to attain the point of balance or 'locking' and this position is held in inhalation in order to achieve release (Figure 7.47).

8

THORACIC REGION

ANATOMICAL REVIEW

The thorax, i.e. the chest, extends between the neck above and the abdomen below. Posteriorly, the thoracic skeletal frame is composed of 12 thoracic vertebrae (dorsal spine) and the posterior part of the ribs. The anterior thoracic frame is formed by the sternum and cartilaginous extensions of the first ten ribs. The lateral convex frame is formed by the 12 ribs bilaterally with 11 interspaces (Figure 8.1).

The skeletal frame consists of the:

(1) Rib cage (24 osseous ribs with 20 cartilaginous extensions anteriorly and the sternum);

(2) Dorsal spine vertebrae (12); and

(3) Shoulder girdle (two clavicles and two scapulae).

The upper seven cartilaginous anterior divisions of the ribs articulate with the sternum. The remaining cartilaginous rib sections fuse with the cartilaginous mass of the 6th and 7th ribs. The somatic tissues of the frame consist of muscles, ligaments, fascia and cutaneous tissues interspersed with the neurovascular supply. Within the somatic structure lie the visceral components of the thorax, i.e. heart, lungs, bronchial tree, esophagus, etc.

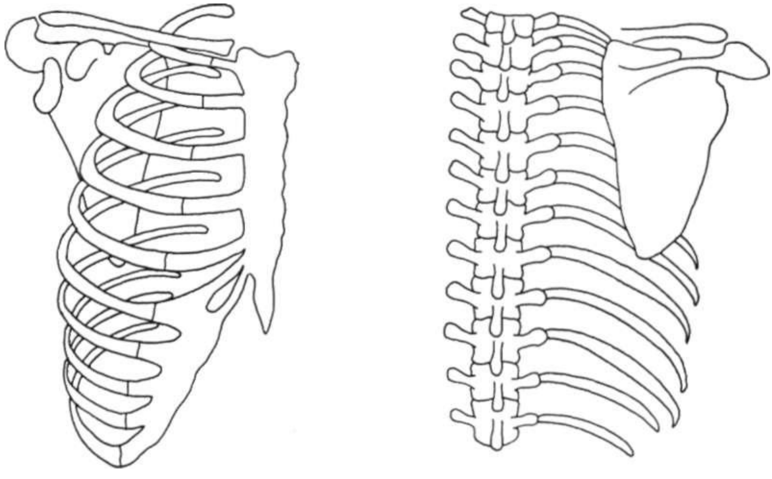


Figure 8.1 Thoracic skeletal structures

DORSAL SPINE

Each dorsal vertebra has from eight to 12 articular surfaces for contiguity with adjacent vertebrae and ribs. The articular facet surfaces he in a great circular plane perpendicular to the body axis and allow for gliding rotation, flexion, extension and side-bending, the latter being limited by the approximating ribs. Both the 1st and 12th thoracic vertebrae are transitional (Figure 8.2), with modifications which make them somewhat like the adjacent upper 7th cervical vertebra and the 1st lumbar vertebra below. Transitional areas are frequently found to have stress lesions. Ten of the 12 thoracic vertebrae have twelve articular surfaces, and the other two, the 1st and the 12th, have ten articular surfaces.

The vertebral ligaments are listed below (Figure 8.3):

- supraspinatus
- interspinatus
- costotransverse
- intertransverse
- capsular
- ligamentum flavum
- longitudinal (anterior, posterior and lateral)
- intervertebral disc

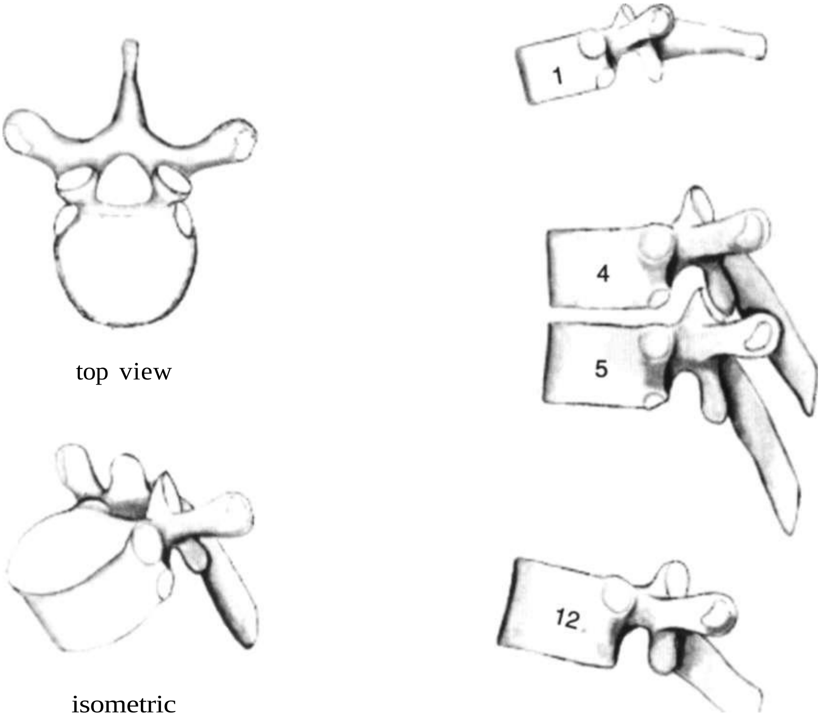
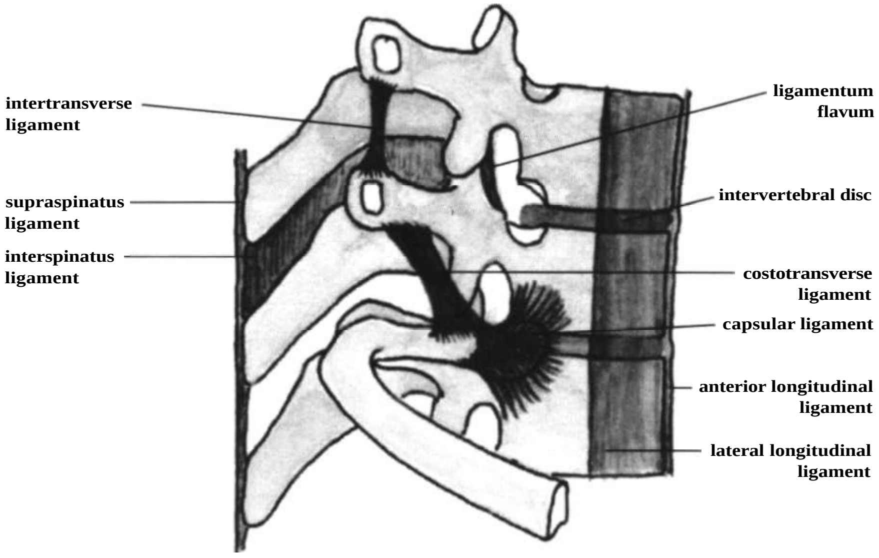


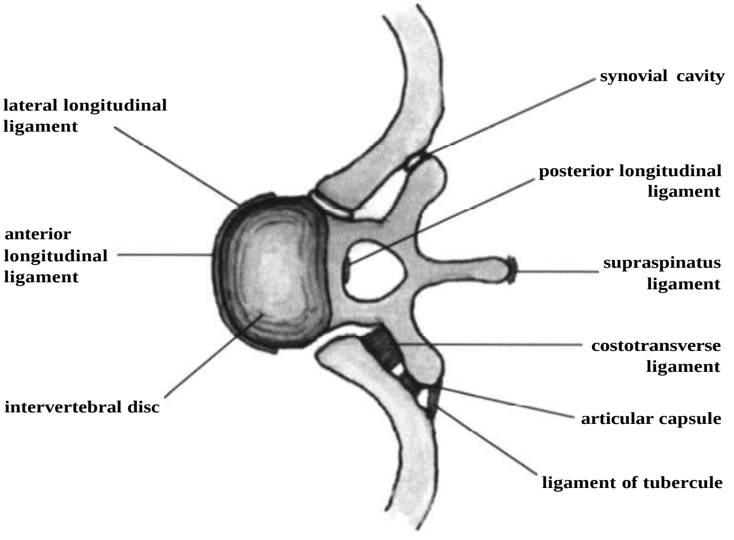
Figure 8.2 The 1st, 4th, 5th and 12th thoracic vertebrae

The heads of the ribs articulate with the bodies of the vertebrae (Figure 8.4). The shaft extends upwards and backwards to articulate with the anterior facet on the transverse process and goes on to the rib angle that directs the shaft anteriorly and down to join with the chondral (cartilaginous) division anteriorly. This extends the ribs to articulate with the sternum.

Posteriorly each rib head articulates with the vertebral demi-facets, one on the vertebra above and one on the vertebra below, except for the 1st and the 12th dorsal vertebrae. The first ten ribs are contiguous with the sternum anteriorly by the chondrosternal joint. The sternum has 16 articulations, the uppermost with the two clavicles, and the remainder with the upper seven anterior cartilaginous extensions of the ribs.



(a)



(b)

Figure 8.3 Thoracic vertebrae with ligaments

The thoracic cage is highly mobile and has two basic motions: elevation and expansion with inhalation; and descent and contraction with exhalation. The motion of the rib cage is a 'bucket type' with respiratory inspiration and expiration (Figure 8.5).

Figure 8.4 Rib articulations with vertebra and sternum

The shoulder girdle hangs by muscular support from the neck and is supported away from the rib cage by the clavicle at the sterno-clavicular articulation (Figure 8.6). The skeletal frame of the girdle is composed of the clavicle and scapula, from which hangs the humerus. The shoulder girdle is a highly mobile structure stabilized by ligaments and muscular attachments to the manubrium sterni, clavicle, rib cage, cervical and dorsal spines. Anteriorly, under the sternoclavicular origin of the pectoralis major, lies the subclavius, under the medial third approximately of the clavicle. It connects the clavicle to the upper border of the first rib medially (Figure 8.7).

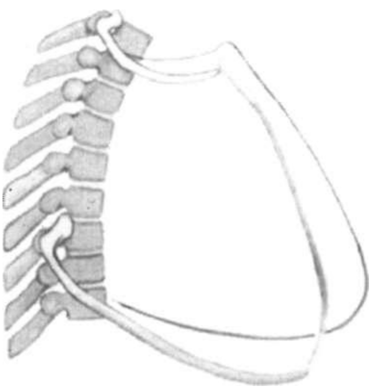


Figure 8.5 Ribs showing respiratory excursion

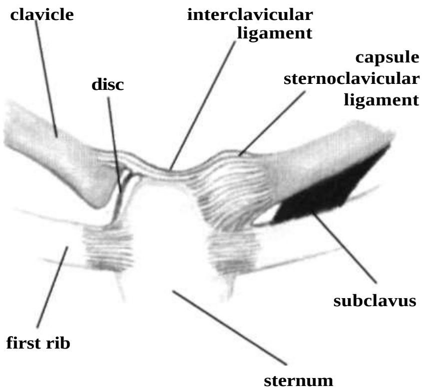


Figure 8.6 Sternoclavicular joint and first rib with ligamentous attachments and disc

Figure 8.7 Anterior thoracic muscles: pectoralis major and minor, subclavius and serratus anterior

The shoulder girdle is a transitional structure between the body trunk and the upper extremities, and it will be discussed in more detail in Chapter 9 on the upper extremity.

Dorsally, the lumbar area becomes involved in shoulder and upper extremity lesions because of the latissimus dorsi originating in the lumbar fascia and lower six dorsal thoracic spinal processes. Overlying the dorsum is the large trapezius that extends from the occiput above to the 12th thoracic vertebral spine below.

The skeletal thoracic frame is overlayed by muscles. The superficial muscles may be identified by distinctive contours. Dorsally: the trapezius, latissimus dorsi and sternocleidomastoideus. Ventrally: the pectoralis muscles, and anterolaterally: the serratus anterior.

The muscles beneath the superficial trapezius and latissimus dorsi are the teres minor and serratus posterior at the lateral aspect of the scapula; the levator scapulae is at the superior angle with the rhomboideus minor and major underneath along the medial border; and the sacrospinalis is medial to this (Figure 8.8).

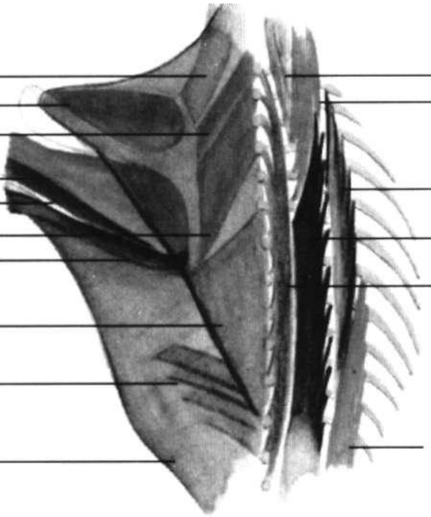


Figure 8.8 Posterior thoracic muscles

Posteriorly, the easily identified superficial muscles (Figure 8.9) are the:

splenius capitis
levator scapulae
supraspinatus
sternocleidomastoideus
trapezius
deltoideus
rhomboideus minor and major
infraspinatus
teres minor and major
latissimus dorsi

Beneath the superficial trapezius, latissimus dorsi, levator scapulae, serratus superior and inferior and the rhomboids are the muscles of the sacrospinalis group, consisting of three descriptive muscle groups (Figure 8.10).

(1) Spinalis dorsi is next to the thoracic spinous processes.

(2) Longissimus dorsi is just lateral to the spinalis.

(3) Iliocostalis dorsi lies over the tips of the thoracic transverse processes and the angle of the ribs (refer to Figure 3.2).

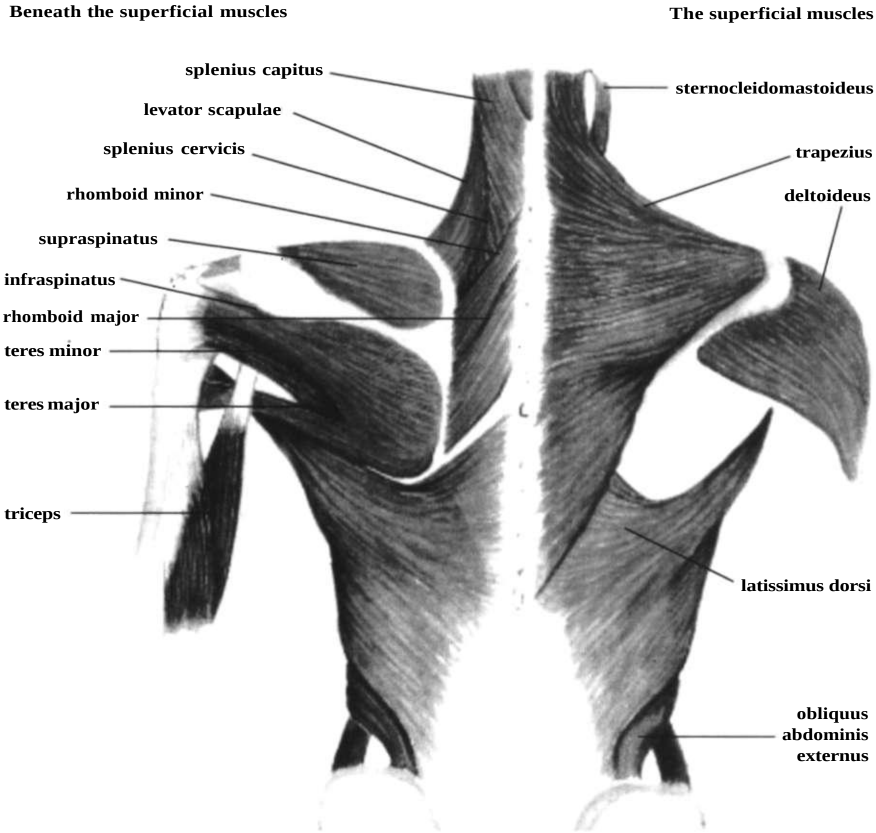


Figure 8.9 Superficial dorsal muscles

The spinalis dorsi, scarcely distinct as it blends with the longissimus, arises by three or four tendons from the spinous processes of the first two lumbar vertebrae and the last two thoracic vertebrae, uniting and extending to insert by separate tendons (four-eight) in the upper thoracic spinous processes. The longissimus dorsi is continuous with and blends with the iliocostalis laterally. It arises from the deep surface of the sacrospinalis aponeurosis, the short sacroiliac ligaments and the transverse processes of the first two lumbar vertebrae. It inserts by round tendons into the tips of the transverse processes of the lumbar vertebrae and inferior margins of the lateral ribs to the tubercles and inferior margins of the transverse processes of the thoracic vertebrae. The iliocostalis dorsi arises by flat tendons from

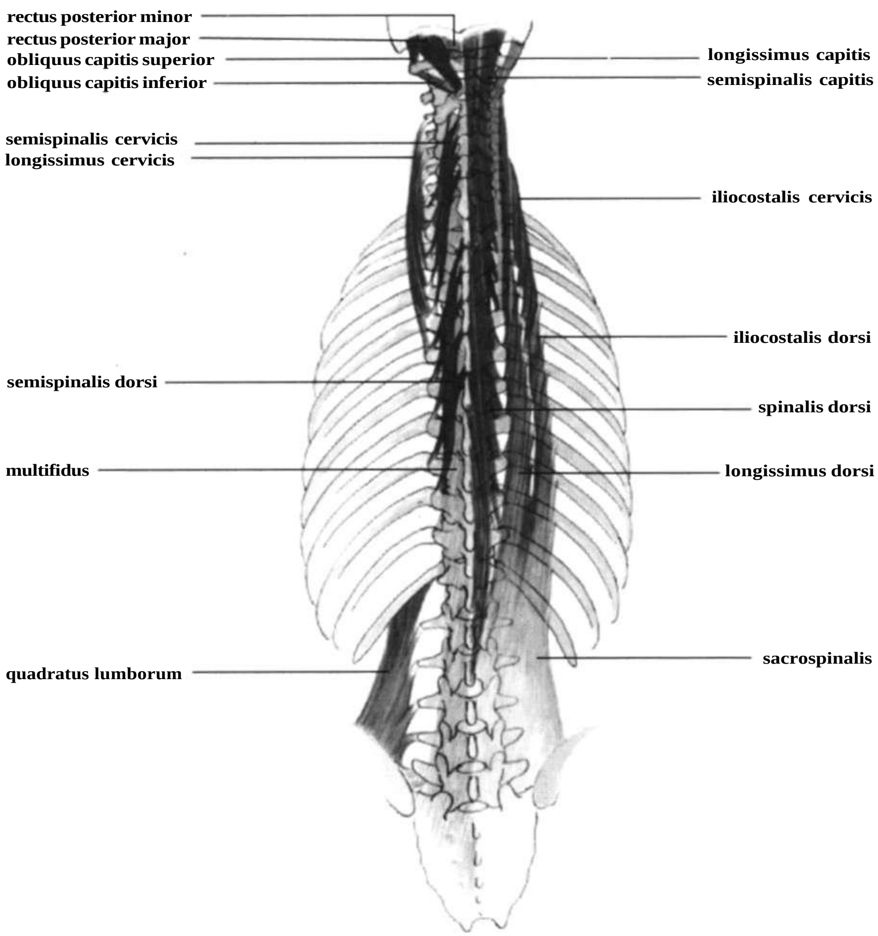


Figure 8.10 Deep thoracic sacrospinalis muscles

the upper borders of the angles of the lower six ribs and inserts in the upper borders of the rib angles and the back of the transverse processes, as well as to C-7.

The thoracic articulations are stabilized and supported by the rib cage and the attending musculature. The ribs limit motion and if any marked rotation occurs, it may result in joint strain with vertebral and disc distortion. The thoracic spinal curve is convex posteriorly and the load is greater on the vertebral bodies than on the facets, as is true of the cervical and lumbar vertebrae.

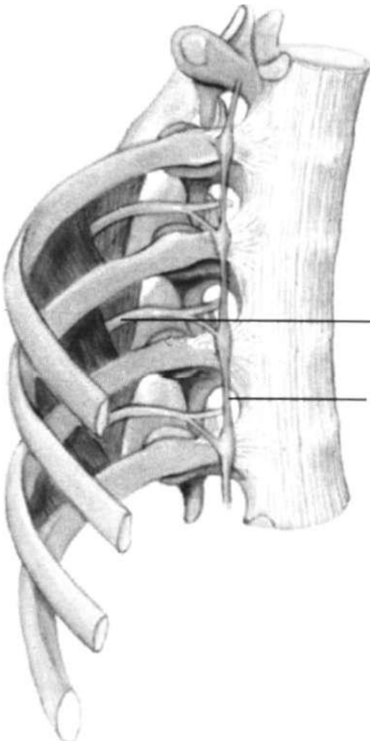


Figure 8.11 Thoracic ganglionic sympathetic nerves

The nervous system plays an important role in manipulation in that it is via the nervous system that tissue irritability reacts and responds not only by maintenance but also by active volitional and passive motions (Figure 8.11). Two neural reflex systems should be considered in applying manipulation. These are the somatico-somatic and the somatico-visceral segmental reflexes (Figure 8.12).

Afferent cutaneous receptors are stimulated by soft tissue manipulation, so helping to explain reflex actions during manipulation. These types of reflexes support the rationale for the clinical use of manipulation. Enumerated below are the kinds of receptors in the skin and the stimuli to which they respond:

(1) Meissner's corpuscles: touch;

(2) Krause's end bulbs: cold;

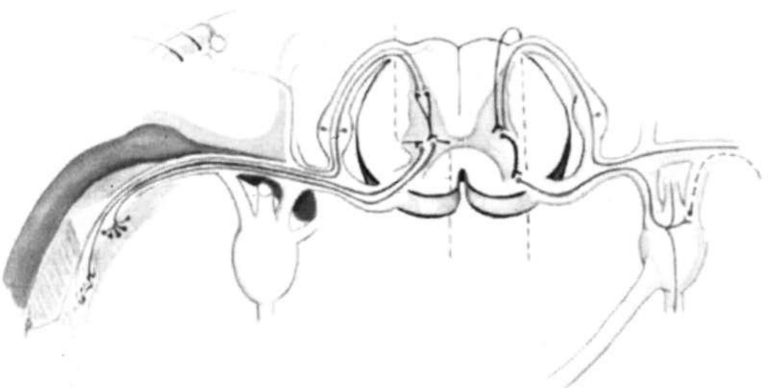


Figure 8.12 Thoracic segmental sympathetic reflex nerves

(3) Ruffini's end organs: warmth;

(4) Pacinian corpuscles: deep pressure;

(5) Merkel's discs: touch; and

(6) Bare nerve endings: pain.

There are four special types of receptors in muscles, tendons and joints:

(1) Muscle spindles have both afferent alpha fibers (larger) and efferent gamma fibers.

(2) Golgi corpuscles are found in tendons. Tension is the prime stimulus for these receptors.

(3) Pacinian corpuscles are found in tendons, joints, periosteum, fascia, mesentary, muscles and subcutaneous tissues and are stimulated by pressure.

(4) Unencapsulated nerve endings, i.e. free nerve endings, are found between muscle fibers, in tendons, fascia and joints and these mediate pain.

Pain is the chief reason for patients seeking the service of a physician. Physical pain is more than a symptom or signal of disease, and particularly when chronic; it may be considered a disease in itself.

There are two neurophysiological theories of pain:

(1) Specificity:

(a) touch-sensitive: Meissner's corpuscles;

(b) cold-sensitive: Krause's end bulbs; and

(c) heat-sensitive: Ruffini's end organs.

(2) Pattern theory:

(a) spinothalamocortical; and

(b) spinoreticulothalamic.

Causes of pain include spasm and cramps; ischemia, perhaps from repeated contractions and dependent on excessive accumulation of metabolites; and local trauma with release of neurotoxins. Often during soft tissue treatment a patient has some relief from pain, but this may be short-lived until the deeper musculoskeletal restrictions and pressure are relieved by joint mobilization.

THORACIC ASSESSMENT AND SOFT TISSUE MANIPULATION

Joint testing and/or myofascial stretching may be carried out with the patient standing, sitting, laterally recumbent, supine or in the prone position. Testing maneuvers for normal freedom or restriction of motion with muscle and ligamentous stretching are similar to those in treatment procedures because in each of these actions the operator applies his palpating hand, with examining fingers, over one area after another while the other hand activates the tissues with motion (Figure 8.13). For instance, when performing interscapular soft tissue manipulation with the patient lying in a lateral recumbent position, the operator anchors and controls the patient's upper shoulder with one hand while the other hand grasps the myofascial soft tissues (thoracic

Figure 8.13 Dorsal soft tissue manipulation

sacrospinalis) with the fingers and draws them with deep pressure laterally from the central area. Counter-pressure is applied by the other hand on the shoulder (Figure 8.14). This creates a perpendicular type of traction against the muscle bundles and effects relaxation of the muscles with circulatory decongestion.

Figure 8.14 Lateral recumbent myofascial technique

Most of the time, the operator checks the dorsal elements with the patient lying prone. In this instance the heel of the hand and thumb are used to relax the tissues after the finger pads have been used to check for lesions with alterations in periarticular soft tissue. When vertebral lesions are present, the spinous area is often quite tender, so in pushing the sacrospinalis away from the spine, pressure should not be applied on the spinous process. While carrying out soft tissue testing and manipulation, the palpating fingers discern the tissue qualities, such as tissue motion, restriction, congestion, contraction and temperature. When the prone counter-stretch technique (Figure 8.15) of loosening the paravertebral soft tissues is used, it may be adapted for active velocity correction of rotation lesions by increasing the downward force. Vertebral lesions are often released and felt and/or heard. This is a very easy technique to use for breaking up restrictive lesions, but the pressure-thrust should not be used unless the patient is relaxed.

