THE CERVICAL AND THORACIC SPINE

MECHANICAL DIAGNOSIS AND THERAPY

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Preface

"It is incumbent on me to observe, that although I believe the matter of this Work to be correct, and regarded as the result of a considerable share of experience, yet I am aware that the reader may detect a too familiar mode of expression, and may censure me for want of attention to its style. The familiarity of the diction arises from my desire to be perspicuous. I prefer plain and simple language to an elaborate and ostentatious phraseology, just as I would a good plain suit to the finest embroidered dress: and am ready to own that my thoughts are more steadfastly directed to the matter which I give, than to the manner in which it is conveyed.

(From "A treatise on dislocations and fractures of the joints", Sir Astley Cooper, Bart., F.R.S., Sergeant Surgeon to the King, 1831.)

Contents

Introduction

We are today facing an "explosion" of the back pain patient population in western society. In the United States between 1972 and 1982, the number of people disabled by low back pain increased at a rate fourteen times that of the growth of the population.[57] The trend is probably worldwide. Similar problems occur with the same or greater frequency in the upper back and neck. Our present treatment methods have not reduced the incidence of back pain in the community nor have they reduced the incidence of recurrence in the individual.

Therapeutic procedures for mechanical disorders of the back have evolved over two to three thousand years. Since Hippocrates first described his treatment,[170] mechanical therapy has played a dominant role in the conservative care of patients suffering spinal pain. In the early stages of treatment for spinal problems most patients today receive some form of conservative care from either a physiotherapist, a chiropractor or an osteopath. These professionals dominate the field of health care providers dispensing mechanical therapies. This treatment is most often a combination of exercises, traction, massage, mobilisation, and spinal manipulation.

In years past little was known about the causes of pains felt in or near the spinal column. Whether the area affected was the upper or the lower back, a multitude of diagnoses and remedies prevailed. Every health related specialty attempted to obtain for itself the responsibility for care of the back by administering the skills of that particular specialty. This situation persists today to a lesser degree. Thus we see some physicians proposing that the answers to most back problems lie in the dispensing of medicines, pills, and embrocations, despite evidence to support the view that most spinal pains are mechanical and not inflammatory in nature. Surgeons attempt to provide solutions by removing, replacing, or modifying various parts of the spinal column. Osteopaths and chiropractors have for almost 100 years applied spinal manipulative therapy (SMT) to the painful back albeit for different reasons. In the past, physiotherapists traditionally applied heat, massage, exercises and electrotherapeutic modalities, and most of these modalities are still in use today. Only since the 1950's have physiotherapists adopted manipulative procedures for spinal therapy.

Osteopaths in the United States were originally regarded as cultists. With time and the accumulation of manipulative experience, the majority of osteopaths moved towards medicine and orthodoxy. The Doctor of Osteopathy in the United States now has equal status alongside medically qualified physicians. Fewer osteopaths, however, now practice manipulation alone. In the United Kingdom, Europe, Australia and New Zealand, non-medically trained osteopaths remain essentially manipulators and unfortunately tend to regard most ills as potentially curable by this form of therapy. Outside the United States comparatively few osteopaths have qualified in medicine. Medical practitioners practising osteopathy have in the main obtained their osteopathic education at the London College of Osteopathy, which requires as a prerequisite some acceptable medical qualification.

As osteopaths in the United States gained medical status and moved away from the practice of manipulative therapy, the resulting void was soon filled by chiropractors. Recently chiropractors have adopted some elements of orthodox medicine. They also employ modalities commonly applied in physiotherapy clinics at the very time when it is dawning on physiotherapists that those tools have little therapeutic value in the treatment of mechanical spinal problems. As chiropractors move towards orthodoxy and potential respectability,[28] it is quite likely that the resulting void in the provision of manipulative therapy could again be filled, but this time by unwary physiotherapists.

As yet, both chiropractors and osteopaths have failed to provid a satisfactory conceptual framework upon which to base treatment methods. Neither have these two groups provided anything in the way of treatments other than manipulative techniques that encourage dependency.

Physiotherapists, on the other hand, as a result of new concepts of mechanical pathology, can deliver a complete spectrum of mechanical forces including spinal manipulative therapy. When applied with appropriate guidelines, these mechanical forces provide outcome predictors, remove clinical guesswork and thereby prevent time wasted by the application of treatment modalities of dubious value.

Most chiropractors remain outside the medical arena and osteopaths have become more medically and less mechanically orientated. Within the medical sphere the physiotherapist remains as the sole provider of mechanical therapy for common mechanical spinal disorders. The very nature of physiotherapy and its practice has made physiotherapists and doctors interdependent one to another. Doctors have neither the time nor the skills to deliver mechanical therapy in its modern form. If patients are to receive appropriate modern mechanical therapy, referring physicians must avail themselves of the services of a modern mechanical therapist.

The competing professions will continue to vie for recognition as providers of the most effective conservative health care for common spinal problems. Ultimately, society will choose the system providing the most cost effective therapies that have the potential to dispense a long-term benefit.

For the physician wishing to obtain for his patient the very best conservative care, the claims and counterclaims from proponents of various mechanical therapies must be bewildering indeed. The diverse and complex therapeutic approaches of today confuse the great majority of us when we are first introduced to the therapeutic scene. As happens so frequently, it is easier to turn away than to become embroiled in the confusion. In this book I attempt to persuade those interested in the mechanical treatment of spinal pain that a more organised and rational approach is desirable and, furthermore, is now available.