Figure 8.15 Prone counter-stretch technique

The same principle of testing and stretching is also used with active joint mobilization as is performed in the soft tissue manipulation of the dorsal sacrospinalis. As the myofascial elements are stretched, kneaded and evaluated during the procedure, the operator needs only to apply more pressure and/or a low to high velocity thrust to a specific restricted area to free the structural restriction.

Testing

Dorsal side-bending
With the patient in the lateral recumbent position, side-bending testing can be carried out as illustrated in Figure 8.16. Active correction may be achieved by exaggeration with or without a low velocity thrust with the heel of the hand or thumb, while the cephalad hand maintains locking to the fixation point by flexion and side-bending.

Figure 8.16 Lateral side-bending thoracic testing

Prone upper dorsal vertebral testing
The patient raises his chest and supports himself by his elbows (Figure 8.17). The operator uses the cephalad hand to create upper dorsal motion by increasing the flexion, while the operator's other hand tests for motion of each spinous process.

Testing the upper dorsals with the patient sitting
(1) The physician puts his elbow on the shoulder of the patient (Figure 8.18) and lays that forearm parallel to the neck and head, grasping the patient's head at the vertex. This gives the operator control of the neck for side-bending, rotation, extension and flexion that carry on down into the dorsal spine. (This maneuver is used for locking down to the upper dorsal area for vertebral or rib techniques.)

(2) The operator then uses the thumb of his other hand to palpate and investigate as the first hand creates movements of flexion, extension, rotation and side-bending.

(3) Either a stretching action or stretching with active mobilization may be applied.

Figure 8.17 Prone upper dorsal vertebral testing

Figure 8.18 Upper dorsal vertebral testing with the patient sitting

Figure 8.19 Supine dorsal testing

Upper and mid-dorsal vertebrae can be tested with the patient in the *supine position* as illustrated in Figure 8.19. Flexing the head and neck with one hand, the effects of motion on the dorsal tissue may be tested with the other palpating hand underneath the thorax. Stretching techniques may be utilized by carrying the motion to the extreme, then slowly repeating the same movement three or four times. Usually by the third time a tissue response is noted, such as release and decongestion. The cephalad hand may be used to vary the flexion with side-bending. The drawback is the weight of the patient. To this final action may be added a thrust or exaggeration of pressure at the fulcrum point by the fixating hand or fingers for active mobilization of the joint(s).

Soft tissue manipulation

Dorsal soft tissue manipulation is carried out most frequently with the patient lying prone on the manipulation table, but it may also be performed with the patient lying in a lateral recumbent position. Soft

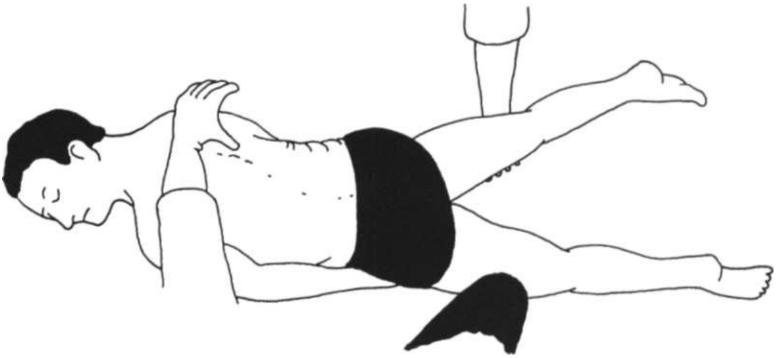


Figure 8.20 Prone dorsal technique using lower extremity

tissue manipulation is carried out to relax, decongest and to warm tissues in preparation for normalization of skeletal and soft tissue structures by active or passive correction techniques and to affect somatic or visceral conditions. The amount of finger or hand pressure used may vary according to the tenderness of the tissues and the patient's tolerance. Sometimes when the pressure is firm and forceful a release may be felt as myofascial relaxation or may be heard.

Another example of soft tissue manipulation is described below. It may be applied, with or without active joint 'correction', to the dorsal spine for stretching and relaxing soft tissues with the patient prone on the treatment table:

(1) The physician stands on the opposite side of the table to the area being treated (Figure 8.20).

(2) The physician uses his cephalad hand to identify lesions while performing soft tissue stretching. If active correction is desired, the physician fixes his thenar and hypothenar eminences or thumb over the lesioned area in question.

(3) The physician reaches across the patient to grasp the far lower extremity by the distal thigh and elevates (extends) that lower extremity until there is a locking up to the affected dorsal area, and then asserts mild adduction.

(4) A gentle stretching motion may then be exerted to the lesioned restricted area.

(5) After there is a tissue release response, the motion may be exaggerated. Again the soft tissue technique may be made into an active correction technique by asserting a mild thrust with the other hand.

This is a powerful technique. To secure the patient from sliding on the manipulation table, the operator puts his caudad knee on the table at the patient's proximate thigh. This technique causes spinal extension and rotation with some side-bending of the dorsal spine. It is easily used in children and light-weight adults. It has been described as a soft-tissue treatment, but it is readily used for vertebral corrections and lower posterior rib lesions. Corrective action may be achieved by using the cephalad hand or fingers to act as a fixating fulcrum, while the caudad hand of the operator extends the far lower extremity with a little adduction so as to lock the spine up to the point of fixation of the other hand. Then that position is held while the patient breathes deeply about three times. This usually effects a correction.

The same principles can be applied in using the upper extremity instead of the lower extremity when upper and mid-dorsal action is desired.

Lateral recumbent soft tissue technique
The operator stands facing the patient, who is lying in a lateral recumbent position, and anchors the upper free shoulder with his cephalad hand. The other hand is used to reach under the patient's arm to grasp the sacrospinalis muscle bundle which is then pulled in a slow rhythmical motion at right angles to the muscle bundle until relaxation is obtained. While doing this, the operator checks the tissue quality and motion (see Figure 8.14).

ACTIVE MOBILIZATION OF SKELETAL LESIONS

Thoracic vertebral and rib lesions

The correctional velocity forces for mobilization of the thoracic spine and the posterior rib components are directed sagittally through and through the thorax after the segment is locked by taking up the vertebral ligamentous slack from above downwards by flexing and/or side-bending the spine.

Figure 8.21 Supine dorsal vertebral flexion technique

Figure 8.22 Supine dorsal vertebral technique with the elbows approximated

Thoracic supine vertebral techniques

(1) With the patient lying supine; the operator reaches across the patient, grasps the far wrist and crosses the patient's arms with the patient's proximal extremity cephalad to the other (Figure 8.21).

(2) The operator then reaches across the thorax with his cephalad hand, grasps the shoulder and pulls it up and towards him so that, with his caudad hand, he may reach across the patient to place that hand under the dorsal spine to locate the lesioned area.

(3) The operator's cephalad hand then cradles the patient's neck and is used to flex the torso from the neck down.

(4) The patient's body is brought into flexion down to the fulcrum point, taking up the slack with the cephalad hand.

(5) The manipulator exerts a thrust through the affected area by the weight of his body resting on the crossed forearms or elbows (Figure 8.22) of the patient. With active correction there is usually a 'popping' sound heard and/or motion noted by the fulcrum hand under the spine. The spinal tension may be exaggerated at the time the thrust is made so that little velocity is required.

The physician's cephalad hand, cradling the neck, controls the flexion of the spine and flexes the spinal column down to the lesioned area and may be used at that point to test for motion by side-bending and/or rotation of the spinal column. The patient must relax to allow this, so that there is no musculature joint splinting, and so that a minimum force is needed to effect release of the restricted lesion.

The manipulator, in both techniques, must be careful not to place the patient's elbows against his pectoral chest at the coracoid area before exerting a thrust. When the patient's arms are crossed, the manipulator's chest is placed so that the forearms of the patient take the pressure. When the patient's elbows are approximated, the elbows are placed against the physician's pectoral muscles. A variation is for the manipulator to use the cephalad hand to grasp the elbows and to lean against the hold.The supine technique has the advantage of the operator's fulcrum hand being specific and able to sense joint mobilization.

Dorsal vertebral corrections

These can be performed with the patient sitting or standing by using the posterior or dorsal technique.

(1) The physician stands behind the patient and puts his arms under the patient's arms and clasps them behind the patient's neck over the patient's hands which also clasp behind the neck (Figure 8.23).

(2) The patient is instructed to let go and relax so that the physician supports him entirely and controls spinal flexion.

(3) The operator pulls the patient backwards and upwards, causing flexion of the spine down to the area in question.

(4) The operator makes a thrust with his chest at the patient's flexed dorsal spine.

Figure 8.23 Dorsal vertebral correction with patient sitting or standing

RIBS

The ribs articulate anteriorly with the sternum and posteriorly at the vertebral bodies and the transverse processes. Restriction and displacement may occur in these areas. A posterior rib lesion does not necessarily mean that there is an anterior lesion, and vice versa. With a posterior rib lesion there is periarticular soft tissue involvement that exhibits at least congestive changes, with tenderness or pain and contractures of the iliocostalis impairing rib excursion. Infrequently, there may be a costochondral joint lesion. General rib elevation and stretching by abduction and extension of the upper extremity usually corrects this.

Testing for rib lesions

Anterior rib lesions

Assessment of the anterior rib may be carried out with the patient either sitting or lying supine on the manipulation table. When the patient is sitting, the physician stands behind the patient and reaches over the shoulder of the patient to palpate the chondrosternal joint and the soft tissues in approximation. When a lesion is present, the periarticular soft tissues are swollen and tender or painful on pressure and there is a discrepancy in the skeletal alignment noted by assessment of adjacent intercostal spaces.

The following procedures are performed with the patient sitting:

(1) The operator stands behind the patient and palpates the costosternal joint for tenderness, congestion and alignment (Figure 8.24).

(2) The operator abducts and extends the approximate extremity to create motion of the rib cage by elevating and expanding the ribs.

(3) Rib correction is performed by exaggerating the extension and abduction.

Figure 8.24 Anterior rib testing

When the patient is lying supine, the procedure is similar:

(1) The operator stands on the side being tested and palpates the costochondral joint.

(2) With the other hand, the operator creates rib motion by moving the adjacent patient's arm up and backwards.

Posterior rib lesions
Rib lesions may be identified by palpation of the soft tissues over the area in question and abduction of the arm posteriorly and upwards while a palpating finger is over the costotransverse joint. Frequently a vertebral restriction is also present. This may be tested with the patient either sitting or in a prone position. For the sitting position, see Figure 8.18; the thumb is moved to the costotransverse joint. The prone technique is illustrated in Figure 8.25. The operator stands at the head of the table and palpates the lesioned rib. With the other hand, the approximating arm is grasped distally, and the arm and shoulder are abducted and extended.

Figure 8.25 Prone posterior rib testing

Corrective rib manipulation

Anterior rib lesions
Anterior rib lesions are readily treated with the patient sitting and the operator standing behind and reaching over the shoulder of the patient on the side being palpated at the costosternal joint. When a lesion is present, the periarticular tissues are swollen and tender or painful on palpation. The joint in question may be compared to the opposite sister joint. The costosternal alignment determines whether it is elevated or depressed. An elevated anterior rib is treated with the palpating finger or fingers placed above the rib (costal cartilage) and pushing down when the rib is elevated, or with upward presssure when the rib is depressed, with circumducting of the adjacent arm up and back.

A first rib lesion causing anterior downward displacement with elevation of the shaft may create a 'thoracic outlet syndrome' with numbness and tingling of the extremity. The anterior and medius scaleni muscles arise from the transverse processes of the cervical spine and insert on the upper surface of the first rib. The cervical and brachial nerve plexes pass between the anterior and medius scaleni muscles and over the first rib (see Figures 7.3 and 7.4).

Depressed anterior rib correction

(1) The physician stands behind the patient who is sitting or lying supine, and reaches over the shoulder and locates the lesioned rib.

(2) The physician applies upward pressure under the depressed rib.

(3) Using his other hand, he grasps the ipsilateral forearm of the patient and moves it in circumduction upwards and backwards so as to draw the rib cage up and away from the sternum by the pull of the pectoral muscles and fascia. The palpating fingers on the rib may feel the motion and release.

Elevated anterior rib correction
The physician applies downwards pressure on the rib while the other hand grasps the adjacent arm and circumducts it up and backwards in an arc, thus lifting the rib and creating a pectoral pull. The approach is similar to the testing for a sternoclavicular lesion, and the ipsilateral upper extremity may be circumducted upwards and backwards to establish altered joint motion or fixation (see Figure 8.26).

These techniques can be adapted for use with the patient lying supine on the treatment table.

Correction of posterior rib lesions
First rib sitting correction The patient sits with his back to the operator (Figure 8.27):

(1) The operator places his elbow on the shoulder above the lesion and grasps the vertex of the patient's head, allowing his forearm to conform to the neck so as to have control of the spinal column from the head down in order to control the neck for locking down to the first rib, with rotation and side-bending away from the lesion, with a little flexion.

(2) The other hand is placed on the upper dorsum and

Figure 8.26 Anterior rib technique

suprascapular area so that the thumb can be placed over the involved first rib by spanning across the vertebral column.

(3) The patient's head and neck are rotated away from the lesioned side, with some side-bending so that the column is locked down to the point of lesion.

(4) A thrust is given simultanously with exaggeration of both of the physician's hands; the head and neck hand and the thumb hand being over the angle of the rib in question. The thumb may feel the articular motion and release created by the thrust.

Figure 8.27 First rib sitting technique

Posterior lesions to the second, third and fourth ribs may be corrected using the above techniques. Corrections may also be undertaken using the supine flexion technique, by making the fulcrum point at the angle of the rib.

Supine first rib correction This corrective technique is applied with the patient supine, for example - first left rib:

(1) The physician stands on the opposite side from the lesioned left first rib.

(2) The physicians's right hand is slid under the patient's thorax and placed under the angle of the first rib, while raising the patient's thorax by the neck with the other hand cradling the nape (Figure 8.28).

(3) The head and neck are then given slight flexion and rotation towards the physician, with side-bending until locking occurs down to the first rib.

(4) The thrust is made by a sudden pull, applied to the first rib, along the axis of the physician's forearm upon which the patient is resting.

Figure 8.28 First posterior rib correction with the patient supine

Alternative supine posterior first rib technique

(1) The physician stands at the head of the table and with one hand cradles and rotates the patient's head with side-bending and slight flexion of the cervical spine away from the lesioned first rib, i.e. locking down to the lesion (Figure 8.29).

(2) The other hand is positioned so that the base of the index finger is placed on the upper surface of the angle of the first rib.

(3) Then a short thrust is given downwards and slightly medially.

(4) Correction may also be applied by simultaneous exaggeration of the forces from both hands.

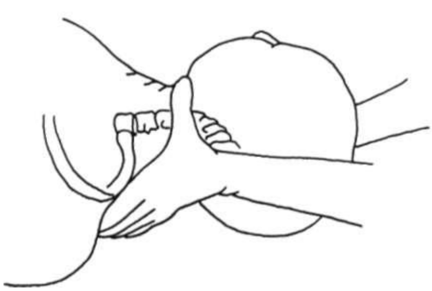


Figure 8.29 Alternative first rib technique

Figure 8.30 Alternative first rib technique

First rib technique with patient lying prone This is the prone technique for the first right rib. The physician or operator stands slightly to the contralateral side, in relation to the lesion, at the head of the table with the patient's chin on the table (Figure 8.30):

(1) The patient's head is rotated with the face towards the lesioned first rib, creating cervical rotation, side-bending and traction in locking down to the first rib, and is secured by the left hand.

(2) The operator's right hand is placed so that the thenar eminence is on the angle of the rib in question.

(3) Any slack is taken up by counter-hand action.

(4) A mild thrust is given with the right hand in a downwards and caudad direction through the angle of the rib.

This technique may be used for other upper dorsal rib lesions, especially for the first rib.

Corrections to the 4th to 12th posterior ribs Rib lesions in this area are treated with the patient supine. The procedure is similar to the dorsal supine vertebral techniques (Figure 8.31). The underlying hand, used as a fulcrum, is placed just lateral to the angle of the rib in lesion and the thrust is applied in a similar way to the vertebral techniques, by a through and through segmental force.

The upper ribs can also be corrected with the patient sitting and the physician standing behind:

(1) The physician puts his elbow on the shoulder of the lesioned

side and grasps the vertex of the patient's head, allowing his forearm to conform to the neck so as to have control of the cervical vertebral column from the head downwards (see Figure 8.18).

(2) The physician's other hand is used so the thumb exerts pressure laterally on the angle of the rib in question.

(3) The patient's head and neck are rotated away from the lesioned area and given some side-bending so that the column is locked down to the point of lesion.

Figure 8.31 Supine posterior rib technique

(4) A thrust is given simultanously with exaggeration of both of the physician's hands (counter-action), i.e. the head and neck hand and the thumb hand over the angle of the rib in question. The thumb may feel the articular motion and release created by the low velocity thrust.

Floating ribs

Floating ribs technique (ribs 11 and 12)

(1) The patient lies prone on the manipulation table (Figure 8.32).

(2) The operator places the heel of his hand, his thenar and hypothenar eminences, over the angle of the 11th or 12th ribs on the opposite side to where he is standing and exerts soft tissue pressure in the direction of the ribs.

(3) At the same time, with the other hand, he flexes the far leg at the knee and side-bends it to him to take up the soft tissue slack to the 11th and 12th ribs under the other hand.

(4) The motion is exaggerated and a thrust is put through the shafts of the ribs in question.

Figure 8.32 Supine floating rib technique

Other rib techniques

Springing ribs dorsally
Soft tissue treatment can be performed by springing and raising the ribs. This is a stretching myofascial technique:

(1) The operator stands in front of the patient (Figure 8.33).

(2) The patient sits and extends his upper extremities over the shoulder of the physician or rests his crossed forearms on the operator's chest which gives extension to the patient's thorax.

(3) The physician's arms and forearms encircle the patient's thorax and the hands and fingers grasp the sacrospinalis muscle bundles bilaterally on each side of the spine.

(4) A springing pressure to the paravertebral soft tissues is applied, thus causing extension of the spine and expansion and elevation of the rib cage.

Figure 8.33 Rib springing

(5) The operator may use his body motion by rocking back and forth.

The ribs may be 'sprung' intermittently by carrying out soft tissue stretching and relaxation. The hands are positioned parallel on either side of the spine and are moved up and down during the springing-stretching activity. During this activity the fingers should be evaluating the tissue response. The physician or operator moves his body back and forth by simply shifting his weight while his hands are in a fixed position. This action intermittently extends and releases the dorsal spine in extension along with the creation of rib motion.

Lymphatic pump

This is a time-tested technique for improving cardiopulmonary circulation and the immune system. The basic maneuver is as follows:

(1) The patient lies supine with the physician standing above the patient at the head of the table (Figure 8.34).

(2) The physician places both hands over the sternal and parasternal areas gently but firmly.

(3) Then the hands either slowly or rapidly perform a push-release motion, creating a pumping action of the thoracic cage/cavity, thus creating alternating positive and negative intrathoracic pressure which decongests the viscera.

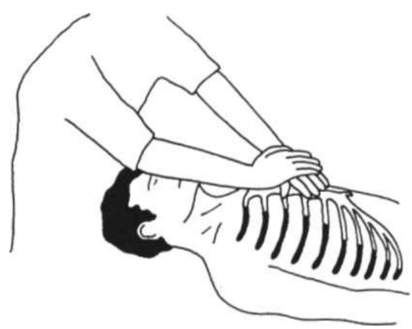


Figure 8.34 Standard lymphatic pump

The operator should perform this action at least 20 times.

Lymphatic pump variation

(1) The patient is supine and the operator stands at one side (Figure 8.35).

(2) The physician takes the wrist of the patient and extends the upper extremity upwards and backwards, which expands the chest cage on that side.

Figure 8.35 Lateral lymphatic pump

(3) The operator's other hand is placed flat over the anterolateral rib cage on the same side.

(4) With the hand on the lateral chest wall the rib cage is pumped with pressure and released in a similar fashion to the standard lymphatic pump while the adjacent extremity is used to elevate and expand the rib cage by the pectoral muscle pull.

The lymphatic pump techniques are quite beneficial in the treatment of upper and especially lower respiratory infections. Children with bronchial and pulmonary congestion respond very well to these techniques. These techniques are easily utilized and I have taught mothers how to use them on their children.

Liver pump

The patient lies supine and the operator or physician stands on the left side of the patient (Figure 8.36):

(1) The physician places his left hand over the area of the right lobe of the liver.

(2) The right hand and forearm are placed over the top of the left hand.

(3) A rhythmical up and down movement is made with the right hand, wrist and forearm, causing a rhythmical movement of the rib cage to stimulate hepatic drainage and decongestion.

A variation of the liver pump is the 'decongestion technique' (Figure 8.37) wherein the operator reaches across the patient from the left side and places his hands, one posterolaterally and the other anterolaterally, over the ribs superficial to the right lobe of the liver and alternatively compresses and releases the ribs.

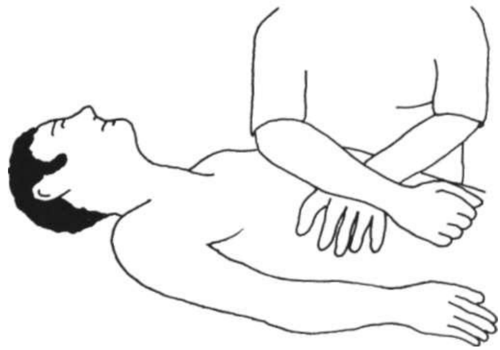


Figure 8.36 Liver pump

Figure 8.37 Liver decongestion variation

Splenic pump

This is performed over the lower left rib cage with the physician standing on the right side of the patient and reaching across the supine patient to place his hands flat over the lower ribs, chondral cartilages and adjacent abdomen. A gentle to-and-fro motion of the hands is used, which provides intermittent compression and release.

9

UPPER EXTREMITY

ANATOMICAL REVIEW

The entire shoulder girdle with its muscular and ligamentous attachments should be included in considering structural dysfunction of the upper extremity. This extends the consideration to the entire span of the trapezius, latissimus dorsi and pectoral muscles proximally and distally to the hand. Associated structural lesions may be found from the spinal area within the origins of the trapezius (occiput to T-12) and latissimus dorsi (T-7 to the sacrum), to the shoulder girdle proper, consisting of the clavicle, manubrium, first rib and scapula, and then on to the proximal and distal humerus, the elbow joint, the proximal and distal radio-ulnar joints and finally to the carpals and metacarpals. Mid- and upper thoracic lesions, as well as the more apparent cervical lesions, affect the neurocirculatory condition of the hands. The fact that dorsal lesions affect the wrist and hand is frequently not understood and is overlooked.

The sternoclavicular joint, the acromioclavicular joint and the glenohumeral joint should be tested for dysfunction. In joint dysfunction there is periarticular soft tissue change - usually edema, tenderness and altered joint motion with some degree of palpatory pain.

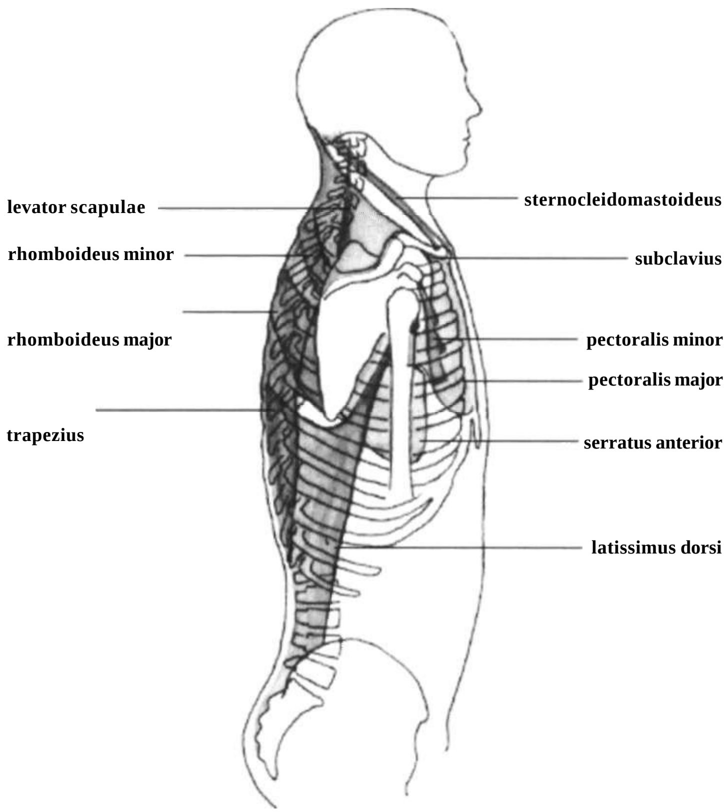


Figure 9.1 Muscular attachments of the shoulder girdle

Figure 9.1 depicts the muscular attachments of the shoulder to the thorax and central axis. The muscles shown are the sternocleidomastoideus, splenius cervicis, levator scapulae, rhomboideus minor, rhomboideus major, trapezius, latissimus dorsi, pectoralis major and pectoralis minor.

CLAVICLE

The clavicle articulates medially at the sternum with a ball and socket joint containing a disc, while laterally the articulation with the acromion process of the scapula is by an overlying bevel contiguously fixed by ligaments which allows a riding-with-shoulder motion. The

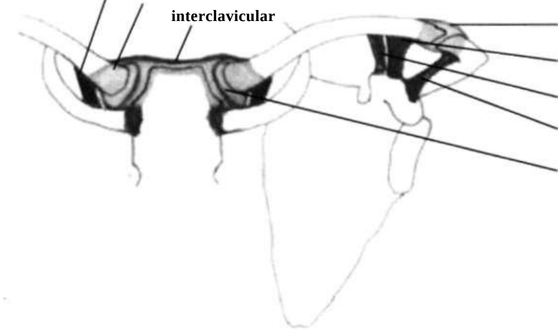


Figure 9.2 Ligamentous attachments of clavicle to sternum, first rib and scapula (anterior view)

clavicle is the only bony connection between the upper extremity and the trunk or central axis of the body.

Clavicular ligaments

The sternoclavicular ligaments (Figure 9.2) are the capsular, anterior and posterior sternoclavicular, interclavicular and costoclavicular ligaments and the articular disc. The acromioclavicular ligaments are the capsular, superior and inferior acromio-clavicular, coracoclavicular (trapezoid and conoid) ligaments and the articular disc (sometimes).

Sternoclavicular joint testing

The operator, behind the patient, palpates the sternoclavicular joint with one hand and circumducts the ipsilateral (adjacent) extremity into extension and abduction.

Method 1

(1) With the patient sitting, or lying down, the physician stands behind the patient (Figure 9.3).

(2) The physician's thumb and index finger are used to palpate for joint motion at the sternoclavicular joint.

(3) The physician's thumb is placed over the medial third of the clavicle.

(4) The physician uses the other hand to grasp the patient's forearm or elbow and moves it by circumduction up, out and backwards.

Figure 9.3 Testing and correction of the sternoclavicular joint

Figure 9.4 Sternoclavicular joint testing using the shoulder action. If not adequate, the forearm and arm can be circumducted in a similar fashion to the sitting technique

Method 2

The operator stands facing the standing or sitting patient. The patient moves both shoulders forward while the operator palpates both sternoclavicular joints and compares the set, congestion, tenderness and motion of the joints.

Method 3

With the patient supine, the ipsilateral upper extremity is put in extension and abduction, rotating the arm externally or internally while palpating the sternoclavicular joint (Figure 9.4). Internal rotation moves the clavicle down: external rotation moves it up.

Testing a joint in lesion may be corrective, if the testing action exaggerates the motion. Corrections can be made simply by stretching or stretching with a low velocity thrust.

Corrective techniques for sternoclavicular lesions

Method 1

(1) The operator stands behind the sitting patient and palpates the joint with the thumb and index finger by reaching over the opposite shoulder and across the chest to the sternoclavicular joint, while the other hand grasps the arm or elbow (Figure 9.3).

(2) The operator places his thumb over the medial third of the clavicle.

(3) The operator uses his other hand to take up slack and exaggerates the extension and abduction of the extremity while the pressure of the thumb is on the clavicle. This motion pulls the clavicle up and away from the sternoclavicular joint, giving a release and re-alignment to the norm.

Method 2

A non-specific shoulder maneuver is performed by the operator standing behind the patient and grasping both upper extremities as illustrated in Figure 9.5. The patient's elbows are approximated posteriorly, causing stretching and expansion of the shoulder girdle frame to separate the sternoclavicular and acromio-clavicular joints. This lacks the advantage of the physician/operator feeling and testing the joint motion during the maneuver.

Figure 9.5 Spreading and stretching action on the clavicles

Acromioclavicular joint testing

Acromioclavicular joint motion can be tested by moving the palpating fingers from the medial sternoclavicular joint laterally to the acromioclavicular joint. The patient's arm is circumducted to create motion in order for the palpating fingers to assess whether the joint is elevated or depressed.

Corrective technique for elevated lateral clavicle

(1) The operator stands behind the sitting patient (Figure 9.6).

(2) The operator places his first great (index) knuckle over the lateral third of the clavicle and presses downwards.

(3) With the other free hand, the operator grasps the patient's adjacent elbow, and circumducts the arm backwards and downwards.

This technique can be applied with the patient lying supine at the edge of the table with the operator standing on that side and

Figure 9.6 Elevated clavicle technique

Figure 9.7 Depressed lateral clavicle technique

anchoring the clavicle with his thumb and index finger while circumduction of the patient's proximate arm is made with the operator's other hand.

Corrective technique for depressed lateral clavicle

(1) The operator stands behind the sitting patient (Figure 9.7).

(2) The operator places his first great index knuckle over the middle third of the clavicle but the hand is posterior so as to put pressure downwards on the upper part of the scapula.

(3) Circumduction of the arm is started from an anterior position, bringing the arm up and finishing laterally and posteriorly.

The last part of this maneuver lifts and spreads the ribs and may be used for anterior rib lesions.

SCAPULA

Anatomical review

The scapula forms the posterior part of the shoulder girdle and is a flat, triangular bone with two surfaces, the ventral surface being broadly concave, and three borders. The dorsal surface is divided by the scapular spine which separates the supraspinatous fossa from the infraspinatous fossa where the respectively named muscles arise. The spine is broad and flattened, ending laterally in the acromion that articulates with the clavicle. On the lateral aspect of the superior scapular edge there is a notch, just lateral to which is the anteriorly projected coracoid process. Below this, on the lateral edge, is the broad glenoid cavity.

The scapula articulates with the clavicle and the humerus. The scapula is attached and supported in position by ligaments and muscles without any bony attachment to the trunk, except indirectly by the clavicle (Figure 9.8). Dorsal lesions affecting the myofascial support alter the position of the scapula. In checking the scapular position, it should be compared with the sister scapula. The muscular tension and ligamentous tone should be evaluated along with position, motion and restrictions.

Scapular ligaments

These are shown in Figure 9.2. The acromioclavicular, trapezoid, conoid, coracohumeral, glenoid capsular and glenoid labrum are for bone structural supports. The superior transverse and inferior transverse serve for neural passage.

Scapular muscles

The muscles connecting the scapula to the anterior and lateral axial thorax are the pectoralis minor and serratus anterior. The muscles connecting the scapula to the vertebral column are the trapezius, latissimus dorsi, levator scapulae and rhomboideus major and minor (see Figure 9.1).

Scapular testing

The scapulae are tested by comparing symmetry. Is one anterior or posterior? The testing may be carried out with the patient sitting, standing or prone. The myofascial tension is tested by a palming grasp of each scapula, simultaneously testing for motion and resistance. When there is a scapular lesion, the acromioclavicular and sternoclavicular joints, along with the ribs, must be checked for lesions. The pectoralis minor, lying under the pectoralis major, arises from the 2nd-5th ribs anteriorly and inserts in the coracoid process (see Figure 9.13, page 122). The serratus anterior arises from the first

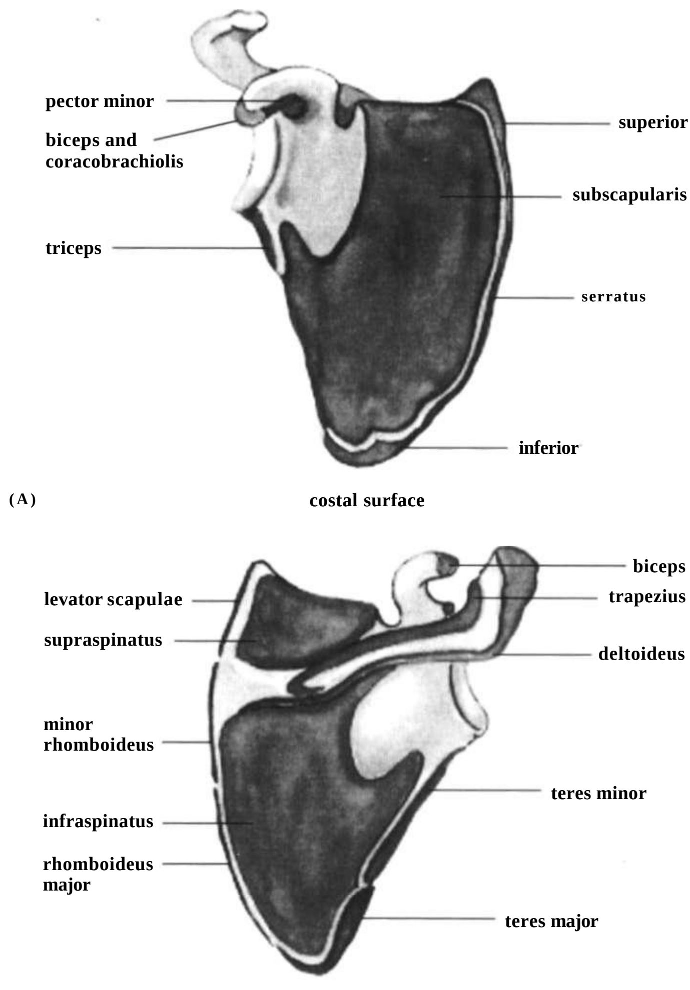


Figure 9.8 Scapula showing anterior (A) and posterior (B) muscle attachments

nine ribs anterolaterally and inserts along the under-surface of the scapula at the vertebral edge. Both muscles pull the scapula forwards whilst winging the scapula outwards. When there is an acromio-clavicular lesion there is periarticular palpatory pain with some alteration of articular approximation. Trigger-point tenderness may be found in the medial aspect of the sternoclavicular joint. The gleno-humeral articulation may be restricted, bearing in mind that the deltoid, supraspinatus, infraspinatus, teres minor and major and the pectoralis major muscles attach to the proximal portion of the humerus.

Apart from the musculoskeletal techniques already mentioned for acromioclavicular lesions, there are myofascial or soft tissue treatments for scapular lesions. Treatment is performed most often with the patient in the lateral recumbent position. The medial border of the scapula is grasped with the finger tips which are worked under the scapula, drawing the scapular mass laterally in a repeated manner until the myofascial tension is felt to release (Figure 9.9).

Testing for joint or other structural motion or restriction and performing stretching maneuvers are similar techniques because in each of these procedures the operator applies his perceiving palpating hand and fingers over one area of examination after another, while the other hand activates the tissues under evaluation. For instance, in interscapular soft tissue manipulation with the patient lying in a lateral recumbent position, the operator anchors the patient's upper shoulder with one hand while the other hand grasps the myofascial soft tissues (thoracic sacrospinalis and rhomboids) in the fingers and draws them deeply from the spinalis muscle group laterally across to and under the vertebral edge of the scapula and continues the motion laterally. This creates a perpendicular type of traction against the muscle bundles, effects relaxation of the muscles and stimulates circulatory decongestion. While doing this, the palpating fingers discern the tissue qualities, such as tissue motion, restriction, congestion, contraction and temperature.

Scapular thoracic myofascial techniques

(1) The patient is in a lateral recumbent position.

(2) The operator stands in front of the patient and anchors the upper shoulder with his cephalad hand.

(3) With the other hand, he reaches under the patient's free arm, grasping the interscapular myofascial tissues and drawing them laterally to bring the fingers under the vertebral edge of scapula, laterally rotating the scapula over the chest wall.

A variation of subscapular soft tissue treatment is to reach below the spine and work the thumbs under the lower scapula (Figure 9.10).

Figure 9.9 Scapular soft tissue manipulation of the dorsum

Figure 9.10 Scapular soft tissue variation

SHOULDER

Anatomical review

The shoulder is the junction of the arm and trunk. The skeletal junction is by the glenohumeral joint, formed by the sacular glenoid fossa of the scapula and the rounded head of the humerus. The joint is an enarthrodial or ball and socket joint. The glenoid socket is shallow, allowing considerable motion to the joint. The surrounding ligaments loosely attach the bones. The ligaments are reinforced by the acromial process and the surrounding muscles.

Glenohumeral joint ligaments

These are shown in Figure 9.11. They consist of the articular capsule with three gleno-humeral bands anteriorly, the coraco-humeral ligament super-imposed, and the restraining transverse humeral ligament for the long tendon of the biceps.

Rotator cuff muscles

Beneath the deltoideus, the muscles in proximity to the joint are the subscapularis (anteriorly), the supraspinatus (superiorly), the infraspinatus (posteriorly) and the teres minor (posteriorly) (Figure 9.12 A and B). All muscles passing from the clavicle and scapula to the humerus affect shoulder joint motion. Segmental nerve ennervation is from C-5 to C-8.

Shoulder muscles

These are the deltoideus, pectoralis major and minor, infra- and suprascapularis, subscapularis, teres minor, latissimus dorsi, teres

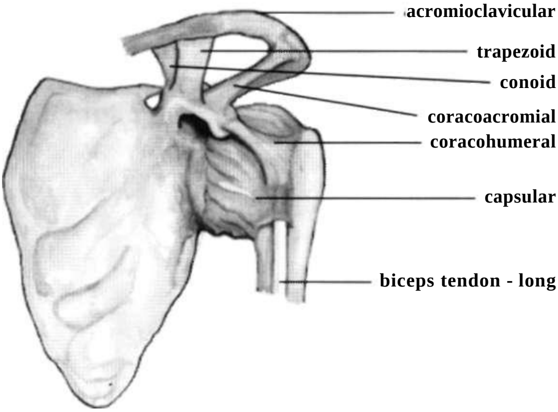


Figure 9.11 Glenohumeral and acromioclavicular ligaments

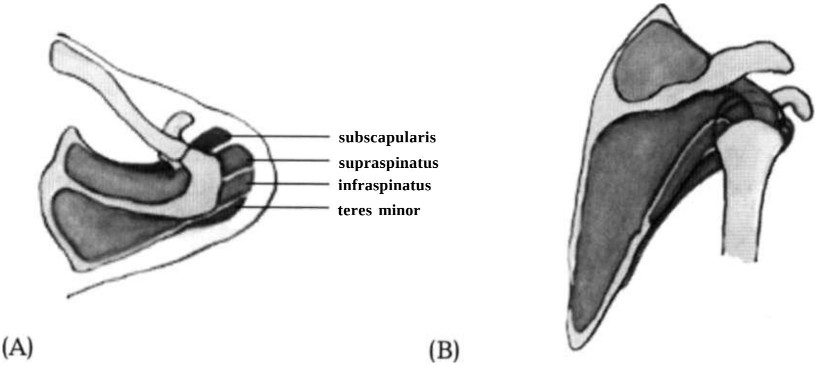


Figure 9.12 Rotator cuff muscles: (A) superior view; (B) posterolateral view

major. Shoulder muscles action and the muscles responsible for each action are illustrated in Figure 9.13.

Glenohumeral joint testing

Glenohumeral ligaments and the biceps brachii long and short tendons must be considered in the functional assessment of the shoulder. Movement at the glenohumeral joint is supplemented by the gliding motion of the scapula over the posterior chest wall and by the motion of the clavicle anteriorly on the sternum. The serratus and rhomboid muscles oppose each action. Lesion of any one joint in this complex affects the others, and the effects may extend to the axial

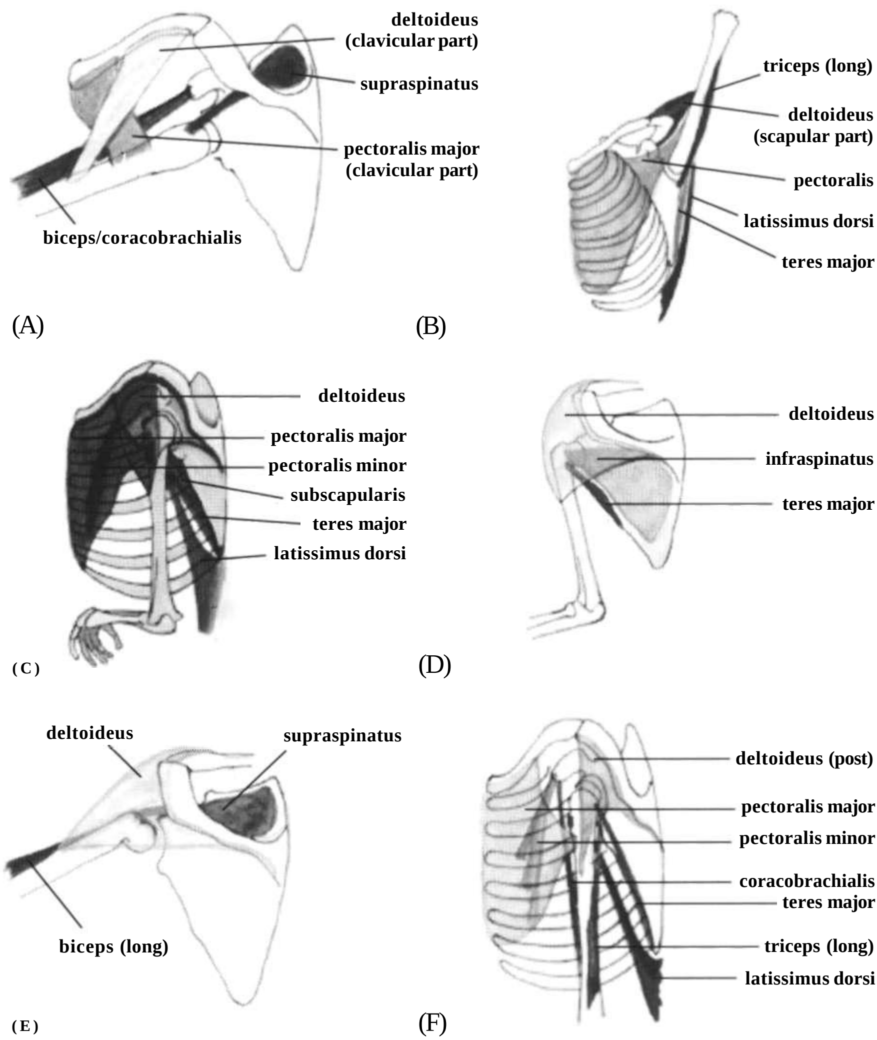


Figure 9.13 Muscle actions of the shoulder. (A) Flexion: deltoideus (clavicular part), supraspinatus, pectoralis major (clavicular part), biceps and coracobrachialis. (B) Extension: deltoideus (scapular part), pectoralis, teres major, latissimus dorsi and triceps (long). (C) Internal rotation: deltoideus, pectoralis major and minor, subscapularis, teres major and latissimus dorsi. (D) External rotation: deltoideus (posterior), infraspinatus and teres minor. (E) Abduction: deltoideus, supraspinatus and biceps (long). (F) Adduction: deltoideus (posterior), pectoralis major and minor, coracobrachialis, teres major, latissimus dorsi and triceps (long)

structures. An example of this is that a sacroiliac lesion causes hypertonic contraction of the latissimus dorsi, thus limiting the motion of the glenohumeral joint motion.

The glenohumeral joint may be checked with the patient either standing, sitting or lying prone on the table. In the prone technigue, the patient hangs the upper extremity over the edge of the table (Figure 9.14). The operator checks for the full range of joint motion while holding the arm.

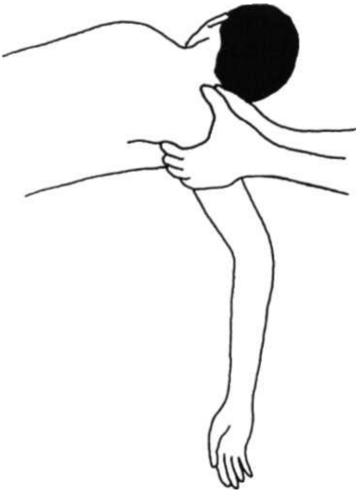


Figure 9.14 Prone testing of the shoulder joint

In the sitting or standing technigue, shoulder motion and limitation may be tested by bilateral internal and external rotation of the arms by standing behind the patient and grasping each forearm. The elbows are in flexion in both maneuvers.

Manipulation of the shoulder joint

The glenohumeral joint is readily examined and treated with the patient either standing, sitting or lying down. The technigues are soft tissue or myofascial technigues.

Sitting or standing technique

(1) The patient's arm is abducted with the forearm resting on the operator's shoulder (Figure 9.15).

(2) The operator palpates the glenohumeral joint and tests for motion by grasping the arm, exerting the range of motion movements and noting any restriction.

(3) The operator clasps both hands over the body of the deltoideus and exerts a downwards and drawing-away motion with a springing action.

Figure 9.15 Sitting or standing shoulder technique

Lateral recumbent technique

(1) The patient is recumbent and facing the operator (Figure 9.16).

(2) The operator grasps and anchors the patient's shoulder with one hand while the other grasps the patient's forearm and forces a full range of circumduction.

Figure 9.16 Lateral recumbent shoulder technique

Supine technique

(1) The operator sits at the head of the table, reaches across the patient's shoulder girdle and grasps the anterior axillary fold, while the other hand's index finger grasps the posterior axillary fold (Figure 9.17A).

(2) By an encircling grasp, the operator exerts an intermittent cephalad traction.

(3) Then the patient grasps his arm with his other hand for resistance as the operator exerts an upward and lateral force with traction and release (Figure 9.17B).

(4) Whilst the traction is maintained, the patient raises the shoulder and pronates and supinates the forearm.

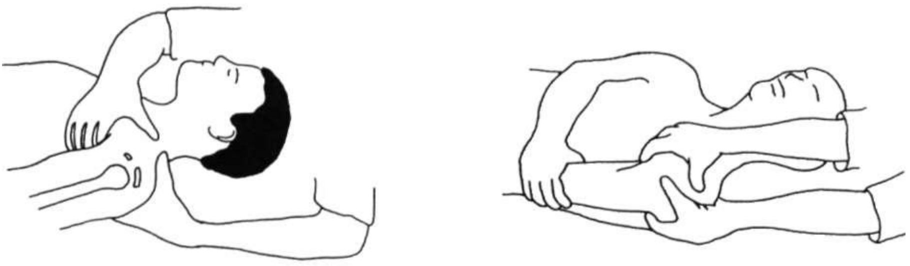

(A) (B)

Figure 9.17 Supine shoulder technique

Spencer shoulder technique

(1) The patient is in a lateral recumbent position with their head on a pillow to reduce cervico-dorsal drag on the shoulder (Figure 9.18).

(2) The operator stands facing the patient and with the caudad hand firmly grasps the upper free forearm of the patient at the shoulder.

(3) The operator anchors the shoulder with the cephalad hand.

(4) With the other hand, the operator circumducts the arm anteriorly and posteriorly to the extremes of the glenohumeral capsular resistance with the elbow sharply flexed. All pressures are gentle, and the motions are repeated several times.

(5) Then, the arm is extended fully and carried in a forward horizontal arc in an upward swing as far as possible. This is repeated three times in slow movements.

(6) The patient's elbow is flexed into a position at right angles to the body and is slowly circumducted, progressively enlarging the circles, while the patient's shoulder is firmly fixed with the other hand.

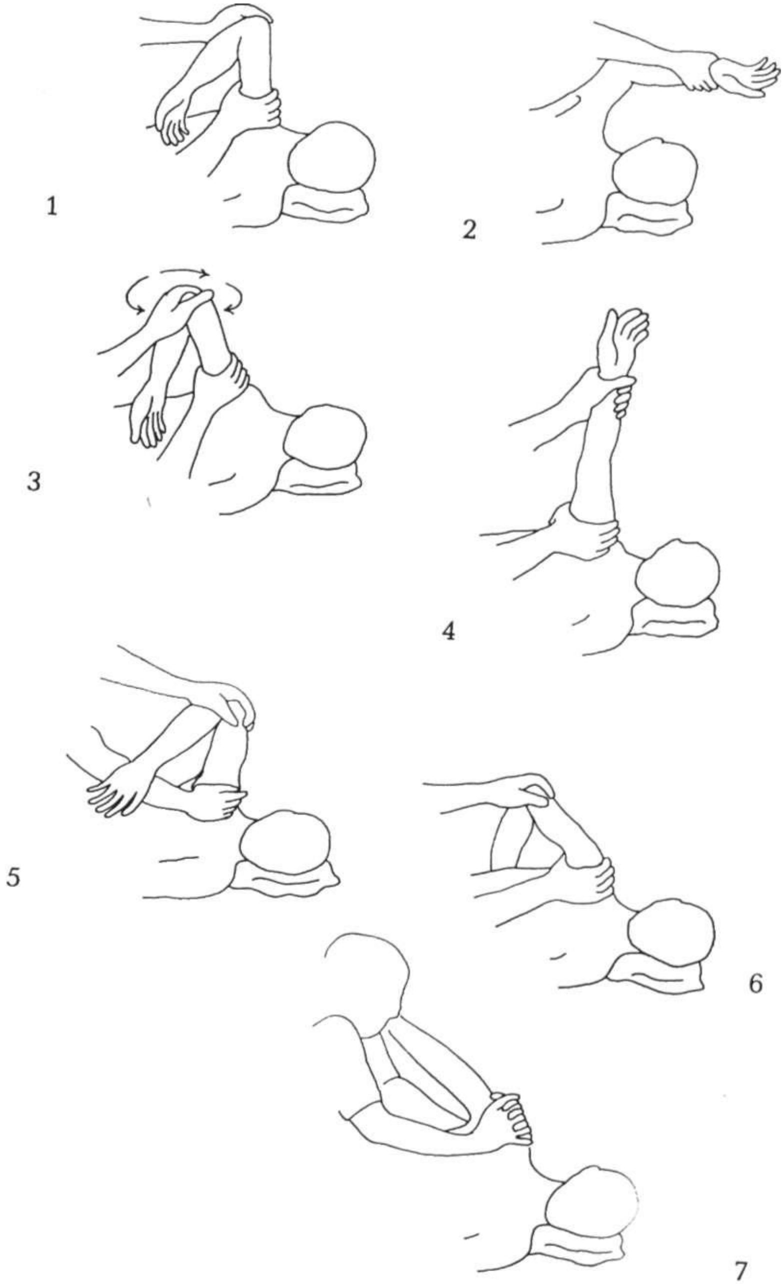


Figure 9.18 Spencer shoulder technique

ELBOW

Anatomical review

The elbow joint connects the arm to the forearm and is surrounded by a complex of supporting ligaments and muscles. It is a composite hinge joint formed by the distal trochlea (pulley) of the humerus, with a semilunar notch for the ulna, a capitulum for the fovea (pit) of the radius and the radial notch for the proximal radio-ulnar articulation.

These three articulations are secured by the broad and loose articular capsule which is thickened medially as the ulnar collateral and laterally as the radial collateral ligaments (Figure 9.19). Three-quarters of the ulnar annular socket is made up by the annular ligament and one-quarter by the notch that stabilizes the proximal radius to the ulna. The ulna-humerus part of the joint, by a simple hinge action, only allows for extension and flexion, whereas the head of the radius and capitulum of the humerus form an arthrodial joint which, with an annular ligament, allows for rotation as well as extension and flexion, and must be considered as a pivotal joint.

Figure 9.19 Elbow joint and ligaments

The elbow ligaments form one large capsule strengthened by fibers from the epicondyles of the humerus. The capsular ligament has the following parts: the ulnar collateral, the radial collateral, the radial annular, the oblique cord and the interosseous membrane.

The proximal radio-ulnar joint allows for rotation only. The forward rotation or pronation is activated by the pronator teres proximally and the pronator quadratus distally. The backward rotation or supination is activated by the biceps brachii, the supinator, and is assisted by the extensor pollicis longus.

Muscles of the elbow

The arm muscles involved with the elbow joint are the coracobrachialis which aids in flexing and adduction, the brachialis used in flexion and the biceps brachii which supinates and flexes the forearm and tenses the antebrachial fascia (long head abducts, short head adducts) (Figure 9.20).

Flexion of the arm is principally by the biceps and the brachialis. The latter arises from the humerus, but the former has three-fifths of its origin from the scapular coracoid process while the long head is from the scapular glenoid cavity. Other flexors are the extensor carpi radialis longus, the brachioradialis and the pronator teres.

The triceps brachii (the only extensor) muscle fibers have three heads that concentrate to form a broad tendon which attaches to the posterior part of the upper surface of the olecranon, with fibers

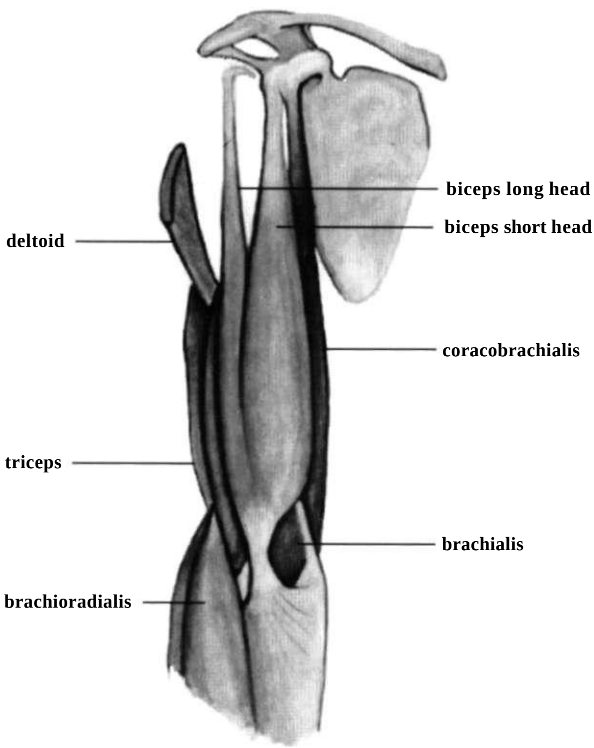


Figure 9.20 Arm muscles

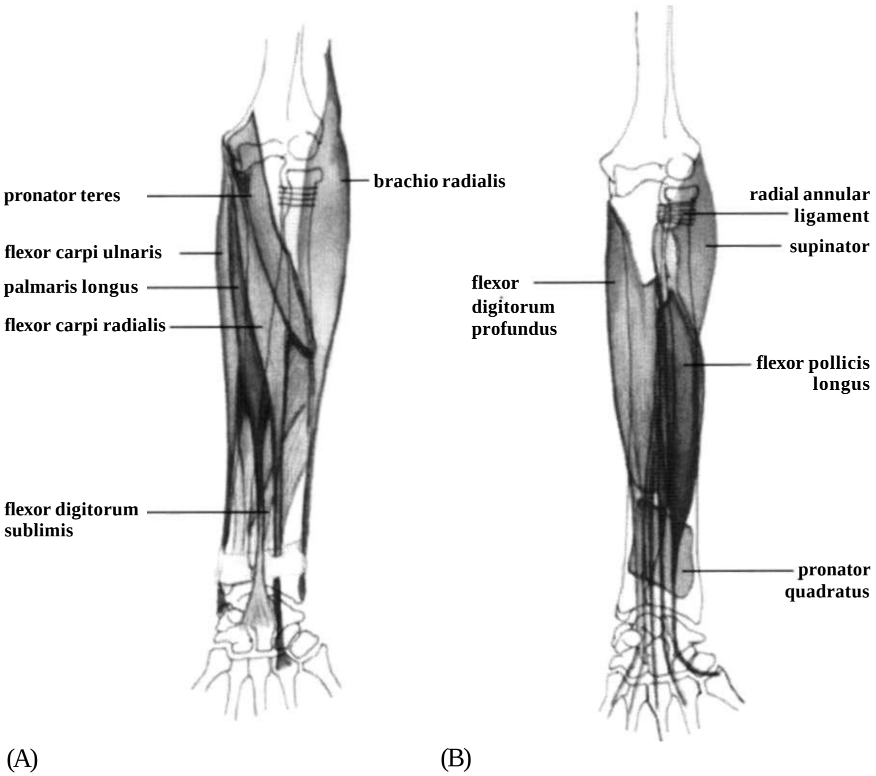


Figure 9.21 The volar or anterior muscles of the elbow and forearm. (A) Superficial muscles; (B) deep muscles

running into the antebrachial fascia. The medial head continues on the forearm as the anconeus.

The forearm flexor muscles involved with the elbow joint are the brachioradialis, the pronator teres, the flexor carpi radialis, the flexor digitorum sublimis, the palmaris longus, the flexor carpi ulnaris, the extensor carpi radialis longus, the anconeus, the supinator and the extensor carpi ulnaris.

The volar (ventral) antibrachial superficial muscles arising from the medial epicondyle are the pronator teres, the flexor carpi radialis, the flexor digitorum sublimis and the palmaris longus (Figure 9.21). Arising from the lateral epicondyle is the flexor carpi ulnaris which abducts the hand and flexes the fifth digit.

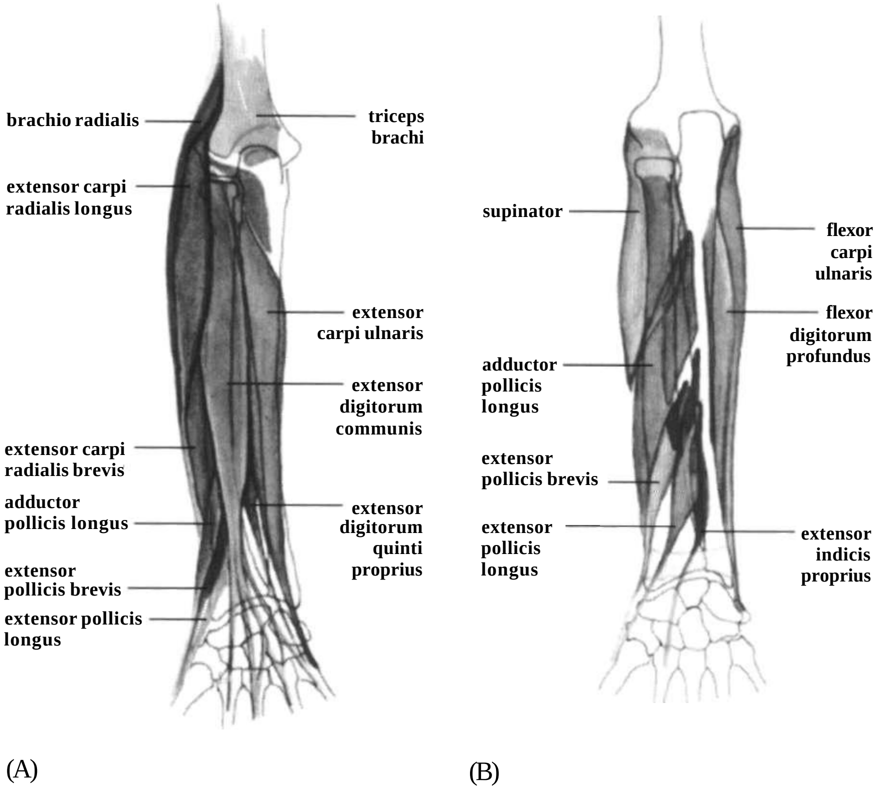


Figure 9.22 Posterior muscles of the forearm. (A) Superficial muscles; (B) deep muscles

The dorsal antibrachial superficial muscles are, laterally, the brachioradialis which flexes the forearm, the extensor carpi radialis longus and brevis which extends/abducts the extensor digitorum communis which serves four fingers, the extensor digiti quinti proprius to the little finger and the extensor carpi ulnaris which abducts the hand and extends five metacarpals (Figure 9.22). Medially there is the anconeus which aids the triceps in extending the elbow.

Elbow testing

Restricted elbow joint motion is tested by observing the forearms in a parallel position with hands in supination. The lesioned side will tend to pronate the forearm (internally rotate). Palpation will disclose

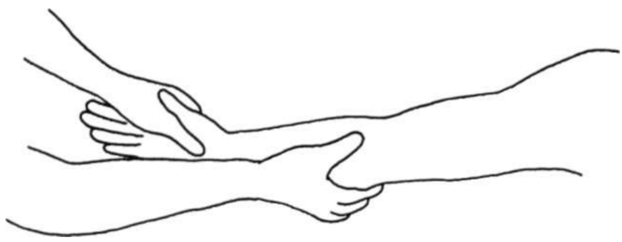


Figure 9.23 Proximal radio-ulnar joint testing

tenderness around the radio-ulnar joint. Motion may be tested by grasping the radio-ulnar joint between the thumb and index finger while the other hand pronates and supinates the forearm with a handshake control (Figure 9.23). When the proximal radio-ulnar joint is lesioned, full extension of the elbow is lacking. The medial and lateral trigger points should be located.

Musculoskeletal manipulation

Proximal radio-ulnar techniques

The patient is supine in these techniques. The first is the trigger point method (Figure 9.24):

(1) With the operator on the side of the extremity in lesion, pressure is held on the trigger point with the elbow flexed until release is noted.

(2) The elbow joint is then gradually extended.

The next method is with two hands encircling the radio-ulnar joint:

(1) The operator uses both hands to encircle and grasp the forearm flexors and holds the proximal radio-ulnar joint by the index finger and thumb

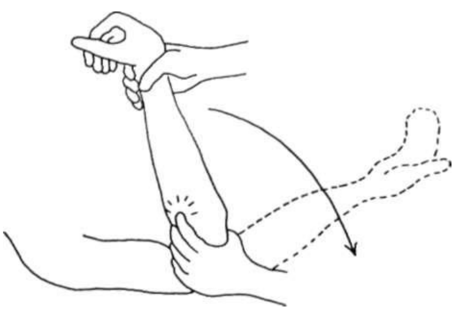


Figure 9.24 Trigger proximal radio-ulnar joint technique

while securing the wrist between the arm and body (Figure 9.25).

(2) The joint is circumducted to loosen it and the patient told to relax.

(3) The elbow is hyperextended with pressure exerted on the dorsal side (underneath).

Figure 9.25 Proximal radio-ulnar technique with two hands encircling the joint

In a variation on the above technique, the operator stands with his back to the patient between the table and the elbow being treated, grasps the patient's wrist with the caudad hand and rests the patient's forearm against his/her torso while grasping the forearm with the other hand, the fingers of which grasp and encircle the proximal flexor muscles and exert pressure upwards from behind the joint to take up the slack (Figure 9.26). The joint is extended to a locking position with supination, then while the patient is relaxed, a sudden upward thrust or exaggeration of the force is maintained, causing a sudden hyperextension of the joint.

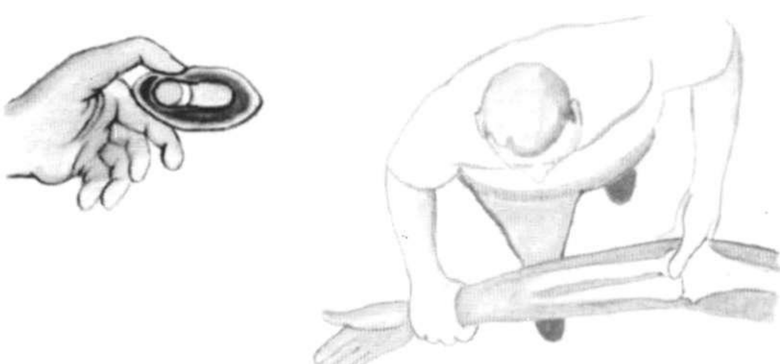


Figure 9.26 Variation of proximal radio-ulnar technique

Figure 9.27 'Hanging the radius' technique

'Hang the radius' sitting technique The soft tissues of the forearm between the ulna and radius are grasped by the index fingers and thumbs with one hand proximally and the other hand distally (Figure 9.27). The forearm is just hung until tissue release is noted.

WRIST AND HAND

Anatomical review

Radio-carpal or wrist joint

The joint is formed by the distal radius with the articular disc and the navicular, lunate and triangular bones (proximal carpals) and is surrounded by a capsule and strengthened by ligaments (Figure 9.28). The wrist joint is a true condyloid (rounded) articulation, so all movements are permitted. Flexion and extension are the most free. Some adduction and abduction are permitted, the former to a greater extent of about 45°. Circumduction is also permitted.

The wrist ligaments are the volar and dorsal radiocarpal ligaments and the ulnar and radial collateral ligaments.

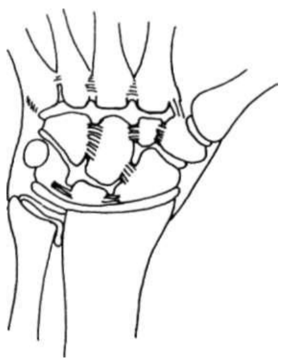


Figure 9.28 Carpal (wrist) bones and ligaments

The mid-carpal joint

This permits extension, flexion and limited rotation.

The causes of *carpal tunnel syndrome* are uncertain; however, in the immediate area, the transverse carpal ligament is contracted,

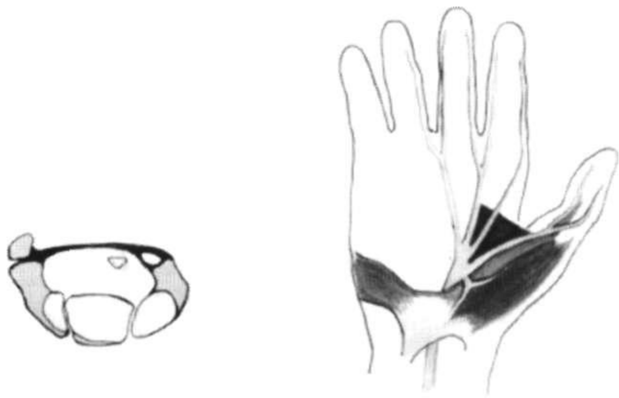


Figure 9.29 Carpal tunnel and median nerve

putting pressure on the median nerve (Figure 9.29). Relief from pain may be achieved by stretching the ligament and mobilizing the wrist joints by grasping the patient's hand with both hands so that the thumbs are exerting pressure and lateral traction on the thenar and hypothenar eminences.

Metacarpophalangeal joints

The distal row of carpals (greater and lesser multangular, capitate and hamate) articulate with the metacarpals. The metacarpophalangeal joints have flexion, extension, adduction, abduction and rotation, except that abduction and adduction do not occur with flexion. This is true for the interphalangeal joints.

Test for range of motion

Wrist motion should be tested by dorsiflexion, ventral flexion, lateral and medial side-bending for restriction of motion. Both wrists should be compared.

Manipulative techniques

These procedures are performed without thrusts and are soft tissue or myofascial techniques.

General mobilization of the wrist (Still's technique)

(1) The operator grasps the patient's wrist between both his hands

and exerts pressure between his thenar and hypothenar eminences (Figure 9.30).

(2) The patient then opens and closes his hand, making a firm fist.

(3) This is repeated two or three times.

Figure 9.30 Still's wrist technique

Carpal technique

(1) With the patient sitting or supine, the operator grasps the patient's hand with two hands, fingers under the patient's palm on either side (Figure 9.31).

(2) The operator's thumbs extend over the dorsum of the hand to rest on the distal ends of the radius and ulna.

(3) Circumduction mobilization is performed, followed by forceful dorsal flexion while pressing firmly downwards with the thumbs.

Figure 9.31 Carpal technique

Intercarpal joint technique
This is similar to the carpal technique but with the thumb pressure exerted over the first and second rows of the carpals.

Interphalangeal restrictions
These are treated by simple rotation, in both directions, of the shafts of the fingers, in order to achieve release.

Upper extremity lesions
For these lesions there is a trigger point in the thenar adductor pollicis brevis for general myofascial release (Figure 9.32). It is held between the index finger and the thumb, and squeezed with some traction and adduction until release is noted.

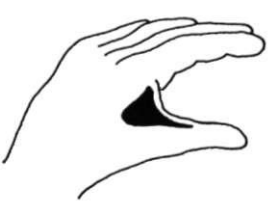


Figure 9.32 Adductor pollicis brevis trigger point

10

TORSO REGION

ANATOMICAL REVIEW

ABDOMEN

The lower torso extends from the thorax to the perineum, bounded anteriorly by the anterior abdominal muscles, laterally by the lateral abdominal muscles and pelvic iliae with the overlying muscles, and posteriorly by the lumbar spine and sacral complex. This takes into consideration the abdomen proper and the pelvic abdomen with the musculoskeletal somatic framework support and the visceral structures therein (Figures 10.1 and 10.2).

The ***abdomen proper*** or major extends from the respiratory diaphragm to the superior aperture of the pelvis, extending from the sacral promontory to the pubes. It is bounded in front and at the sides by abdominal muscles and the iliacus muscles; behind it is bounded by the lumbar vertebral column and the psoas and quadratus lumborum muscles.

The ***pelvic abdomen*** or abdomen minor is limited inferiorly by the pelvic diaphragm, principally containing the levator ani and the coccygeus on either side. The viscera and the lumbar-sacral complex are palpable through the anterior abdominal wall and through the rectum and vagina.

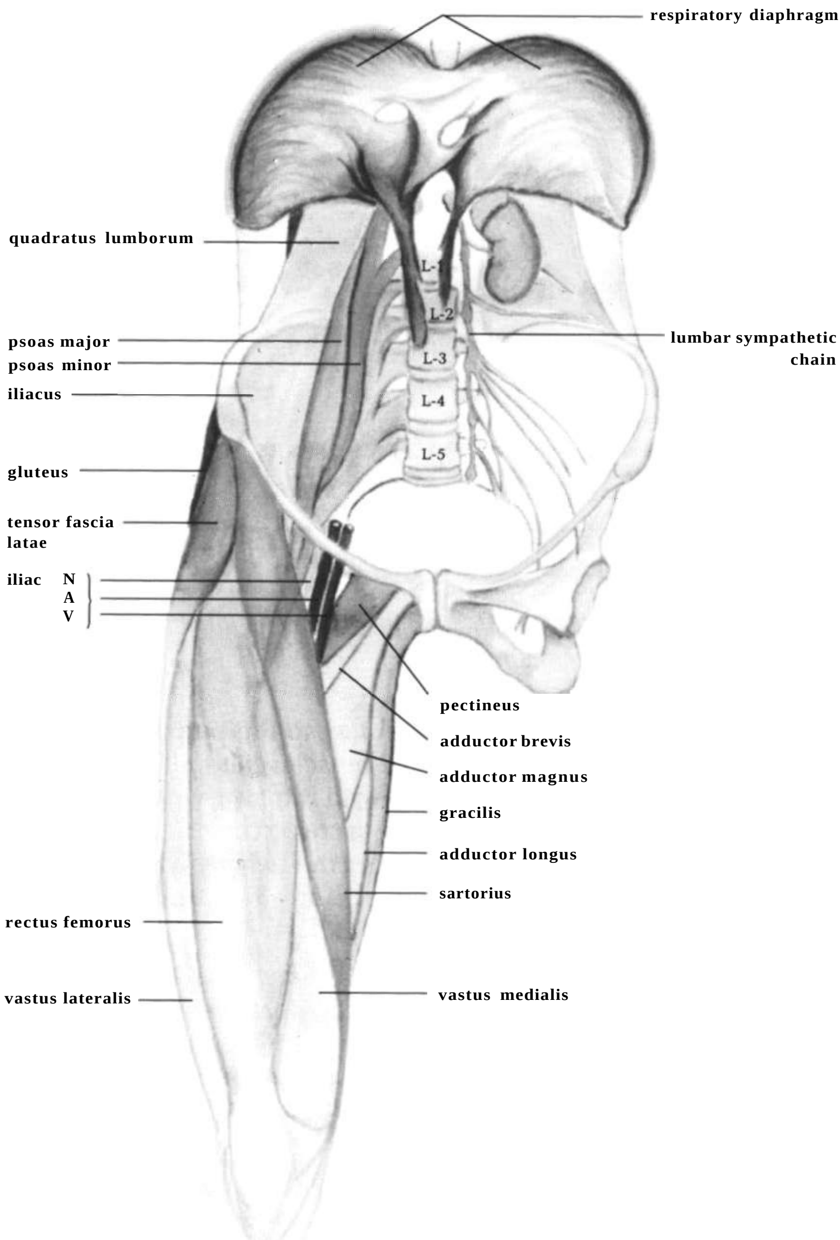


Figure 10.1 Abdominal cavity with associated muscles

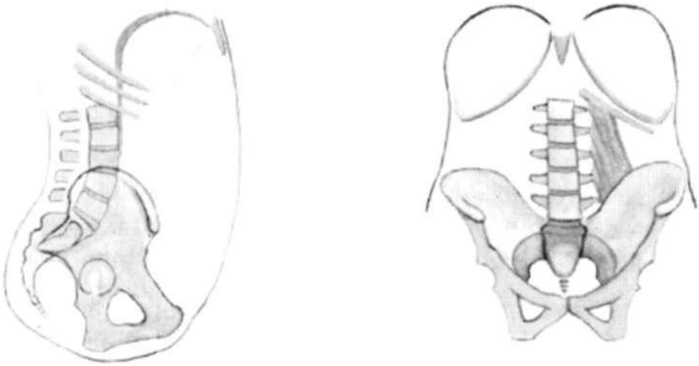


Figure 10.2 Scheme of abdominal regions

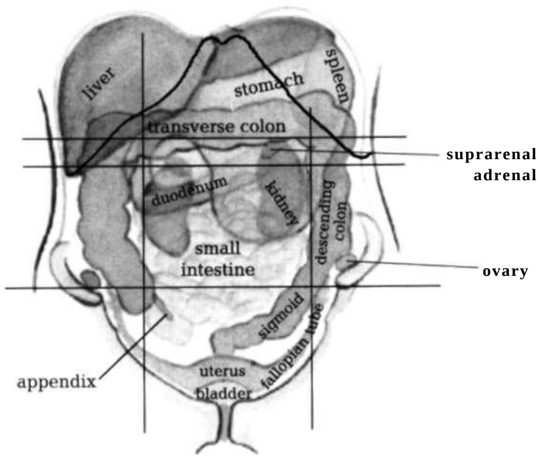


Figure 10.3 Visceral structures in the abdomen

The viscera in the abdomen proper may be palpated (Figure 10.3). To do this, the patient should relax the anterior abdominal musculature by flexing the lower extremities with the feet resting on the examining table. The large bowel is perhaps the easiest visceral structure to palpate. A spastic or irritable bowel is palpable for there is discernible localized visceral tension and tenderness. The small bowel is likewise palpable, such as in duodenal spasm with or without duodenal ulcer. Sometimes the lower edge of the liver is readily palpable. The kidneys and the suprarenal glands are palpable by deep palpation. When the patient has been under chronic stress, the adrenal (suprarenal) glands will be tender and swollen and T-11/12/L-1 will be in lesion and tender. Palpation in the iliac fossa may sense the ovary and may ascertain pain if it is diseased.

Palpation of viscera in the minor abdomen is by way of the vagina or rectum. In performing a pelvic examination, the ovary may also be appreciated as well as the uterine position. In the male, the prostate may be evaluated rectally.

The skeletal system consists of the lumbar vertebrae and pelvis, the latter consisting of the sacrum, coccyx, iliae, ischiae and pubes. The lumbar vertebrae (Figure 10.4) are the largest mobile segments in the spine and are distinguished by the lack of transverse foramina or articular facets on the bodies. The pedicles are very strong, with articular facets. The superior facet is concave and faces backwards and medially to receive the converse interlocking lower facet from above. Each lumbar vertebra is progressively larger from above downwards. The 5th lumbar vertebra has a deeper anterior body diameter than posteriorly and the spinous process is not as broad as those above. The lumbar vertebrae provide the origins and insertions of some important muscles that are frequently involved in lower back disorders (ilio-psoas complex) and respiratory disorders (respiratory diaphragm).

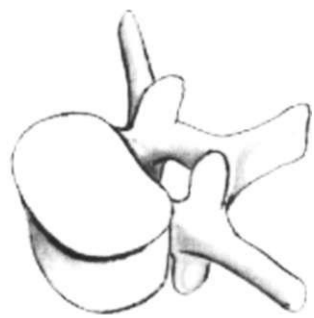


Figure 10.4 Lumbar vertebra

The sacrum is roughly keystone-shaped. The sacral base, onto which the lumbar column rests, is directed upwards and forwards. The sacral base plane should be horizontal from side to side, and the sacrolumbar angle should be about 35° or less. When the sacral base plane is not horizontal, the pelvis is tilted downwards and anteriorly on the lower side and the lumbar column follows with rotation, extension and side-bending, causing a scoliosis. The functional axis of the sacrum in flexion and extension is at the second sacral segment, S-2. The sacro-iliac joint surface is delineated as L-shaped with the apex forwards and the short arm is directed backwards and superiorly.

The four or five coccygeal bones extend the spine downwards and forwards from the sacrum and are suspended in ligamentous tissue, the tension of which determines the position of the coccyx.

The back must be considered in abdominal disorders, and vice versa, for these two areas are complementary in function through the autonomic nervous system. In this respect, as a general rule, everything from T-12 upwards should be considered the abdomen proper, and everything from L-l downwards should be considered with the minor or pelvic abdomen.

The following are examples of viscerosomatic reflexes. When tenderness is elicited at the tip of the right 12th rib and depression of the 3rd rib, gall bladder dysfunction should be considered. Side stitches pain should alert the physician to respiratory diaphragmatic dysfunction. When the ilioinguinal ligament is hypertensive and sensitive, attention should be paid to the colon and there is often an L-3 lesion.

When a patient is moderately flexed and rotated while standing, i.e. cannot stand up straight, the psoas and iliacus are in contraction on the flexed side and the insertion of the common tendon on the femur is tender to painful. The iliopsoas, a lateral rotator, is the most powerful flexor of the thigh and hip and flexes the pelvis on the thigh.

LUMBAR SPINE

The anterior body of a lumbar vertebra is for weight-bearing, while the posterior is for mechanical guidance in joint motions. The primary motions of the lumbar spine are flexion and extension, but rotation and side-bending are also accommodated by the loose arrangement of the diarthrodial facets (allowing for free motion) and the rather flexible amphiarthrodial (discs with little motion) joints of the vertebral bodies anteriorly (Figure 10.5).

The lumbar vertebrae are the largest moveable vertebrae and bear a considerable amount of weight. The lumbar spine is similar to the cervical spine in that it does not have the protective stabilization of its motion as does the thoracic spine with the ribs. The lumbar vertebral extension motion is limited and is very vulnerable to injury, unlike the flexion and side-bending motions. The 5th lumbar (Figure 10.2) vertebral base plane should meet the base plane of the sacrum sagitally at no more than about a 35° angle. Clinically, the lower lumbar vertebrae along with the discs show the greatest amount of degenerative change commensurate with the aging process.

The lumbosacral joint and L-4-L-5 joints receive their primary stress from gravity in weight-bearing (Figure 10.6) and are subject to frequent structural dysfunction and degenerative changes. The entire pelvis must be considered because pelvic lesions occur concomitantly with lumbar lesions. Lesions aggravate degenerative processes.

Lumbar ligaments
The anterior longitudinal and iliolumbar ligaments functionally tie the lumbar column to the sacrum and are subject to stress. The anterior longitudinal ligament and discs may be evaluated by deep palpation through the abdomen, whereas the intraspinous and supraspinous ligaments are checked by direct palpation with the patient prone (Figure 10.7). By putting direct downward pressure on the lumbar spinous processes, the integrity of the disc ligaments may be tested with a springing action, when the patient is prone.

Lumbar stress sometimes causes a pelvic twist with scoliosis of the

Figure 10.5 Lumbar vertebral right rotation showing iliolumbar and posterior sacroiliac ligaments

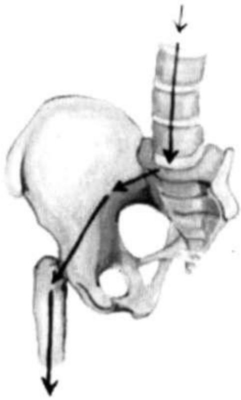


Figure 10.6 Gravity forces in the lumbar and sacral regions

lumbars causing flexion and rotation of the pelvis by spasm of the iliopsoas-lumbar muscle complex (Figure 10.8). A pelvic twist involves one or both sacroiliac lesions and with this the 5th lumbar vertebra is usually rotated towards the posteriorly restricted sacroiliac lesion. The lumbar fascia and iliolumbar ligaments are affected, which is understandable when it is remembered that the iliolumbar ligament origin is from the tip of the transverse process of the 5th lumbar vertebra and spreads laterally to the posterior crest of the ilium. The iliolumbar ligament limits rotation and the forward sliding of the 5th lumbar vertebra on the sacrum.

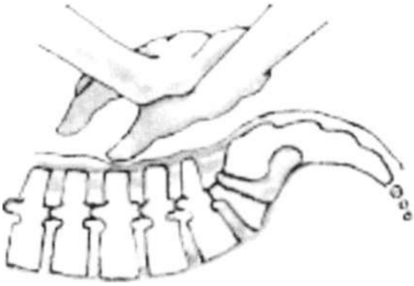


Figure 10.7 Lumbar ligament testing

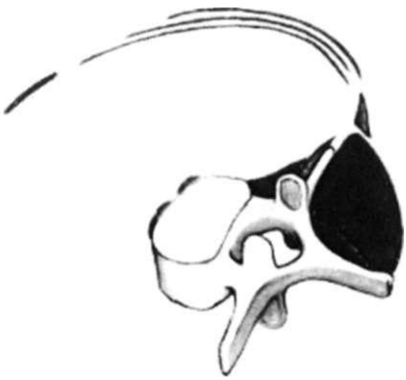


Figure 10.8 Sectional scheme of the lumbar torso muscles at L-3

PELVIC GIRDLE

The bony pelvic girdle consists of the sacrum, two iliae, two ischii, and two pubes. The crests of the iliae are at the level of L-4. Functionally the pelvic girdle is as highly mobile as the shoulder girdle.

Evaluation of the pelvic girdle requires consideration of the sacrum, iliae, ischiae, pubes, the acetabular structures and the lumbar column because these structures are often in associated structural dysfunction. Frequently a pelvic twist is seen with both anterior pubic and posterior sacroiliac lesions and rotation of the 5th lumbar vertebra.

Some patients come into the office bent over, twisted and pulled to one side at the hip level. This may be due to 'psoas spasm', which really involves the psoas, iliopsoas, iliacus and lumbar muscles on the flexion side (Figure 10.9). Spasm flexes and rotates the lumbar spine and pelvis with a shortening of the psoas group. Palpation reveals tenderness of the upper and middle lumbar vertebrae and the insertion of the psoas on the tubercle of the femur.

The sacroiliac joints are subject to considerable stress, consequently structural dys-function is common. With sacro-iliac lesions, there are associated lesions of liga-mentous and myofascial structures. The sacro-iliac joints have long and short sacroiliac ligaments (Figure 10.10). Under stress reactions, acute or chronic, these palpable ligaments become tender to painful with edematous changes which cause a weaken-ing of the tensor strength. Not infrequently acetabular lesions occur with pelvic girdle structural dysfunc-tion and this may be tested with flexed external rotation of the femur ('sign of four' maneuver) and internal rotation.

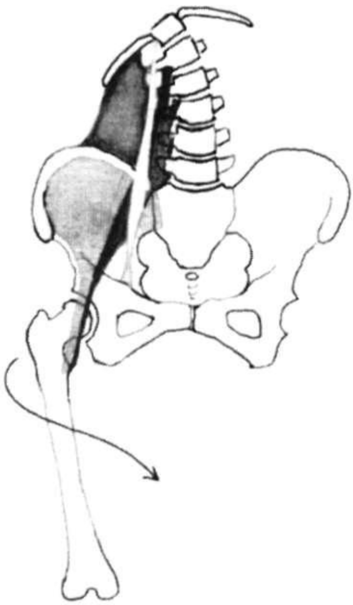
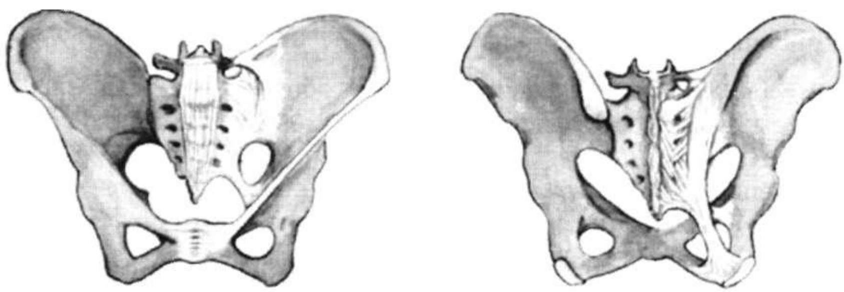


Figure 10.9 Iliolumbar psoas spasm complex



(A) (B)

Figure 10.10 Pelvic girdle with ligaments. (A) Anterior view; (B) posterior view

Figure 10.11 Testing sacroiliac joint motion and ligaments

PELVIC TESTING

Sacroiliac testing

The long and short sacroiliac ligaments are tender at the insertion points on the sacrum and ilium with dysfunction (Figure 10.11). Usually L-5 is rotated with a posterior iliac lesion on the side to which L-5 rotates, and this in turn creates stress on the ipsilateral sacroiliac ligaments which are palpated as painful and edematous.

The supraspinatus ligaments between L-5/S-1 and L-4/L-5 are painful to palpation with lumbosacral structural dysfunction. Integrity, resilience or weakness of the sacroiliac ligaments may be checked by applying a downward pressure over the joint when the patient is prone. Too much play or give means laxity of the ligaments.

Other pelvic testing

Frequently an anterior pelvic or pubic lesion occurs with a posterior sacroiliac lesion. This is easily determined by checking the pubic joint by the alignment of the pubic tubercles (Figure 10.12). The pubic tubercle is usually painful on the lesioned side.

When there is a pelvic twist there are lumbar lesions and pelvic myofascial spasticity of the iliac, psoas and piriformis with tenderness at their origins and insertions. With myofascial lesions, the tendons of the muscles, either at the origin or insertion or both, are ususally palpated as hyperesthetic, i.e. tender to painful. In a pelvic

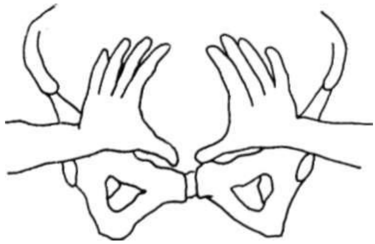


Figure 10.12 Pubic lesion testing

twist the common tendon of insertion of the iliopsoas muscles may be involved. The insertion of the psoas is on the lesser tubercle of the femoral trochanter on the medial aspect of the thigh below the groin, and the iliacus muscle inserts just below this and is easily palpable. The pyriformis, arising from the 2nd—4th sacral segments, passes through the greater sciatic notch to insert on the tip of the greater femoral trochanter. Tendon/muscle irritability and contracture is easily palpated at the lateral border of the sacrum, at the greater sciatic notch and at the tip of the trochanter. Piriformis contractures may cause irritability of the sciatic nerve.

COCCYX TESTING

A lesioned coccyx may be involved in perirectal and rectal complaints and may cause pain or coccydynia over the sacral area. The coccyx, along with the associated ligaments (see Figure 10.13), is easily checked by grasping the coccyx between the index finger, which is inserted rectally, and the thumb, which is applied externally, of a gloved hand, then testing for position, motion and restriction which

Figure 10.13 Minor pelvis showing coccygeal ligaments

may affect the pelvic floor. The amplitude of motion is about 30°. Most often the coccyx is restricted anteriorly, which causes a slackening of pelvic support which, in turn, may be a cause of recurrent, poorly explained chronic urinary problems.

Restrictions may be associated with lumbosacral dysfunction and vise versa. The soft tissues, sacrotuberous and sacrococcygeus ligaments, the levator ani and the pubococcygeus, are palpated and treated with counter-tension manipulation so that coccygeal motion and normal position may be re-established.

LOWER TORSO SOFT TISSUE CONSIDERATIONS

Abdominal soft tissue techniques are for the very adept and sensitive fingers. The abdominal and pelvic viscera may be palpated and moved. To do this the patient should lie supine with the thighs and legs flexed and the feet resting on the table. In the abdomen proper, the colon may be palpated and evaluated more easily than the small bowel (Figure 10.3). The proximal small bowel, i.e. the duodenum, may be appreciated. The kidneys and adrenal glands may be palpated. When the adrenals are tender to painful due to subacute and chronic stress, there are somatic lesions of T-9-T-12. The anterior longitudinal spinal ligament and lumbar discs may be palpated and may be painful when there is a lumbar sprain or degenerative disease. In the minor pelvis, the uterus is not hard to evaluate and manipulate when the uterus is flexed, rotated or in extension. Ptosis or sagging of the minor pelvic floor may contribute to uterine ptosis. Generally, a markedly sagging uterus requires surgery, but an anterior flexion coccygeal lesion may account for pelvic floor laxity. In the male, the prostate is easy to evaluate and to manipulate for decongestion both directly with massage and indirectly by lifting the pelvic floor. In rectal pain and dysfunction, the perineal myofascial tissues may be tense. Structural dysfunctions are relieved by rectal internal and external soft tissue myofascial manipulation. Coccydynia is frequently relieved by correcting the coccyx range of motion by stretching the sacrococcygeal and sacrotuberous ligaments.

Dorsal lumbar soft tissues, such as the lumbar fascia and muscles, can be evaluated by direct palpation of the tissues for tension. Vertebral ligamentous tone is evaluated by direct palpatory pressure applied segmentally to the vertebrae and ligaments dorsally and abdominally.

LUMBAR AND PELVIC MANIPULATIVE TECHNIQUES

Myofascial techniques

Prone technique

With the patient prone, the operator uses the thumb, thenar and hypothenar eminences of one or both hands to push the sacrospinalis muscle bundle laterally with a slow intermittent action until there is tissue release.

Lateral recumbent technique

(1) The patient is in the lateral recumbent position with knees and thighs flexed (Figure 10.14).

(2) The operator faces the patient and reaches over the patient's waist with both hands to grasp the upper paralumbar myofascial bundle.

(3) The operator pulls towards himself with his body while using his thigh or hip as a stop against the patient's knees.

(4) Soft tissue intermittent traction pressure with a hold is exerted until tissue release is felt.

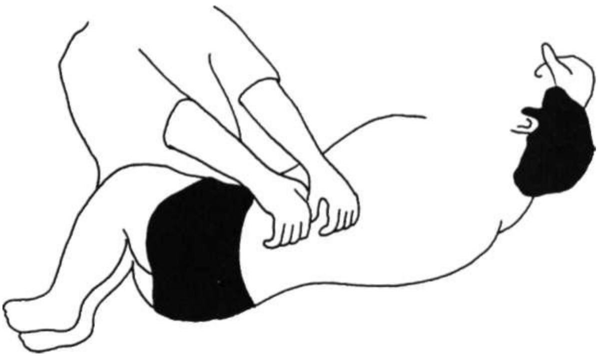


Figure 10.14 Lateral myofascial technique

Iliolumbar stretching

(1) The patient is in the lateral recumbent position (Figure 10.15).

(2) The operator's cephalad hand and forearm are used to rotate the upper torso away, while the caudad hand and forearm bring the lower torso/pelvis forwards into rotation to a point of tension.

Figure 10.15 Iliolumbar stretching

(3) The twist is exaggerated and a slow, rocking, twisting and stretching motion is applied. The caudad hand or cephalad hand may be used to palpate the tension in the iliolumbar and lumbodorsal fascia and vertebrae.

During the slow rocking and exaggeration of the tension exerted by the opposing forces of the operator's forearms, there may be a myofascial release with joint mobilization. Sometimes additional traction or stretch of the lumbar area is needed, so the manipulator may use his non weight-bearing foot to spring the patient's dependent lower extremity as illustrated in Figure 10.16 .

Figure 10.16 Lumbar stretch with leg leverage

Lateral lumbar side-bending

(1) The patient is in the lateral recumbent position on the table with the thighs and legs flexed in parallel (Figure 10.17).

(2) The operator grasps the knees or legs and brings the knees beyond the edge of the table, while stabilizing the torso, and then palpates the myofascial lumbar tissues and spine.

(3) The paralleled legs are raised and lowered to spring and stretch the lateral lumbar soft tissues in side-bending. This mobilizes and stretches the soft tissues on the convex side (Figure 10.18).

Figure 10.17 Lateral lumbar side-bending stretch

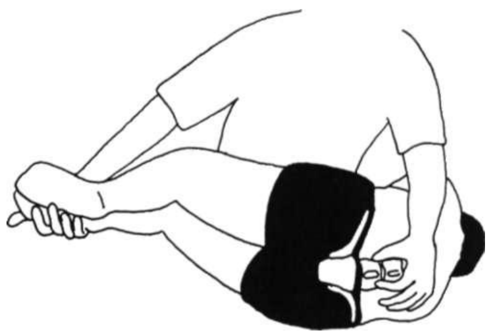


Figure 10.18 Checking lumbar motion

Sitting, twisting and side-bending

(1) The sitting patient places his interlocking hands behind his neck (Figure 10.19).

(2) The operator puts one arm through the patient's proximal flexed arm and forearm, or under the arm, and crosses in front of the chest, grasping the other arm on the opposite side, thus gaining control over flexion, extension, side-bending and rotation of the torso.

(3) The operator's other hand, acting as a fulcrum for resistance and force, is applied against the torso at the paraspinal soft tissues on the contralateral side.

Figure 10.19 Sitting, twisting and side-bending

(4) While directing the lateral force with one hand, the other controls dorsal motion and tension by levering the arms of the patient.

Supine flexion

(1) The patient is supine with the legs and thighs flexed on the abdomen (Figure 10.20).

(2) The operator uses one forearm and his thorax to weight the flexed extremities, while the other hand secures the patient.

(3) Intermittent exaggeration of the flexion is carried out by the operator's weight on the lower extremities, thus stretching the lumbar fascia and muscles.

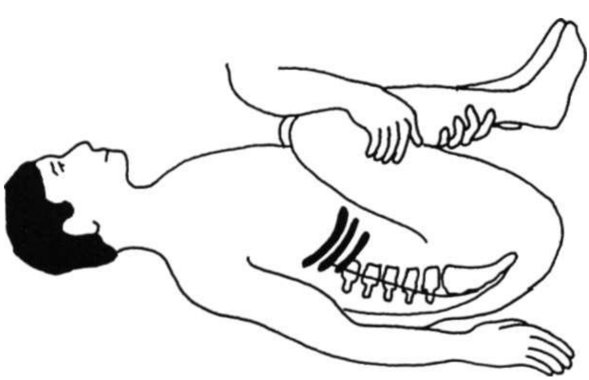


Figure 10.20 Supine flexion

Lumbar myofascial twisting

(1) The same basic supine flexion approach is used.

(2) The operator's cephalad hand secures one shoulder and the other hand rotates the patient's lower torso in an opposing direction by the flexed extremities, thus causing stretch-twisting of the lower back.

(3) The same thing is done by anchoring the opposite shoulder and twisting the forced flexion of the body in the other direction.

Prone pressure with counter-pressure

(1) With the patient prone, the operator reaches across the patient and grasps the pelvis around the anterior superior iliac spine and the adjoining musculature (Figure 10.21).

(2) With the heel of the other hand, pushing away, pressure is exerted against the lumbodorsal myofascial structures, while the other hand pulls, thus creating a twisting, stretching action.

Figure 10.21 Prone counter-pressure technique

(3) The action is applied intermittently until there is a soft tissue release.

Prone scissor technique

(1) The patient is prone; the operator brings the far fully extended lower extremity up and across the other lower extremity, while the operator's cephalad hand secures the lumbosacral area (Figure 10.22).

(2) The elevated extremity is used as a lever with adduction and extension.

(3) With the fulcrum pressure exerted over the sacroiliac joint, restrictions are released, particularly with posterior sacroiliac lesions. Note: the fulcrum hand may be used to work up the lumbar spine into the thoracic area for soft tissue stretching.

Figure 10.22 Prone scissor technique

Rocking the sacrum

(1) With the patient prone, the operator places one hand over the other on the sacrum with the tips of the fingers at the lumbosacral joint, reinforced by the other hand (Figure 10.23).

(2) Intermittent downward pressure is exerted and a rocking action is added with the pivotal point at S-2.

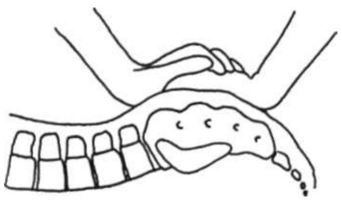


Figure 10.23 Sacral rocking

The tips of the fingers of the hand that faces the base of the sacrum and approximates the lumbosacral joint should feel for the sacral motion of flexion and extension at L-5/S-1. The rocking should also be lateralized to check the sacroiliac ligaments. Sacral rocking gives the operator the chance to check the tension of ligamentous attachments to the sacrum, i.e. sacroiliac and lumbosacral ligaments. In releasing tension between the lower lumbar vertebrae and the sacrum, correction of associated lesions is facilitated.

Sacrococcygeal ligamentous technique

(1) With the patient prone or in the lateral recumbent position, the operator places an index finger into the rectum and grasps the coccyx between that finger and the thumb which overlies it on the dorsum outside.

(2) The ligamentous tension and restriction is noted. The coccyx is moved in flexion, extension and lateral side-bending.

(3) The index finger is used to check the tension of the lateral soft tissues containing the tendinous arch - the white band of the pelvic fascia and the sacrotuberous ligament (see Figure 10.13).

(4) This is treated with stretching until relaxation occurs.

Musculoskeletal techniques

Lumbar spine

The lumbar spine requires rotation to some degree and flexion from below and above to establish a locking at the focal point of a lesion in order for a sagittal force to be used for correctional manipulation. The force may be a velocity (high or low) or a tension/stretching technique by gradually increasing the tension at the locking point, assisted by the respiratory release. This latter myofascial technique may use torso rotation, with rocking, and a mild low velocity thrust at the end of the exaggeration.

Thigh technique

The thigh is grasped at the knee and a longitudinal and downward thrust is used after the slack is taken up (Figure 10.24). Thrusting is restricted to a mild to moderate degree. No severe thrust is required or needed after soft tissue preparation and proper positioning of the patient. If mobilization does not occur on the first thrust, this is repeated after some joint traction is carried out.

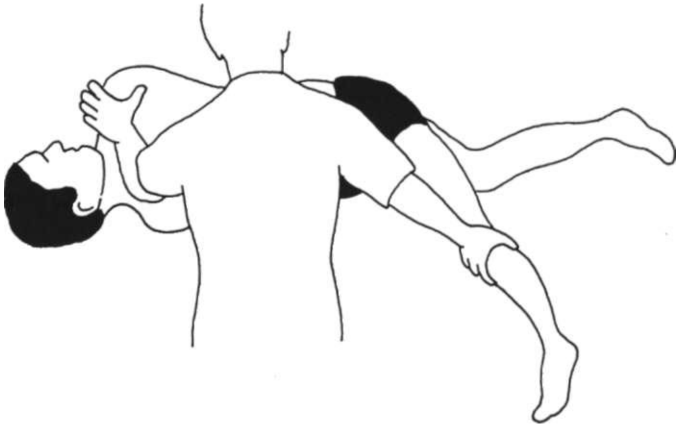


Figure 10.24 Lateral lumbar vertebral technique using thigh

Lateral lumbar (lumbar roll) ***technique for lumbar mobilization***

(1) The patient is put into the lateral recumbent position.

(2) The operator palpates the condition of the lumbar area with one hand, while the other hand pulls forward the patient's lower shoulder by the arm, in order to rotate spine down to the lesion to feel the 'locking' at L-1,2,3,4 or 5.

(3) With the other hand, the operator drops the patient's upper leg off the table, thus rotating the pelvis and lower lumbar vertebrae, as desired, to the point of 'locking' (Figure 10.25). This rotation action also flexes the lumbar vertebrae. The amount of flexion determines the 'locking' point.

(4) The operator maintains the locking tension by the action of both his arms in controlling the torsion.

(5) With his caudad forearm, the operator exerts a downwards and lateral thrusting force directed parallel through the lumbar facets.

In step (4) as the operator maintains the lumbar flexion and twisting tension, he may gently exaggerate and rock the hold and a correction may take place by the accentuation of tension in the locking position. Some manipulators hook the patient's upper foot behind the knee of the lower leg. I prefer to drop the upper extremity off the table because that exerts traction on the lumbar myofascia, and sometimes, by doing this, lumbar vertebral release is facilitated. However, this is after adequate soft tissue manipulation has been performed beforehand.

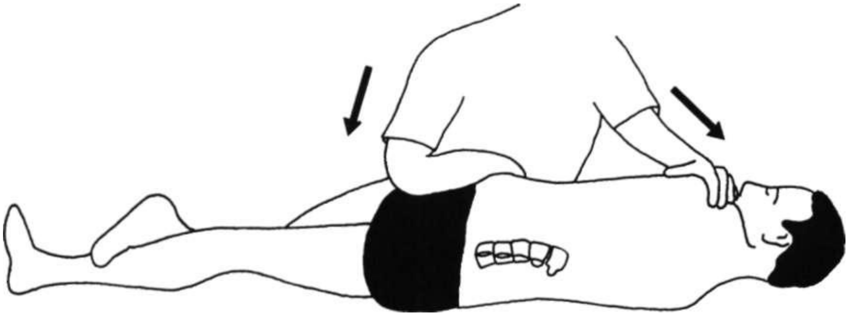


Figure 10.25 Lateral 'lumbar roll' sacroiliac technique

Sacroiliac lesions

Lateral sacroiliac techniques for a posterior iliac lesion The patient and operator are in the same locked position as used in the lumbar roll (Figure 10.26), except that rotation locking is down to the sacrum and the pressure fulcrum is at the posterior superior iliac spine. The thrust is forward and lateral, parallel to the crest of the ilium.

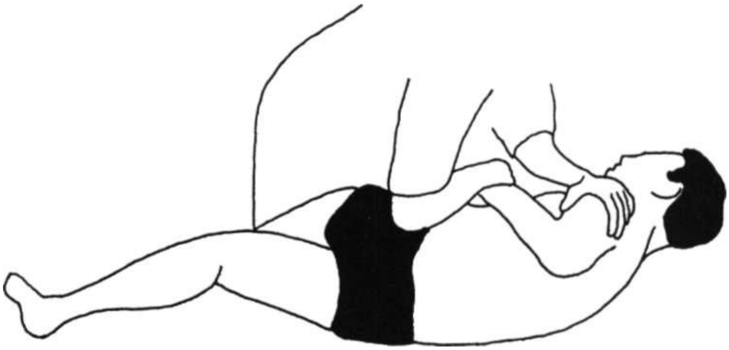


Figure 10.26 Lateral sacroiliac technique for a posterior lesion

Prone technique for posterior iliac lesion With the patient prone, the operator reaches across the patient and grasps the far lower extremity at the distal thigh or knee area with the caudad hand (Figure 10.27), while the cephalad hand is positioned over the far sacroiliac posterior lesion and exerts anterior pressure after taking up the slack. The counter-action of the hands is exaggerated with a thrust through the sacroiliac joint by the cephalad hand.

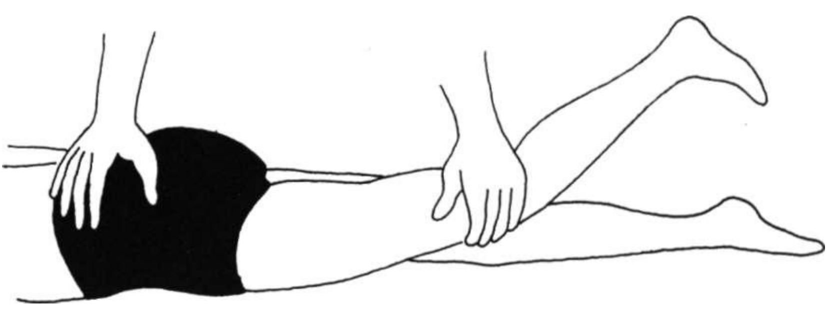


Figure 10.27 Prone sacroiliac technique

Figure 10.28 Lateral sacroiliac technique for an anterior lesion

Anterior iliac lesion This is similar to lateral sacroiliac technique for a posterior lesion described above, except that the fulcrum of pressure and thrust is on the inferior posterior iliac spine and is given downwards and laterally (Figure 10.28).

Supine sacroiliac technique

(1) With the patient supine, the operator ilexes both the patient's knees and thighs, and places the knees against his axilla and chest (Figure 10.29).

(2) The other hand is placed under the posterior superior iliac spine on the same side as the operator is standing (for posterior lesions under the inferior spine) and the patient is rolled so that the weight of the pelvis and extremities rest on the hand, which thus acts as a fulcrum.

(3) The corrective force is directed parallel to the thighs, downwards through the patient's knees.

Figure 10.29 Supine posterior sacroiliac technique with the knees flexed

Supine traction with thrust technique For a posterior iliac lesion, the following procedure is used (Figure 10.30):

(1) The patient is supine and the operator is at the foot of the table.

(2) The operator grasps the foot with both hands on the lesioned side and elevates the foot about 6 inches (15 cm) above the table.

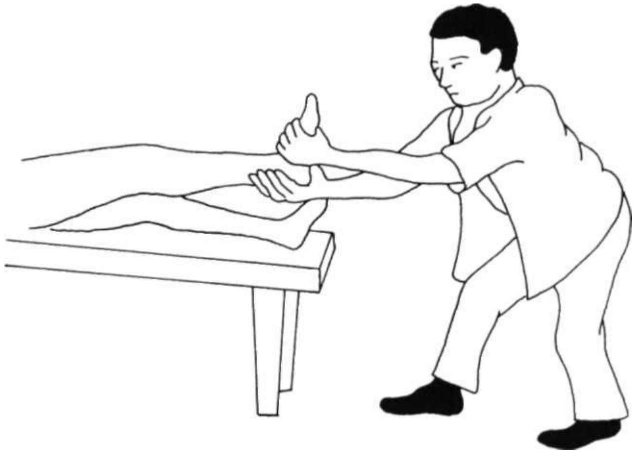


Figure 10.30 Supine posterior sacroiliac traction with thrust

(3) The operator then exerts traction.

(4) When the patient exhales, the operator makes a sudden pulling thrust in line with the extremity.

Supine anterior sacroiliac lesion correction This is performed in basically the same way as above, except that the lower extremity is elevated 18 inches (45 cm) above the table.

Flexed thigh sacroiliac technique This is performed for a posterior iliac lesion as follows:

(1) The patient is supine, with the thigh and leg flexed and abducted (Figure 10.31).

(2) With lateral and downward pressure, the knee is circumducted and the lower extremity extended fully to end parallel beside the other extended lower extremity.

Figure 10.31 Flexed abducted thigh sacroiliac technique

Figure 10.32 Anterior sacroiliac adducted thigh technique

For an anterior iliac lesion, the technique is similar to that described above, except that the knee is adducted and sprung medially, then circumduction with full medial adduction force is performed before extension of the extremity (Figure 10.32).

Pubic lesions

Pubic lesions are easily palpable by comparing the symmetry of the pubic tubercles on each side of the symphysis. Usually the side in lesion is tender to painful (see Figure 10.12) The two supine sacroiliac techniques illustrated in Figures 10.30 and 10.31 may be used to correct anterior pubic lesions.

Muscle energy technique for pubic lesions Method A, with abducted knees, is described below:

(1) The patient is supine with flexed, abducted knees and the feet together and flat (Figure 10.33).

(2) The operator secures each knee in abduction with each hand.

(3) The patient is instructed to try to approximate the knees against the operator's resistance.

(4) The patient's active muscle effort is performed three times.

(5) The operator then slowly releases the knees to approximation.

Figure 10.33 Public lesion, method A

Figure 10.34 Pubic lesion, method B

In method B, the knees are adducted:

(1) The patient is supine with the knees flexed and approximated (Figure 10.34).

(2) The operator secures the knees in approximation.

(3) The patient then tries to actively abduct the knees with muscle action.

The following is a variation of the technique with knees abducted:

(1) While the operator maintains the pressure of abduction in both knees that are in flexion, the patient is instructed to extend both legs by pushing the feet towards the end of the table.

(2) As the patient does this, the operator makes an exaggeration of the abducted knees and may make a small thrust or springing.

(3) This technique may be modified for use just on the lesion side by unilateral abduction of the thigh, carried to the point of resistance, then given a small thrust exaggeration.

Coccygeal lesions

Coccyx lesions may be signalled by coccydynia, a condition of pain in the coccyx area, of varying intensity and usually involving the surrounding tissues with hypertonic sacrococcygeal elements, ligaments, fascia and muscles. Manipulation is carried out as follows.

(1) One hand is used to grasp the coccyx between the index finger, which is placed intrarectally, and the thumb placed externally over the dorsum of the coccyx (Figure 10.35).

(2) Fixation or mobility is determined at the sacrococcygeal joint and the supporting soft tissues.

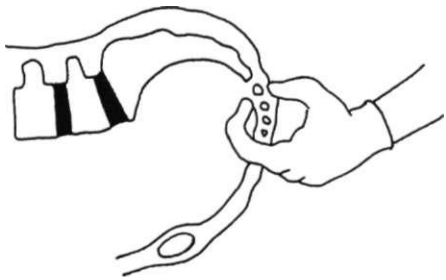


Figure 10.35 Coccyx technique

(3) Gentle pressure and release manipulation is applied until tissue release is felt, thus establishing mobility, decongestion and normalization of coccyx position.

VISCERAL MANIPULATION

Viscera lifting with lower dorsal and lumbodorsal pressure is advantageous for relieving visceral congestion, particularly with intestinal problems.

ABDOMINAL OMENTUM (VISCERAL) LIFT

(1) The patient is in the right lateral recumbent position with the operator standing behind (Figure 10.36).

Figure 10.36 A visceral or omentum lifting technique

(2) The lower thoracic or thoracolumbar segmental lesions are located and pressed with the flexed fingers straddling the spines.

(3) The other hand reaches over the patient and, with spread fingers, starts in the right inguinal area by drawing upwards and diagonally across the abdomen and laterally towards the splenic area.

The motion of the abdominal hand is slow with moderate palpatory pressure. Visceral manipulation should consider and utilize fascial traction in line with the inherent visceral motion.

Prostate manipulation

(1) Using the rectal approach, with the gloved index finger the physician palpates the prostate lying anterior to the rectum.

(2) The lateral areas and lobes are palpated and motion is applied to the central lobe with gentle pressure. This is repeated a few times for tissue response.

(3) This step is repeated on the opposite side and lobe.

(4) The final move is from the superior position of the middle lobe and the finger is brought down and backwards and out of the rectum.

Uterus manipulation

Malposition of the uterus does occur and causes certain signs and symptoms. The uterus may be malpositioned by being anteverted, anteflexed, retroverted, retroflexed or pulled to one side. With the patient supine and in stirrups, the physician performs the examination and treatment bimanually:

(1) The abdominal hand is placed flat suprapubically.

(2) The index and middle finger of the other hand are inserted vaginally to feel the cervix and determine the position of the uterus, i.e. whether anteriorly or posteriorly flexed, pulled to one side, poorly supported with lax tissues or restricted with parametrial congestion.

(3) Lateral, deeper palpation is made to ascertain the parametrial and ovarian status in the iliac fossae.

(4) An abnormal position of the uterus may be corrected by manipulation to normalize the position, this being followed by the patient doing knee-chest exercises at home.

For a more sophisticated discourse on abdominal manipulation, the reader may refer to ***Visceral Manipulation*** by Barral and Mercier (1988) which is included in the bibliography.

11

LOWER EXTREMITY

ANATOMICAL REVIEW

The lower extremity consists of the hip, thigh, knee, leg, ankle and foot. Functionally the lower extremity must include areas from the dorsilumbar spine, lumbar spine, pelvic girdle and on down the extremity to the foot.

In many lower extremity structural disorders, there are dysfunctions of the pelvis and lower back. In knee and hip lesions, associated lesions are often found at D12/L1, L5, the ipsilateral sacroiliac, pubes and adductor and flexor myofascial structures. The thigh adductors extend from the pubes downwards to insert into the medial fibrocapsular ligamentous tissue of the knee joint (see Figure 10.1).

Thigh restrictive lesions affecting the pelvic girdle almost always have structural dysfunction at the lumbodorsal transitional area because the psoas minor arises from the 12th thoracic (T-12) and first lumbar (L-l) vertebrae to insert in the iliac fascia and iliopectineal eminence of the pubes, and the psoas major arises from all transverse processes and fibrocartilages of the five lumbar vertebrae to descend in common with the psoas minor and the iliacus, passing over the crest of the pubes and inserting onto the lesser trochanter of the femur. Iliopsoas action flexes and laterally rotates the thigh and aids in adduction.

In knee complaints, there are usually tarsal lesions below and pelvic girdle lesions above. Adductors are involved (Figure 11.1), and in the foot there is frequently a tarsal lesion, most often a cuboid lesion. The foot should be checked in knee problems. For the pelvic-thigh-knee musculoskeletal connections refer to Figure 10.1.

HIP

The hip is defined as the acetabular-innominate joint. The hip articulation is an enarthrodial (ball and socket) joint, formed by the femoral head and the acetabulum, the receptacle. Both surfaces are covered with cartilage. The covering of articular cartilage on the head is thicker centrally, except for the central attachment of the teres femoris ligament. The acetabular cartilage is lunate with a central deficit.

Hip joint ligaments

The articular capsule is very strong and loose with the following descriptive ligament parts: pubocapsular, iliofemoral and ischiocapsular. Within the capsular ligament (Figure 11.2) are the following ligaments: the teres femoris, glenoid labrum and transverse acetabular.

Figure 11.1 Adductor muscle complex

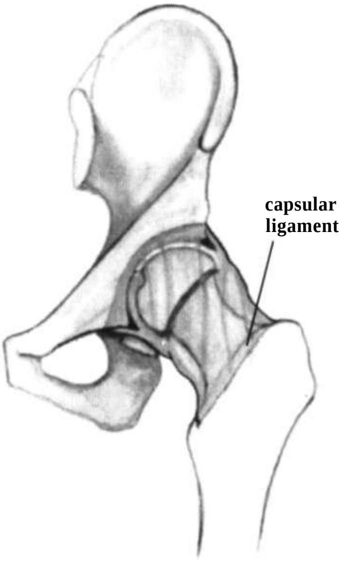


Figure 11.2 Hip joint ligaments

Hip joint muscles

The muscles span from the lumbopelvic skeletal system above to the knee skeletal system below and their muscle action is given below. The anterior (flexor) muscles (Figure 11.3) are the psoas major, psoas minor, iliacus, rectus femoris, sartorius and tensor fasciae latae. The medial (adductor) muscles are the gluteus maximus, adductors magnus, longus and brevis, pectineus, gracilis, obturators and gemelli. The posterior (extensor) muscles (Figure 11.4) are the gluteus maximus and the hamstrings (biceps femoris head, semitendinosus and semimembranosus).

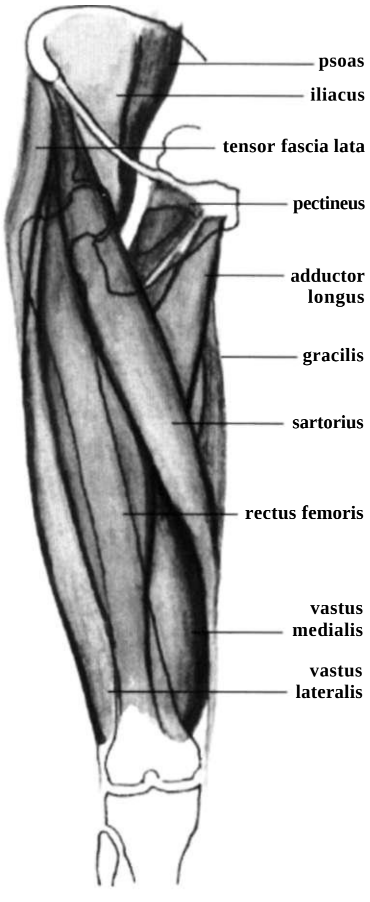


Figure 11.3 Anterior hip muscles

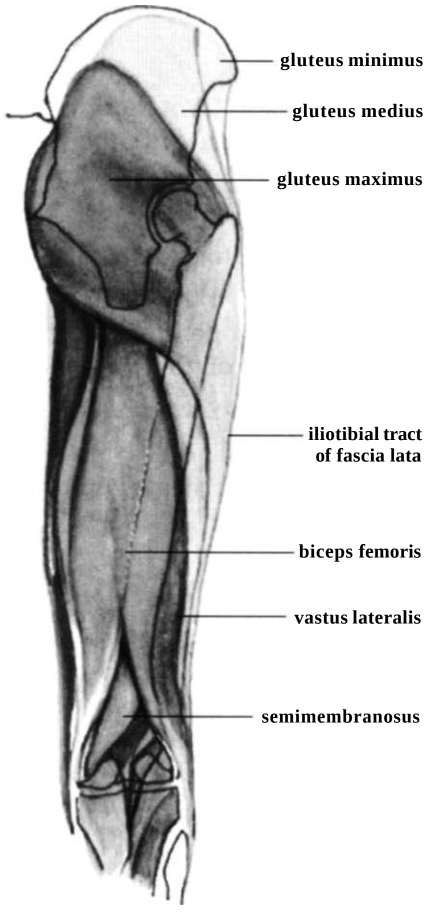


Figure 11.4 Posterior hip muscles

The lateral (abductor) muscles (Figure 11.5) are the tensor fasciae latae, gluteus medius, gluteus minimus, sartorius and piriformis. The medial rotators are the gluteus medius and minimus, tensor fasciae latae and the adductor magnus. In standing, the muscles involved are the iliopsoas, pectineus and upper adductors. The lateral rotators are the gluteus maximus, adductors, pectineus, iliopsoas, obturators, gemelli, piriformis and quadratus femoris.

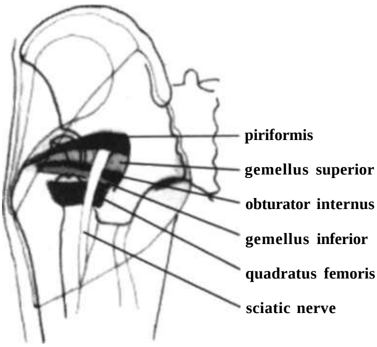


Figure 11.5 Deep posterior hip joint muscles

Testing for hip joint motion

This is carried out with the patient supine.

External rotation

(1) The operator stands next to the patient and flexes the proximate knee and thigh (Figure 11.6).

(2) Then the operator externally rotates the flexed knee and places the ankle on the opposite suprapatellar area.

(3) The knee is pushed down until hip joint resistance is encountered.

(4) The opposite extremity is then compared for the degree of abduction.

Figure 11.6 External rotation testing: sign of four

Internal rotation
This is performed in a similar manner to external rotation, except that the flexed knee is carried medially (Figure 11.7). Observing a discrepancy of increased resistance and decreased motion indicates a hip joint lesion.

A confirmatory technique is to stand at the foot of the table and internally and externally rotate both extremities simultaneously by grasping an ankle in each hand to test the resistance.

Treatment of hip joint lesions is performed by exaggeration and stretching of the procedures above.

Figure 11.7 Internal rotation testing

KNEE

Anatomical review
The knee joint, the largest joint in the body and one of the weakest joints, is a complex hinge-type of joint consisting of three articulations: two condyloid of the tibia, patella and the femur, and the supporting proximal tibiofibular joint. The latter is not usually included, but functionally it must be. There are 11 descriptive ligaments of the knee proper.

Knee joint ligaments
The internal ligaments (Figure 11.8) are the anterior cruciate, posterior cruciate and transverse ligaments. The external ligaments

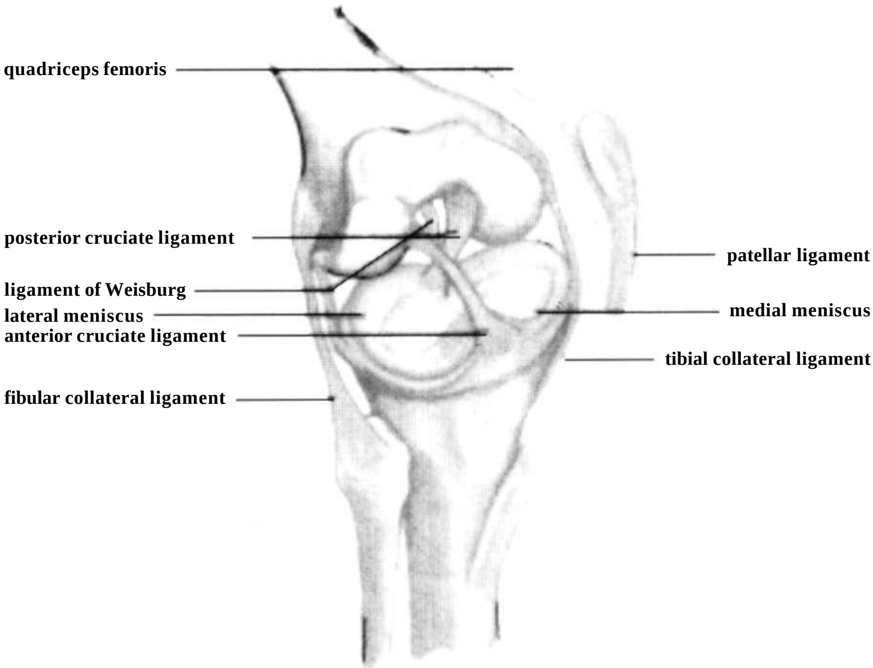


Figure 11.8 Knee ligaments

are the capsular, ligamentum patellae, oblique popliteal, arcuate popliteal, fibular collateral, tibial collateral, medial meniscus, lateral meniscus and coronary.

Knee *muscles*

Overlying the ligamentous structures of the knee are the supporting muscles. From the top down; these are the:

(1) Gluteal: the gluteus maximus (in part) with the tensor fasciae latae lock the extension of the knee.

(2) Thigh: the extensors are the quadriceps femoris (four parts), rectus femoris and three vasti muscles. The medial rotators are the sartorius, semimembranosus, and the semitendinosus, inserting at the medial condyle. The lateral rotators are the adductor gracilis and the biceps femoris, long and short.

(3) The leg muscles supporting the knee (Figure 11.9): the gastrocnemius plantaris (flexors), soleus (fibular head origin), tibialis anterior, extensor digitorum longus, tibialis posterior and peroneus longus.

The tendinous insertions of the muscles around the knee will be tender to palpation when a lesion is present and the origin should then be checked for tenderness. This will help to determine what manipulation is needed.

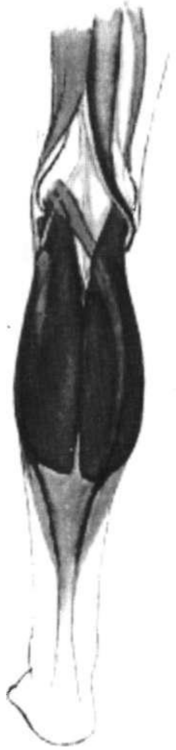


Figure 11.9 Posterior knee muscles

Knee testing

The object is to determine the tone of the ligaments and the condition of joint motion. Testing may be performed with the patient supine, prone or sitting on the edge of the table.

Patient sitting

(1) The operator takes the distal leg and places it between his distal thighs (Figure 11.10). He then grasps the proximal leg so as to encircle the knee with the thumbs to palpate the anterolateral and anteromedial ligaments.

(2) The action of the cruciate ligaments is then tested by drawer action using a to-and-fro motion.

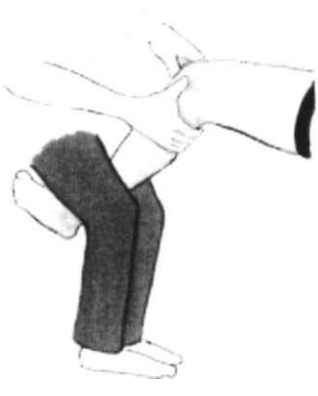


Figure 11.10 Knee ligament testing in the sitting position

Patient supine on the table

(1) The operator flexes the knee to 90° and grasps it with the hands in a similar manner to that described above (Figure 11.11).

(2) The operator pulls the leg forwards to test the posterior cruciate ligament and pushes the leg backwards to test the anterior cruciate ligament.

(3) The proximal tibiofibular joint is tested to see if there is periarticular congestion and tenderness with or without displacement.

(4) With the knee joint in partial flexion, the anteromedial and anterolateral ligaments are palpated and tested.

(5) With the leg extended, the resilience of the collateral ligaments, lateral and medial, is tested by springing the joint medially and laterally.

Patient lying prone

(1) Flexion and extension are tested.

(2) In flexion, internal and external rotation are tested.

(3) The motion of both knees is compared.

Knee manipulation techniques

Posterior displacement of the tibia on the femur (patient prone)

(1) The lower extremity at knee is flexed to 90° (Figure 11.12).

Figure 11.11 Knee ligament testing in the supine position

Figure 11.12 Tibio-femoral technique

(2) The operator encircles the proximal leg and places the patient's foot on his shoulder.

(3) As traction is exerted with both hands, the operator lifts the leg with his shoulder by rising, causing dorsiflexion of the foot.

Posterior proximal fibular lesion (patient supine)

(1) The operator places the first metacarpophalangeal joint of one hand behind the proximal tibiofibular joint (Figure 11.13).

(2) The operator's other hand rotates the leg externally, and fully flexes the leg against the thigh.

(3) A sudden thrust is made with the fulcrum of force being behind the tibio-fibular joint.

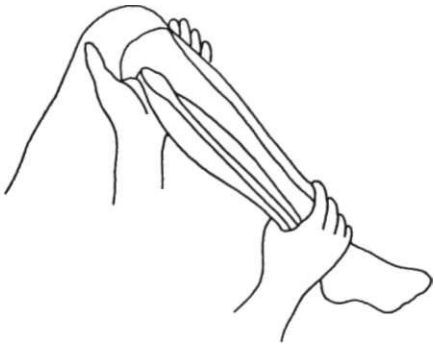


Figure 11.13 Supine proximal tibiofibular technique

Proximal fibular lesion (patient prone)
This is illustrated in Figure 11.14; it is similar to the above, with the first metacarpophalangeal knuckle used as a fulcrum against the flexion force.

Figure 11.14 Prone proximal tibiofibular technique

Anteromedial meniscus displacement

(1) The patient is supine on the table and the operator flexes both the thigh and the leg. With the knee in 90° flexion, he cradles the leg between his arm and body (Figure 11.15).

(2) The operator's medial thumb is placed over the anteromedial aspect of the knee joint with the other fingers encircling the popliteal space.

(3) Pressure is exerted by the other hand on the lateral aspect of the joint.

(4) Forces are exerted through both hands and the knee is carried downwards and medially with the joint progressively extended. Anteromedial meniscus displacement is corrected (Figure 11.6).

Figure 11.15 Meniscus technique

Figure 11.16 Anteromedial meniscus lesion correction

ANKLE

Anatomical review

The ankle joint is a ginglymus (hinge) joint (Figure 11.17) formed by the lower malleolar ends of the tibia and fibula with the inferior transverse ligament for the reception of the convex surface and lateral facets of the talus.

A transverse description of the ankle/foot identifies two parts: the proximal part (tibia, fibula, talus, calcaneus) and the distal part (the navicular, cuboid, cuneiforms, metatarsals and phalanges).

Five ligaments connect the bones of these two parts (Figures 11.18, 11.19 and 11.20): the capsular, deltoid, calcaneofibular, anterior and posterior talofibular ligaments.

Figure 11.17 Coronal section of ankle joint

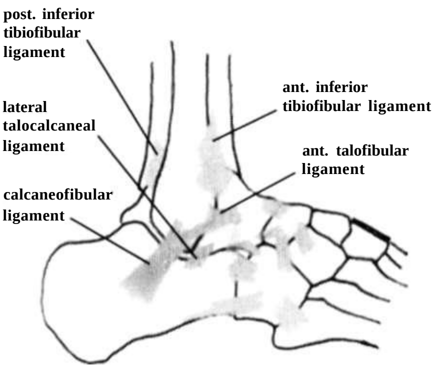


Figure 11.18 Lateral ankle ligaments

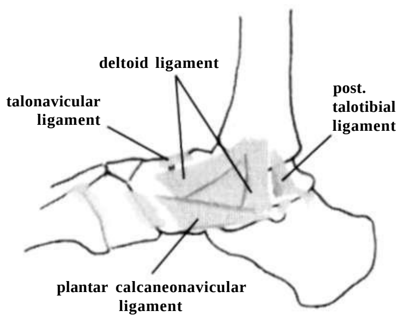


Figure 11.19 Medial ankle ligaments

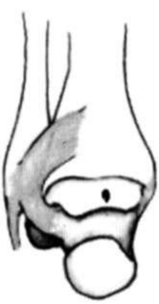


Figure 11.20 Fibular ligaments of ankle

Figure 11.21 Testing posterior tibial displacement

Figure 11.22 Testing anterior tibial displacement

Ankle testing

This is illustrated in Figures 11.21 and 11.22. Functional considerations must include the foot, leg, knee and pelvic girdle.

Distal tibiofibular joint

Restricted motion is detected by grasping the lateral malleolus between the finger and thumb and exerting alternate anterior and posterior forces while the tibia is held firmly by the other hand.

Talotibial lesion

In anterior lesions, dorsiflexion is usually limited and in posterior lesions, plantar flexion is limited. This should be compared with the other ankle.

Ankle manipulation

Ankle joint traction technique

(1) The patient is supine with the operator at the foot of the table.

(2) The operator grasps the foot by encircling it with both hands (Figure 11.23).

(3) Mild traction is exerted, then a sudden pull.

Figure 11.23 Ankle traction technique

Figure 11.24 Talotibial and talocalcaneal technique

Figure 11.25 Anteromedial talocalcaneal lesion treatment

Talotibial and talocalcaneal technique

(1) The patient sits on the table.

(2) The operator grasps the heel with one hand and the dorsum of the foot with the other hand (Figure 11.24).

(3) Traction is exerted downwards to take up the slack and the joint is put through the full range of motion.

Anteromedial talocalcaneal technique
Anterior rotation of the fibula causes inward rotation of the head of the talus: posterior displacement causes outward rotation. These lesions cause disturbance in talocalcaneal foot balance. Treatment is illustrated in Figure 11.25.

FOOT

Anatomical review
The foot has two arches: the longitudinal and the transverse arches (Figure 11.26). The dorsum of the foot is convex both longitudinally (Figures 11.27 and 11.28) and transversely and the plantar surface is concave in both directions.

The longitudinal arch is formed by seven tarsal and five metatarsal bones and the ligaments binding them. The arch rests on the calcaneal tuberosity posteriorly and the heads

Figure 11.26 Transverse arch of the foot

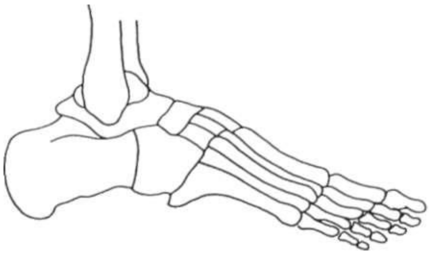


Figure 11.27 Longitudinal arch, lateral view

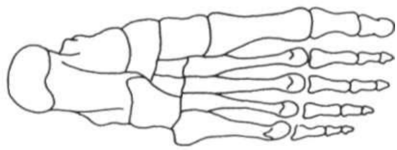


Figure 11.28 Longitudinal arch, plantar view

of the metatarsals anteriorly. The greater tension rests on the plantar ligaments. The calcaneocuboid joint is supported and closed by two ligaments, i.e. the long and short plantar ligaments. The long plantar ligament spans between the medial and lateral calcaneal tubercles to the bones of the 2nd, 3rd, 4th and 5th metatarsal bases. The short ligament is partially covered by the long division as the fibers stretch from the anterior calcaneal tubercle to just behind the ridge on the cuboid. Lateral to this is the spring ligament (Figure 11.29), the plantar calcaneonavicular. Supporting the longitudinal arch are the muscles together with the ligaments that form the 'stirrup' structure.

The transverse arch is really formed by a series of arches; the posterior part is formed by the anterior part of the tarsals, and the anterior part is formed by the metatarsals. The transverse arch is strengthened not only by ligaments, but also by the short muscles of the foot and the long tendon of the peroneus muscle.

These two main arches are important for the springing action of the foot for taking up the shock of walking and running. The joint movements are limited to gliding.

The 'stirrup' is formed by the tibialis anterior, the peroneus longus, the tibialis posterior (partial aid), the long and short plantar ligaments, the plantar spring ligament and the calcaneonavicular ligament (Figure 11.30).

Figure 11.29 Spring ligament

The strongest ligament of the foot is the talocalcaneal ligament, interosseously bridging the talocalcaneal articulation. The anteromedial articulation is smaller and designed as an axis for rotation between the two bones. The posterolateral articulation forms a broad crescent. The interosseous ligaments lying between the articulations consist of a great number of short fibers in such a way as to allow freedom of motion of the talus and calcaneus without separation.

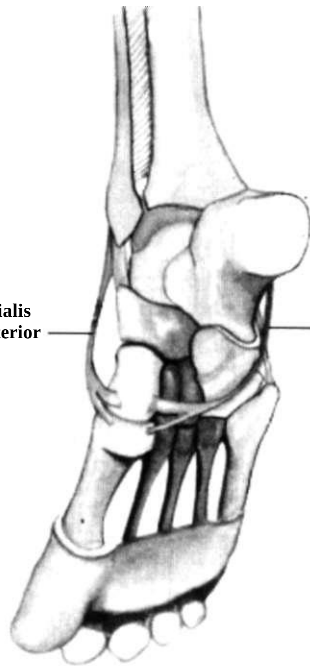


Figure 11.30 Foot stirrup

Calcaneocuboid articulation

The cuboid's postero-inferior edge is extended as a ridge for a significant distance under the calcaneus, which prevents a downwards and inwards rotation of the anterior end of the calcaneus; therefore, cuboid lesions precede the calcaneal rotation. Cuboid lesions are very frequent in foot disorders and eversion of the foot occurs with spreading of the inner tarsal joints; there is a shifting of weight-bearing to the medial aspect from the lateral norm. This provokes a downward displacement of the internal cuneiform and navicular bones and allows the head of the talus to rotate medially and downwards, which forces the base of the calcaneus in a lateral direction, carrying the distal fibula anteromedially with the proximal fibula lesioned posterolaterally. The soft tissue failure leads to excess stress on bony joint surfaces, causing inflammation and pain, a shift in weight more anteriorly, and callus and corn formation on frictioned surfaces, as well as causing hallus valgus. Normally the great toe dorsiflexes by 45° and plantar flexes 35°.

Arches of the foot

There are two arches for gravitational consideration:

(1) Longitudinal arch: weight-bearing is from the anterior metatarsal heads to the posterior tuberosity of the calcaneus, the largest tarsal bone (Figure 11.31). The longitudinal arch is divided into two functional parts:

(a) Inner functional or spring arch for spring and shock absorbing action; it consists of the three medial digits with metatarsals and cuneiforms, navicular and talus (light bones).

(b) Outer static part consisting of the calcaneus, cuboid and the 4th and 5th metatarsals and digits (dark bones); it is primarily for weight-bearing.

(2) Transverse arch: this consists of the cuboid, three cuneiforms and the navicular. The three cuneiforms and the navicular rest partially on the cuboid ledge.

Figure 11.31 Long arches

Figure 11.32 Walking weight-bearing sequence

Both arches serve a spring function in weight-bearing, shifting and springing action. Weight-bearing is basically on a tripod, with the walking sequence of the stepping foot as follows (Figure 11.32): first, the weight is taken by the calcaneus (1 on Figure 11.32), then shifts forward to the heads of the 4th and 5th metatarsals (2) and finally to the medial aspect under the 1st metatarsal head (3).

Testing for tarsal motion

(1) The heel is grasped so that the fingers curl around the lateral aspect of the calcaneus with the base of the hand on the inner aspect.

(2) The other hand grasps the dorsum of the foot so that the thumb is on the medial arch and the index finger curls around the lateral aspect (Figure 11.33).

Figure 11.33 Tarsal testing

Figure 11.34 Releasing joint pressure

(3) A rotary motion is performed while checking the articular action.

(4) The fingers should palpate for motion and points of tenderness, particularly in respect to the cuboid, internal, cuneiform and navicular.

Soft tissue manipulation must be used before active corrective manipulation, which is performed with the thumbs working the soft tissues at right angles to the length of the foot and/or grasping the calcaneus posteriorly with one hand while the other hand grasps the forefoot with the heel of the hand pressing the plantar area and the fingers closed over the toes (Figure 11.34).

Corrective manipulative techniques

Talocalcaneal technique

The talus supports the tibia above, rests upon the calcaneus below, articulates laterally and medially with the tibial and fibular malleoli, and articulates anteriorly with the navicular. The posterior talus joint has a large concave facet for the convex facet of the calcaneus. The anterior talocalcaneonavicular joint is supported by the spring ligament, and is supported underneath by the tendons of the tibialis posterior and flexor hallucis longus and the navicular.

Testing for motion For the left foot the following procedure is used:

(1) The operator's right thenar eminence is placed over the lateral aspect of the calcaneus with the fingers passing posteriorly around the tubercle of the calcaneus (Figure 11.35).

(2) The left hand holds the dorsum of the foot in order to grasp the talus so that the lateral aspect of the hand is approximating the tibia.

(3) Joint radial motion is tested.

Figure 11.35
Talocalcaneal testing

If restriction is in the lateral direction of the talus and of the posterior glide of the large facet, then there is an anteromedial lesion; if restriction is in the contrary motion, this indicates a posterolateral lesion.

Anteromedial lesion technique With the above-mentioned hold, a lateral thrust of the hypothenar eminence against the talus is performed. Counter-force is applied by the thenar eminence of the other hand on the calcaneus.

Posterolateral lesion technique The same principle as above is used but with the hands reversed. The right hand applies counter-force to the calcaneus while the left hypothenar eminence is thrust medially.

Tarsal techniques for cuboid, navicular or cuneiforms
In performing these techniques it is important to have a firm grip, ensure relaxation of the operator's wrists, and ensure relaxation of the patient.

Methods I and II

(1) Corrective manipulation may be carried out with the patient either standing facing the wall and lifting the foot back to the operator, by lying prone and letting the leg fall from the edge of the table, or by lying supine on the table. The correctional techniques for the two former methods are essentially the same. The plantar forces or vectors are directed differently to pass through each bone (Figure 11.36).

(2) The right thumb is placed on the plantar surface of the right tarsal in question and reinforced by the other thumb.

(3) The fingers of the hands encircle the foot dorsum with the index fingers along the metatarsal bases supporting each other with a firm grip, especially medially and laterally at the thumbs (Figure 11.37).

(4) Plantar flexion of the foot against the thumbs acts as a fulcrum, and at the same time the leg is snapped forwards like a whip with the vector force appropriately directed to the tarsal in lesion.

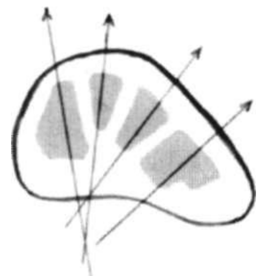


Figure 11.36 Plantar vectors for thrust correction

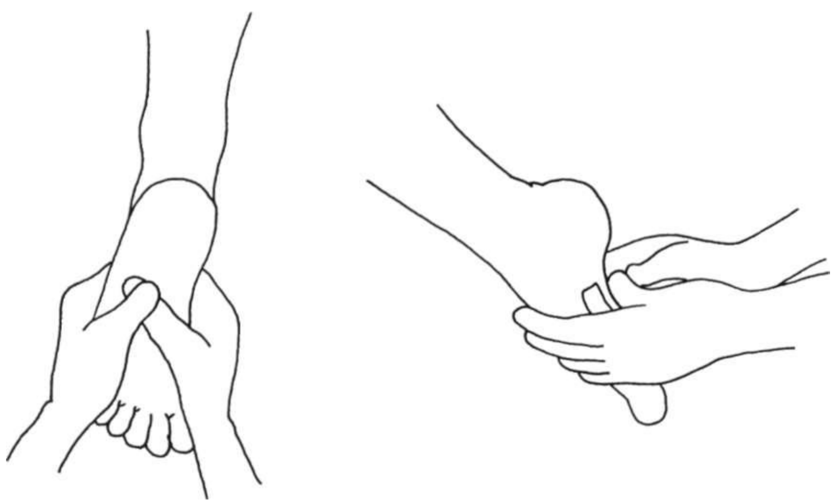


Figure 11.37 Correction of cuboid tarsal lesion

Method III

The patient is supine and relaxed on the table with the operator at the foot of the table:

(1) The operator's thumb is placed plantarly under the cuboid or other tarsals (Figure 11.38).

(2) The other hand is used to grip firmly over the dorsum of the

foot and bring the anterior foot into plantar flexion over the other thumb until 'locking' is felt.

(3) When the slack is taken up, then a synchronized thrust and counter-thrust is made over the plantar thumb fulcrum so that the operator's hands are making a colliding motion.

Figure 11.38 Supine cuboid thrust

Cuboid lesions not uncommonly cause pain and dysfunction of the knee as well as the foot. In functional assessment of the foot, the ankle, knee, hip and lower back should be included.

Metatarsophalangeal technique

(1) The thumb of one hand is placed plantarly under the head of the metatarsus and the other hand encircles the tarsals (Figure 11.39).

(2) The digit is put into plantar flexion and the slack is taken up.

(3) An exaggerated flexion is made of the digit and at the same time the fulcrum thumb suddenly exerts a counter-pressure.

Figure 11.39 Metatarsophalangeal release

Spring action technique

This technique is used after specific foot corrections to facilitate tissue restitution and is described for the left foot:

(1) The operator places the thenar eminence of the right hand on the lateral aspect of the cuboid with the fingers wrapping around the heel (Figure 11.40).

(2) The left hand fingers are placed on the dorsum of the anterior transverse arch, and the thumb on the plantar surface, with the web between the thumb and index finger against the inner aspect of the navicular and internal cuneiform bones.

(3) A medial motion is made with the right hand against the cuboid and base of the 5th metatarsal, while a lateral movement is made with the left hand.

(4) This is repeated a few times with a squeezing action which forces a recoil action to aid the inner functional arch during walking.

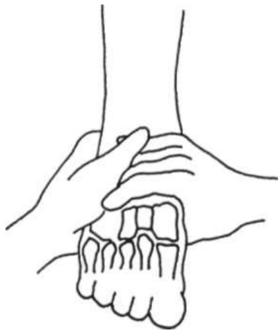


Figure 11.40 Spring action technique

Self-help for patients with foot exercises

Foot lesions are not uncommon because the small muscles of the foot are not adequately exercised frequently enough in our current daily activities. Without adequate exercise of the small muscles of the foot, ideal myofascial tone is lost.

The foot was designed for motion and many people either sit or stand too much without giving the small muscles of the foot varied exercise, so that frequently the arches are weak and foot disorders occur. A simple exercise of dynamic isometric contraction and relaxation of the plantar muscles many times a day brings about improvement by strengthening the supporting soft tissue elements in the foot. At first there may be muscular cramps, which is a result of the poor muscle tone, weakness and deficiency in circulation, but with continued exercising there is an improvement in muscle tone and function, with a decrease in pain and muscle cramps and an increase in foot comfort.

12

FASCIA

ANATOMICAL CONSIDERATIONS

The fascia is an extensive network of supportive tissue sheets. This organ system may be thought of as the flexible soft tissue support of the body in contrast to the rigid supporting skeletal system. The fascia is a sheet or band of connective tissue, with sensory nerve endings and a rich blood supply. It invests and connects muscles and viscera throughout the body and varies in nature from dense and tough fibrous tissue to loose, fatty areolar tissue.

Functionally, the fascia supports organ parts, metabolizes and defends against adversity as part of the reticuloendothelial and immune systems. The fascia envelops the entire body from the top of the head to the plantar surface of the feet and pervades extensively throughout the body, separating and supporting other organs and tissues.

White, fibrous collagen cells are the most characteristic cell type, in addition to fibroblasts, mesenchymal cells, lymphatic monocytes, pigment and fat cells. The fascia is formed by the condensation of the general connective tissue of modified interstitial fibroblasts (cells that create fascia) with fluid-containing capillary cavities. It pervades the entire muscular system, forming the origin to muscle fibers, in places almost forming extensions of the tendons or gristly aponeuroses over the muscles, and extending into muscle bundles as septal partitions, attached most usually to bone and cartilage. The fascia is continuous and extends into the extremities.

Extremity fascia is made up of the same cells as tendons and ligaments and is somewhat inelastic, which is in contrast to the fascia of the torso which is more flexible. The sheets of the fascia are like sleeves of connective tissue dividing various tissues into compartments.

The fascia is descriptively named by its anatomical location, and is a structure that is reactive with muscles, so it may become tense or lax just as muscles do. When fascial tension increases above the norm, pressure is exerted on the continuous specialized bands (ligaments), resulting in stress which may cause liminal or overt discomfort or pain. Frequently, contracted fascia is seen clinically and in the contracted state it is usually relatively irritable or hyperesthetic. Hyperesthesia, easily noted by palpatory examination, is particularly apparent at attachments to bones and aponeurotic junctions. This is where fascial nodules may be palpated and treated for fascial release.

The fascia fills spaces, forms meshes to support circulatory vessels, nerves and viscera, compartmentalizes muscles, binds bones together, and by action promotes and supports the flow of lymph. The fascia is an important part of the circulatory system. When the fascia contracts (hypertonicity) or is lax (hypotonicity), there is interfering with the normal circulation and tissue mobility, which adversely affects tissue vitality by interference with nutritional support and elimination of waste metabolites.

Manipulation of both general fascia and the specialized forms, i.e. aponeuroses and ligamentous tissues, is based on circulatory and mechanical principles. Fascial manipulation, at the very least, effects alteration of musculoskeletal mechanics. Restriction of joint motion may be due to fascial tension and thickening and, in time, degenerative fibrosis and calcification may occur. In the early stages of fascial contracture, stress points may be noted as nodules or 'trigger' points.

Fascial tension is altered in structural dysfunction. The fascia can be stretched when relatively lax or contracted. Fascia stretching, directly or indirectly, by twisting or wringing during manipulative treatment, helps bring about fascial tissue (and muscle) relaxation and restitution.

By increasing the fascial tension on a joint, joint motion may be tested.

Repeated testing, with the stretching of the fascia on the joint area, may cause a release of joint restriction and the re-establishment of normal joint motion.

The fascia has the property of motion, this being expressed as tension, fasciculations (seen as a small section of a muscle twitching) and spasm.

Manipulation of fascia may be by:

(1) Stretching: e.g. cervical traction;

(2) Twisting; e.g. lumbar myofascial stretch as in the pre-thrust twisting position of the 'lumbar roll'; and

(3) Pressure on fascial areas or nodules with fascia release: e.g. 'hang the radius' or 'thenar release'.

Diagnostic and treatment maneuvers in fascial manipulation basically stretch muscular and other soft tissues as well as the fascia. Soft tissue manipulation involves fascial treatment. In the early section of the book, I mentioned superficial lymphatic drainage wherein the skin is stroked. This technique is a superficial fascial technique with modified stretching and circulatory stimulation. The superficial fascia or hypodermis is a layer of cutaneous loose areolar tisssue. This fascia extends into a deeper fibrous network by septae, thus forming the deep fascia that extends to ensheath the muscles and visceral tissues.

Cervical fascia

Descriptively cervical fascia is divided into:

(1) Tela subcutanea fascia: this is the most superficial (Figure 12.1), and attaches from the head and neck, becoming thicker as it spreads down dorsally to attach to the underlying muscle fascia.

(2) External fascia: this lies beneath the subcutaneous tissue and ensheaths most of the platysma muscles, and extending to attach to the mandible above and the manubrium sterni below. Posteriorly it ensheaths the trapezius and infraspinatus muscles.

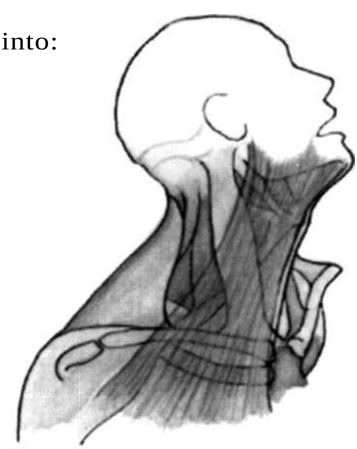


Figure 12.1 Superficial cervical fascia with platysma

(3) Middle and prevertebral fascia: the external cervical fascia spreads deeply to attach to the hyoid and thyroid cartilages, ensheathing all the neck muscles, then spreads further downwards to attach to the manubrium, and even deeper to become the middle and prevertebral fasciae.

For simplicity, the anterior cervical or middle fascia is attached to the base of the skull, the mandible, hyoid, scapula, clavicle and manubrium sterni.

The prevertebral fascia covers the vertebrae and runs laterally over the longus colli and scalenae muscles and dorsally to cover the levator scapulae. The space between the middle and prevertebral fascia is called the visceral compartment, and contains the larynx, trachea, esophagus, thyroid, brachial plexus and subclavian artery.

The cervical fasciae extend into the thorax in a similar way (Figure 12.2), having somatic and visceral components and extending downwards into the lumbar and visceral areas.

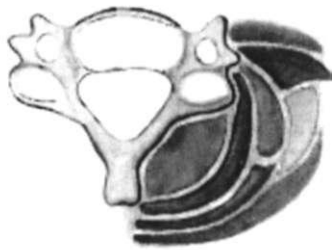


Figure 12.2 External deep cervical fascia, transverse section

Lumbar fascia

The lumbar fascia is the dorsal or posterior aponeurotic attachment of the transversus abdominis. The posterior part splits to form a sheath for the deep vertebral muscles, and the superficial layer (posterior lamella) is tough and thick and extends to attach to the lumbar spines and even downwards to the spines of the sacrum and coccyx transverse tubercles, crest of the ilium and adjacent ligaments. The fascia of the latissimus dorsi and serratus posterior inferior reinforce it. The deeper ventral layer lies between the intrinsic dorsal musculature and the quadratus lumborum muscle and extends from the 12th rib to the iliolumbar ligament, strengthened by the lumbocostal ligament extending between the transverse processes of the 1st and 2nd lumbar vertebrae and the 12th rib, and by fibrous processes that extend into it from the lumbar transverse processes. To facilitate a visual perspective of the lumbar fascia a transverse lumbar section is shown in Figure 12.3.

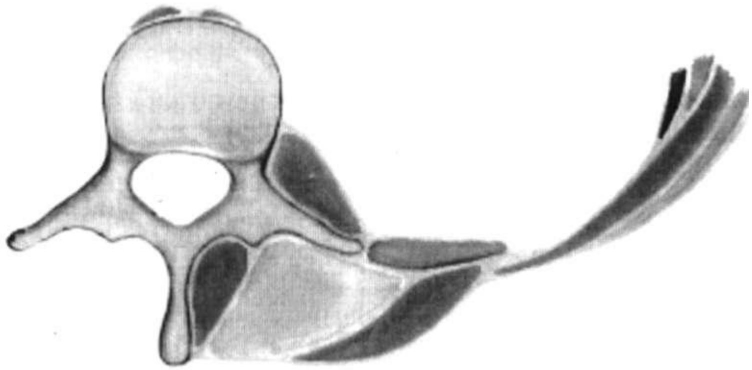


Figure 12.3 Lumbodorsal fascia, transverse section

REGIONAL FASCIA MANIPULATION

Cervical fascia

The posterior and lateral cervical fascia may be treated by simply stretching the neck. Usually the patient is supine with the operator performing intermittent traction and at the same time gaining information about the tissues by checking for motion of the spine and tissues. Rotation of the neck may be added, which introduces the fascial twisting technique.

Anterior cervical fascia release

(1) The patient is seated in front of the operator with a flexed body and hanging head (Figure 12.4).

(2) The operator's thumbs are directed downwards and behind the clavicles and just lateral to the insertion of the sternocleidomastoideus.

(3) The patient's arms are lateral to the operator's forearms, with the hands resting on the operator's arms, and then the patient slowly drops his weight forwards. This causes

Figure 12.4 Anterior cervical fascia release

the thumbs to move into the mediastinum just anterior to either side of the trachea, so gently holding the pretracheal fascia.

(4) The patient slowly assumes an erect posture to accomplish this action.

The platysmal superficial fascia may be released by cervical traction with the head rotated away from the side affected using one hand, while the other hand is placed on the pectoral area, exerting traction away (see Figures 12.1, 7.32 and 7.33).

Posterior cervical fascia release
For the suboccipital cervical restrictive myofascial contractures, the finger tips are used to support the suboccipital area while slow intermittent traction is used until a release of tissue tension and congestion is noted (see Figure 7.30). A steady traction of about 1 minute may be needed for release.

Thoracic fascia

Thoracic outlet/inlet release
The patient sits in a neutral position with the operator standing behind with his hands palming over the supraclavicular fossae (Figure 12.5):

(1) The thumbs are placed at the costotransverse joints bilaterally.

(2) The index fingers engage the 1st ribs behind the clavicle, with the other fingers lying on the clavicle.

(3) With pressure, the thumbs are moved apart to load tension, while monitoring tension on the 1st rib anteriorly with the index fingers.

(4) The fingers on the clavicles push down or pull up the clavicles, loading tension.

(5) The patient then moves the neck in flexion, extension, side-bending and rotation.

Figure 12.5 Thoracic outlet/inlet technique

(6) The operator maintains the position until release and relaxation are noted, then the process is discontinued.

Intrathoracically the fasciae envelop the viscera, i.e. the heart, lungs, bronchi, esophagus, etc. The diaphragmatic fascia attaches to the pericardial fascia above and the peritoneal fascia lining the abdominal cavity and contents below. Posteriorly the fascia continues as the deep fascia of the dorsum.

Anterior chest release

(1) The operator stands facing the supine patient and places his hands on the patient's chest with the heels of the hands at the costosternal joints (Figure 12.6).

(2) The operator's fingers are placed on the ribs and induce a lateral force, so placing the tissues in tension until a release is felt.

Figure 12.6 Anterior chest release

(3) Then the operator slowly returns patient to the original position and rechecks for rib motion.

Upper chest release

When there is asymmetry of the ribs with inspiration, there are vertebral lesions. To treat these, the following procedure is used:

(1) The patient sits and the operator stands behind and to the side, reaching under the patient's shoulder and grabbing the opposite shoulder or proximal arm (Figure 12.7).

(2) The operator's other hand is used to palpate for vertebral restriction.

Figure 12.7 Upper chest release

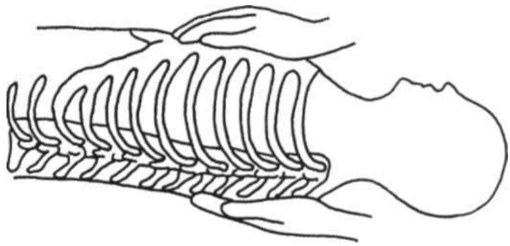


Figure 12.8 Thoracosternal release

(3) The patient is humped forward and controlled by the operator who may then test for motion at various levels with extension, side-bending or flexion.

(4) The tension and release mechanism is applied.

Thoracosternal release

The patient lies supine with the operator at the head of the table:

(1) The operator places one hand under the patient's thoracic spine, with the heel of the hand at the cervicodorsal transition and the fingers saddling the spinous processes (Figures 12.8).

(2) The operator's other hand is placed with the heel at the sternomanubrial joint and the fingers lying on the sternum and sternocostal joints.

(3) While stabilizing the spine with one hand, the other introduces forces (posterior, lateral, medial, superior and inferior) to load the tissues, maintaining the force in one direction after another until fascial release is noted.

Lower anterior rib/chest release

(1) The operator stands alongside and facing the supine patient.

(2) The operator's hands are placed around the lower chest on the ribs, with the thumbs approximating at the xiphoid cartilage (Figure 12.9).

(3) The operator carries the ribs forwards and laterally on inhalation and holds for a few seconds.

Figure 12.9 Lower anterior rib release

(4) Then the operator moves the ribs backwards and medially on exhalation for a few seconds. This is repeated until release is felt.

Rib release technique

(1) The patient is sitting, with their arms at their sides, and the operator is seated behind with his hands on the ribs, the thumbs at the rib angle with the index fingers along the rib shaft, and holding firmly on inhalation or exhalation (Figure 12.10).

(2) The patient raises his hand when no longer able to breathe.

(3) If the rib is caught in inhalation, the patient is instructed to inhale and hold the breath.

(4) When the patient can no longer hold the breath and signals for exhalation, the operator moves the rib anteriorly and circumducts the rib laterally while pulling the rib angle downwards.

(5) When the rib is caught in exhalation, the patient holds the breath out as long as possible, then signals the operator for inhaling.

(6) As the patient inhales, the operator moves the rib backwards and circumducts the rib medially, while pushing the rib angle upwards.

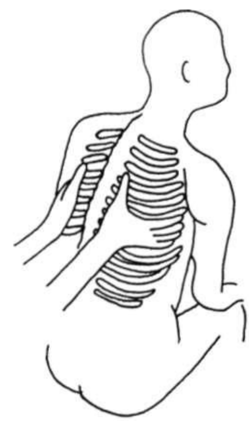


Figure 12.10 Rib release technique

Rhomboid-scapula release

With the patient prone, the operator stands at the side of the table facing the patient's head:

(1) The operator places the thumb of the hand closest to the patient along the far lateral aspect of the spine of the mid-dorsal vertebra (Figure 12.11).

(2) The other hand rests over the near scapula with the thumb along the medial border of the scapula.

Figure 12.11 Rhomboid-scapula release

(3) While the one hand stabilizes the spine and associated muscles, the other introduces forces in all four directions to load the tissues throughout respiration.

(4) The tension is maintained in the direction of tissue release until optimal balance is felt. This is performed in each direction.

Respiratory diaphragmatic lift

(1) The patient is supine with the operator at the head of the table.

(2) The operator reaches over the patient and introduces his fingertips under the costochondral arch bilaterally (Figure 12.12).

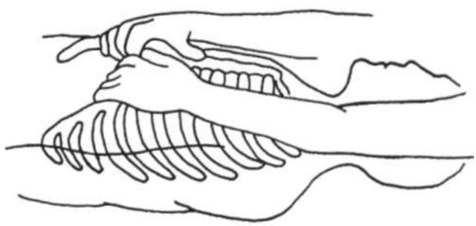


Figure 12.12 Respiratory diaphragm lift

(3) As the patient exhales, the operator lifts the lower rim of the thorax in a craniolateral direction, and this is maintained as the patient inhales, which is not held.

(4) The operator advances his fingers with subsequent exhalation until there is no further advancement.

The lower anterior chest release may be modified slightly using the thumbs to exert upwards and outwards force, while the lateral fingers lift upwards and outwards in conjunction with the respiratory cycle, as in the previous technique.

Abdominal fascia

Superficial abdominal fascia covers the outer wall with two layers:

(1) Superficial adipose layer, the fascia of Camper; and

(2) Deep membranous layer devoid of fat, Scarpa's fascia.

Underlying the membranous layer is the aponeurosis, the fibrous reinforcement fascia of the external oblique abdominal muscle and below that and laterally the fascia lata (deep fascia) of the thigh. Medially it extends down into the membranous layer to the spermatic cord and is stopped in the midline by the fibroelastic suspensory ligament of the penis.

Deeper abdominal fascia, similar to that which is wrapped around the limbs, is made of the same tissue as the tendons and ligaments and has little elasticity. All torso muscles are enveloped by a greater or lesser amount of aroelar tissue complementing the fascial sheathing.

External arcuate ligament release

(1) The patient is sitting, with the operator sitting and facing the patient (Figure 12.13).

(2) The operator starts advancing his thumbs under the 12th rib just lateral to the erector spinae muscle mass.

(3) The patient bends his thorax over the operator's thumb which gently and gradually advances upwards and posteriorly as the patient exhales and holds this position as the patient exhales. When the thumbs are at a point against or under the arcuate ligament, they are drawn laterally slowly with some pressure to relax the arcuate ligament, often also affecting the internal and cruciate ligaments.

Figure 12.13 External arcuate ligament release

Lumbar fascia

Anatomical review

Briefly, the dorsal aponeurotic fascia, the fibrous reinforced section, is attached to the transversus abdominis and splits to form a sheath for the deep vertebral muscles, the fibers running transversely. The superficial layer is tough and thick and passes behind the deep muscles to attach to the lumbar spines. The deep layer passes between the deep muscles and the quadratus lumborum (also see Figure 12.3) to attach to the tips of the lumbar transverse processes, the lower ribs above and the iliac crest below (Figure 12.14).

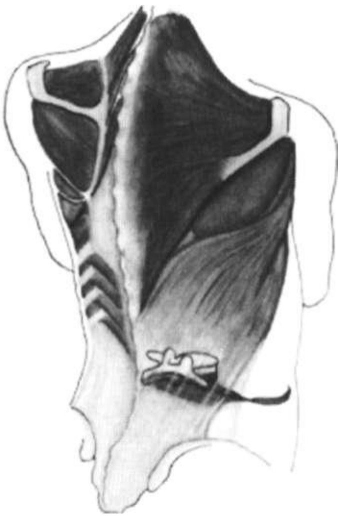


Figure 12.14 Lumbodorsal fascia

Lumbodorsal fascia release

The following is a description of the torso twisting-stretching technique:

(1) The patient is in the lateral lumbar position (Figure 12.15).

Figure 12.15 Torso twisting-stretching lumbodorsal fascia technique

(2) The thorax is rotated away from the operator and the pelvic girdle brought towards the operator until resistance is felt.

(3) Stretch is applied and the maneuver accentuated. The procedure is repeated three times.

The stretching may be done with or without the twisting of the torso. The operator should palpate and feel the tension in the lumbodorsal fascia. This maneuver sometimes effects a musculoskeletal as well as a fascial release.

Prone iliolumbar fascia stretch and twisting

Method 1

(1) The patient is prone on the table.

(2) The operator stands at the waist of the patient and the cephalad hand is applied on the far iliolumbar fascia and underlying muscle mass.

(3) The operator's caudad hand reaches across the patient and grasps the gluteal mass and anchors his fingers around the ilium at the anterior iliac spine.

(4) Intermittent counter-pressure action is applied by pulling the ilium up while the hand on the iliolumbar fascia pushes away (see Figure 10.21)

Method 2

(1) The patient is prone on the table.

(2) The operator reaches across the patient and elevates the far thigh by grasping the distal thigh above the knee and extends and adducts the extremity, putting a stretch on the iliolumbar fascia (Figure 12.16).

(3) The operator stabilizes the position of the patient with his other hand which is placed over the lower dorsal sacrospinalis, this acting as a fulcrum for locking.

(4) The operator's cephalic hand/thumb or fingers are used as a fixing fulcrum force on the iliolumbar fascia in the twisting and stretching action with counter-forces (see Figure 10.21)

Figure 12.16 Iliolumbar stretch, method 2

The operator may palpate and feel the tension in the lumbar fascia. Sometimes, with this maneuver, a myoskeletal release is noted. If desirable, the operator may add a velocity thrust.

Method 3 With the patient prone, the operator flexes the legs to the point of tension/ resistance (Figure 12.17), then forces the flexion gradually according to the patient's tolerance and holds until fascial release is felt. This stretches the iliolumbar fascia anterior to the lumbar spine.

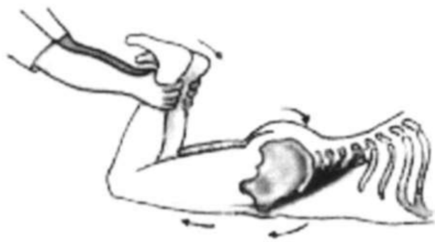


Figure 12.17 Iliolumbar stretch and release, method 3

Lumbosacral fascial release

(1) The operator stands beside the patient who is lying prone.

(2) The operator places the heel of one hand over the sacral base with fingers approximating the coccyx (Figure 12.18).

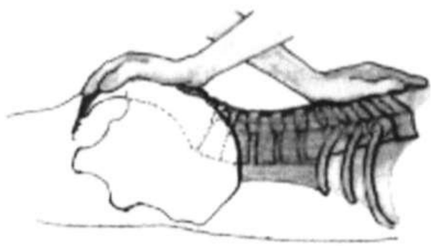


Figure 12.18 Lumbosacral fascial release

(3) The operator places the other hand at the thoracolumbar junction, with the fingers running up the spine over the spinous processes.

(4) The operator exerts traction on the lumbar fascia by moving his hands in opposite directions, and maintains pressure to the point of release.

Pelvic fascia

Anatomical review

The pelvic fascia pervades all the pelvic contents such as the uterus, ovaries, urinary bladder, rectal bowel, prostate, muscles, etc. Organs such as the rectum and bladder are covered with loose areolar mesodermal fascia with the characteristics of expansion and contraction. Organs such as the prostrate which do not expand are surrounded by dense fasciae.

Subdivisions of the pelvic fascia are:

(1) Parietal, covering the obturator internus and pyriformis;

(2) Diaphragmatic, covering the upper surface of the pelvic diaphragm or floor formed by the levator ani and coccygeus; and

(3) Visceral, covering the bladder, rectum and genital organs.

The basic fasciae are reinforced by ligaments that suspend and support the viscera in the pelvic frame.

Pelvic diaphragm technique

This effects correction of pelvic drag.

(1) The patient lies either supine or on the left side with the thighs slightly flexed to relax the pelvic floor (Figure 12.19).

(2) The operator's finger tips are to the right of the tuberichium and he advances them upwards between the obturator membrane and the rectum while the patient exhales. Finger pressure is held through the respiratory cycle.

Figure 12.19 Pelvic diaphragm lift technique

(3) After several cycles of deep respiration, release of the resistance will be felt and the tissues will spring upwards in advance of the fingers.

Fascia of the upper extremities

Anatomical review

The upper extremity fascia of the arm is a tough, deep fascia, divided into anterior and posterior compartments, with medial and lateral intramuscular septae that extend down to the medial and lateral epicondyles of the elbow below (Figure 12.20). The forearm deep fascia extends down from the epicondyles (the lateral and medial bony

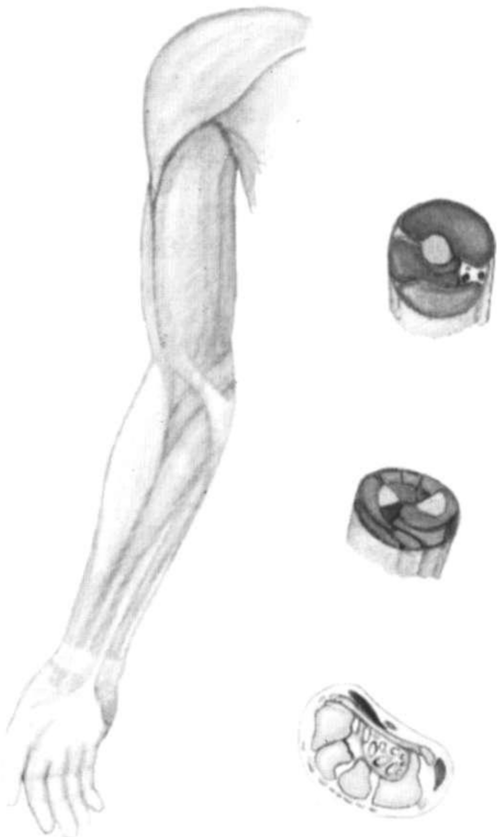


Figure 12.20 Upper extremity fascia with cross-sections

prominences of the distal humerus) and the olecranon posteriorly and antibrachial aponeurosis anteriorly.

The fascia of the forearm is strengthened at the wrist by transverse fibers that collectively form the volar ligament of the carpal bones of the wrist. Below this lies the transverse ligament of the carpus, extending from the pisiform and hamulus medially to the tubercle of the navicular and tubercle of the trapezium laterally, making a canal through which the flexor tendons pass to the fingers. The palm fascia of the hand is described as central, lateral and medial. The deep layer forms a strong ligamentous band near the heads of the metacarpals, the superficial transverse ligament.

Fascia manipulation may be performed by stretching, which may be by direct pressure or by the indirect traction of twisting.

Shoulder fascial technique

(1) The patient is lying supine on the table with the operator at the head of the table.

(2) The operator reaches with both hands to encircle the shoulder, grasping the anterior and posterior axillary folds with the index fingers (Figures 12.21).

(3) With both hands the operator applies traction.

(4) After release is felt, the patient reaches across with the other hand, grabs the arm and pulls it back across his body.

Figure 12.21 Shoulder release

Upper extremity fascial technique

(1) The patient is supine on the treatment table.

(2) The operator grasps the upper extremity with both hands at the proximal arm so as to encircle the arm (Figure 12.22).

Figure 12.22 Upper extremity fascial twisting technique

(3) Progressing from the upper arm the operator literally wrings the extremity by opposing motions of the hands and works his way down to the hand.

(4) The thenar is spread apart from the hypothenar eminence.

(5) Each finger is wrung, starting with the small finger and advancing over to the thumb.

A final touch may be by the operator grasping the thenar mass between the index finger and thumb to assert pressure on the trigger point (Figure 12.23).

Internal twisting or wringing raises the shoulder girdle: external wringing lowers the shoulder girdle. Palpating the sterno-clavicular joint may be used as a monitor. Some fascial techniques may and can be used for testing joint motion. This is readily demonstrated by palpating the sterno-clavicular joint while wringing the ipsilateral arm externally and internally.

Figure 12.23 Thenar trigger point

Lower extremities fascia

Anatomical review

The fascia of the lower extremities is similar to that of the upper extremities and is tough, providing compartmentalization to muscles, nerves and vascular systems (Figure 12.24). When standing erect, the toes are normally directed outwards due to fascial and muscle tension between internal and external rotators.

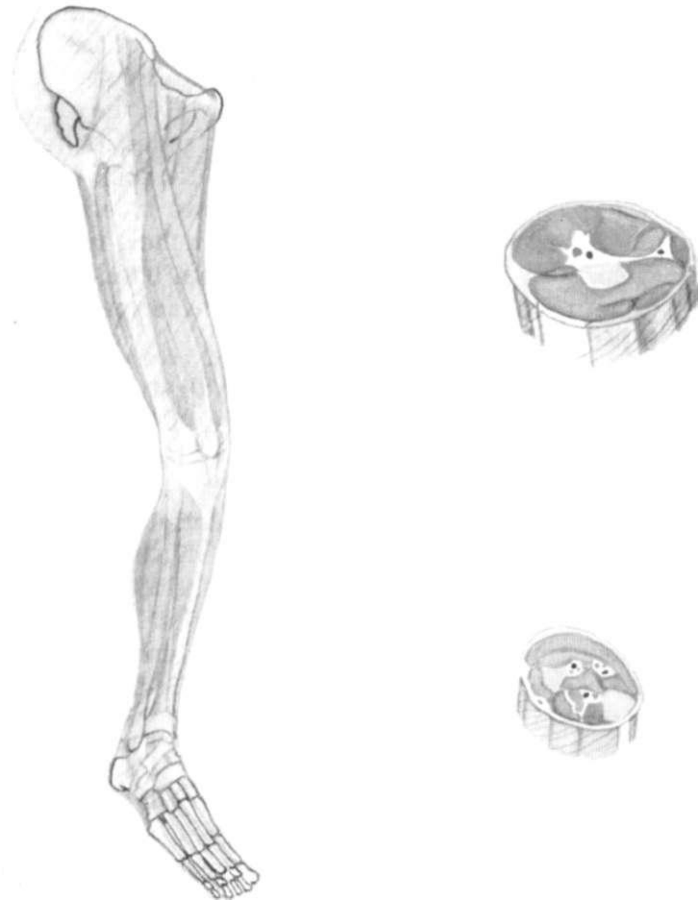


Figure 12.24 Lower extremity fascia with cross-sections

In the proximal anterior thigh, the psoas tendon lies in front of the hip joint with the iliacus. The psoas inserts at the lesser trochanter, beneath which the iliacus attaches.

When these muscles are in spasm along with hypertonicity of the associated fascia, the torso is flexed and internally rotated on the involved thigh and the tendon is painful to pressure. The iliopsoas tendon may be lifted or stretched by holding it forwards at a point just proximal to the insertion as the patient lies supine, a technique used in psoas spasm and lordosis and sometimes for treating sciatica.

The string or deep fascia of the thigh, which forms the fascia lata laterally, is attached above to the anterior superior iliac spine, the inguinal ligament, pubes, pubic arch, ischial tuberosity, and sacrotuberous ligament, and, as the gluteal fascia, to the sacral spines and the outer lip of the iliac crest. Below, it is attached to the condyles and tubercle of the tibia in front and to the tendons of the knee. Laterally, it is extremely strong, formed of two layers with fibers perpendicular to the muscle fibers and between them runs vertically a layer with coarse fibers, forming the iliotibial band which is the conjoint aponeurosis of the tensor fasciae latae and the gluteus maximus.

The deep fascia continues down the leg with strong longitudinal fibers. Fibers at the mid-portion are weak in the attachment to the tibia and below become stonger as it conforms with the strong transverse fibers of the ankle to retain the long tendons of the distal leg. Posteriorly, the deep fascia has several sheets, the investing layer between the soleus and the three bipentate muscles covering the tibialis posterior and popliteus; it is attached to the tibial medial border and posterior border of the medial malleolus and attaches to the fibula laterally via the peroneus. The intramuscular layer above arises from the soleus and below forms the ankle, retaining the five deep tendons at the back of the ankle. The narrowing of the soleus forms the tendon Achillis.

In the foot, the dorsal fascia is thin. The plantar fascia is much stronger and thicker, attaching posteriorly to the front of the calcaneal tubercle and anteriorly splitting into five bands attaching to each of the ligaments of the metatarsophalangeal joints by the medial and lateral fibers of each band attaching to the long and short tendons.

Lower extremity twisting

This may be performed in the same manner as with the upper extremity. With internal wringing, the patient feels the tension in the lumbar fascia, in a similar way to feeling the tension in the dorsal fascia with the wringing of the upper extremity. Wringing or twisting is performed by both internal rotation and external rotation.

A modified technique is easy to perform (Figure 12.25). It is simply externally rotating the lower extremities to exert a wringing tension on the fascial limits, and then doing the same thing using internal rotation.

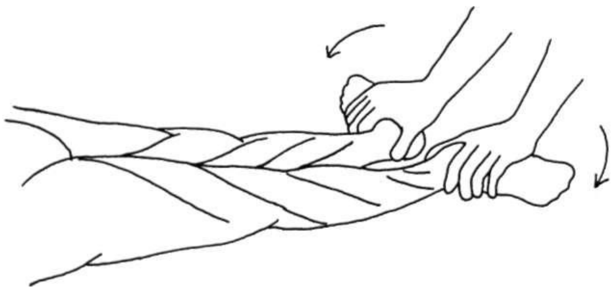


Figure 12.25 Modified lower extremity twisting

In the course of palpating the fascia, 'trigger points' or nodules of congestion and tenderness may be noted. These points may be used for specific fascial release by applying gentle pressure until a tissue change of softening is noted; this takes about 90 seconds. The techniques of Jones utilized these trigger points. The pleasing thing about these techniques is that no great force is needed and the technique involves either stretching the fascia or wrapping the area over or towards the nodular congestion of the fascia. Essentially, the technique is a matter of putting tension on the affected area until 'release' is appreciated.

13

SELF-HELP MANIPULATIVE TREATMENTS

Throughout the book I have occasionally indicated techniques that may be utilized at home, either by oneself or by a friendly person who may assist. In many instances, rather easy and simple soft tissue (muscle and fascia) manipulation facilitates the healing process. Below are a few examples of manipulation for common complaints.

HEADACHES AND NECK PAINS

Palpation of the neck muscles, while supine, will reveal a number of sore and congested areas and point tenderness at the tendinous insertions of the neck muscles on the transverse processes of the vertebrae. Decongestion and relaxation of the soft tissues may be accomplished by manipulating them with the hands (Figure 13.1) and/or by using something to create a pressure on the muscles and spine, such as a bottle (which may be filled with hot water if desired) (Figure 13.2).

Figure 13.1 Neck with hands only

Figure 13.2 Neck manipulation using an aid to create pressure

CERVICODORSAL (UPPER BACK) AND INTERSCAPULAR/ SHOULDER PAINS

Stand 2' (60 cm) away from a wall (Figure 13.3). Reach forward with both hands and place them on the wall, then let your body lean into the wall. Resist the falling of the body into the wall by using both upper extremities to push and relax to intermittently work the shoulder girdle.

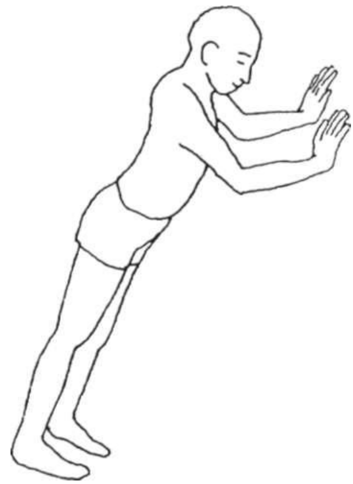


Figure 13.3 Cervicodorsal and interscapular/shoulder pain technique

CHEST-SHOULDER STRETCH

Lie supine with the head at the end of the table or bed (Figure 13.4). Then reach up and over the head and let the upper extremities fall by gravity.

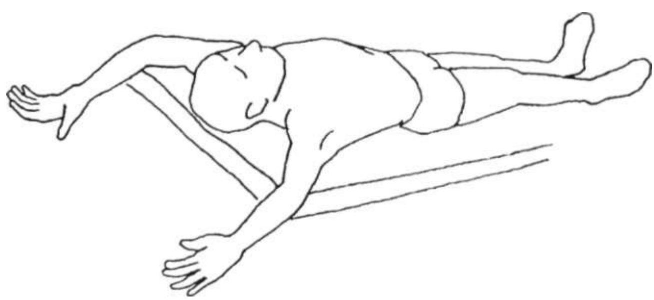


Figure 13.4 Chest-shoulder stretch

LOWER BACK PAINS AND ACHES

Dorsal recumbent leg-thigh flexion

Lie supine and bring the knees up towards the chest, allowing the legs to go into a natural flexion (Figure 13.5). Grasp the legs just below the knees and pull downwards causing a stretching of the lumbar myofascia.

Figure 13.5 Dorsal recumbent leg-thigh flexion

Lateral recumbent twist

Lie on the side and drop the upper leg over the side of the mattress as illustrated in Figure 13.6. Then reach to the thigh and with the fingers exert pressure to rock the leg so that a to-and-fro tension is felt in the lower back. Sometimes a release of restriction is felt.

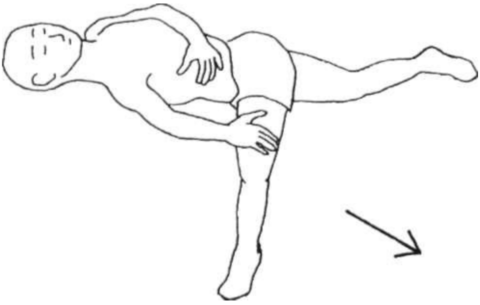


Figure 13.6 Lateral recumbent twist

Dorsal recumbent leg raise

Lie supine and raise and lower the paralleled legs (Figure 13.7). This helps to strengthen both the anterior and posterior abdominal muscles.

Figure 13.7 Dorsal recumbent leg raise

FOOT PAINS

Flex the small plantar muscles while either sitting or standing, or both, until tension is felt in the plantar muscles (Figures 13.8). Any cramping indicates a weakness and may require a progressive increase in the amount of exercising. This may also help alleviate knee problems.

When performing soft tissue stretching/ tension procedures it is important for the person to concentrate on relaxing the muscle tension as much as possible, continuing the procedure for a few minutes at a time and repeating it at least three times. On many occasions partial to complete restitution takes place, either immediately or within a short time afterwards, and the body's healing action provides relief.

Figure 13.8 Flexing the plantar muscles

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