The report of the Quebec Task Force (QTF) on Activity Related Spinal Disorders[139] recommends that for the diagnosis of non specific back problems, a system of classification by pain patterns be universally adopted. The authors of the report have concluded that pain pattern classification is likely to provide answers in our search to improve methods of treatment. Those already familiar with my approach to therapy for mechanical disorders of the lower back will be quick to recognise the significance of the QTF report. The importance of a system of treatment that can rapidly alter pain patterns utilising repetitive motion must eventually be recognised.

In 1980 I completed a monograph entitled The Lumbar Spine: Mechanical Diagnosis and Therapy.[100] It provides a description of my concepts of mechanical diagnosis and therapy for problems related to the lower back, formulated and refined over a thirty year period of clinical observation, experimentation and practice. The ideas expressed in the text stirred interest and some controversy.

Nothing has emerged since then that would require me to alter the essential ingredients of my proposals regarding diagnosis and treatment of the lower back using repetitive motion. On the contrary, evidence to support the concepts and methods is growing steadily. There is no need, therefore, to delay the publication of the description of the procedures required to efficiently identify and treat patients with problems related to the cervical and thoracic spine.

Since 1980, laboratory investigations[2, 129, 91, 92, 167,] and clinical studies[4, 168, 38, 39, 41, 89, 118, 122, 126, 142,] have provided support and information that allow clinicians and therapists a better understanding of these new concepts and techniques. Worldwide there are now few conservative care centres where my methods of mechanical diagnosis and therapy, or variations on these, are not practised.

In the cervical and thoracic spine all of the original principles pertaining to the lumbar spine apply. Three subgroups in the non specific spectrum of back pain can be identified: Posture, Dysfunction, and Derangement. The effects of repeated movements are analysed the same as in the lower back. The centralisation phenomenon occurs even more readily and patients are able to apply self- treatment procedures more efficiently because of the ease with which corrective movements can be applied to the neck. The anatomy of vertebral articulations in the cervical and thoracic spine differs considerably from the lumbar spine. In comparison to the lumbar spine the anatomical differences require the use of other movements in different planes when applying treatment to the cervical and thoracic region.

It is now clear that by using an organised dynamic mechanical evaluation, and guided by the centralisation phenomenon, the modern mechanical therapist has bridged the gap that previously existed between treatment based on patient generated forces (voluntary movement) and therapist generated forces (mobilisation or manipulation). The suitability or otherwise of any given motion, as determined by a dynamic evaluation, allows the prediction of outcomes and provides the safety margins that must be in place before the application of any hands-on procedures.

Mechanical therapy in evolutionary terms is in its infancy. We are only now understanding the true nature of the mechanical problems that arise in the spinal column. We must continually test new and fresh concepts that are demonstrably effective. We must bring the new information to bear on our approach to treatment by ridding ourselves of outmoded and unproven therapies. While there is no question that there is an important place for the continued use of SMT, its use or rather misuse is cause for concern.

SMT is probably the most widely used therapy for the treatment of mechanical back pain. But should we apply therapist generated forces without first investigating the potential for recovery using patient generated forces? Should we apply SMT in order to find out retrospectively if the procedure was indicated? Should we dispense SMT to the entire population with back and neck pain in order to deliver the procedure to the very few who need it?

It is one of the main theses of this book that the great majority of patients (70%) can be taught to manage and treat their own back and neck problems using the methods and principles described here and elsewhere.[100] If there is the slightest chance that a patient can be educated in the methods that enable him to reduce his own pain and disability using his own understanding and resources, he should receive that education. Every patient is entitled to the information, and every therapist should be obliged to provide it.

Neck pain, and pain referred from the neck to the upper back, shoulders and arms, is so widespread throughout both eastern and western societies that it could almost be said to be universal. In addition, mechanical disorders affecting cervical segments may cause pain in the head in the form of occipital, frontal and temporal headaches. Few of us escape such symptoms during our lifetime. Fortunately, rather more frequently and more rapidly than occurs in the lumbar region, most of us recover spontaneously.

However, a sufficient number of people suffering from neck and referred pain are so affected either by the persistence or by the severity of the symptoms or, as is the case in the lumbar spine, by the recurrent nature of the problem, that they seek assistance. Therapists and clinicians worldwide respond to this request for assistance, and in doing so are helping to create patient dependence. The patient rightly or wrongly attributes his recovery to the treatment he is receiving at the time the symptoms resolve, and returns for more of the same at the first sign of recurrence. Such is the nature of our treatments that they are seen by the patient as the source of healing. Perhaps this is what is wrong with our present therapies.

Within these pages I have attempted to provide some of the solutions to the problems we all have in treating mechanical disorders of the upper spine.

The conceptual models that I have proposed to explain the rationale of the treatments recommended in this book may eventually alter, but the effectiveness of the procedures will not change: if patients are selected and treated as outlined without dilution or contamination of the principles, the procedures will be as effective fifty years from now as they are today.

We now have the potential to dispense the long-term benefit that has so far eluded those involved in the treatment of these fascinating disorders.

PART A

THE CERVICAL SPINE

CHAPTER ONE

Anatomy

The material presented here is not intended to instruct the reader in anatomical detail. For those requiring more precise and in depth knowledge of anatomy it is better to consult an appropriate anatomical text book.

ARTHROLOGY

The cervical spine is the most complicated articular structure of the body and permits a wide range of motion for the head in relation to the trunk.

Between the occipital bone and the first thoracic vertebra there are eight motion segments. Hadley[67] and Buetti-Bauml[20] identified them as Occ/C1, C1/2 etc, down to and including C6/7 and C7/T1. Because of great differences in anatomy and function a distinction is made between the upper cervical segments Occ/C1 and C1/2, and the lower cervical segments C2/3 to C7/T1.

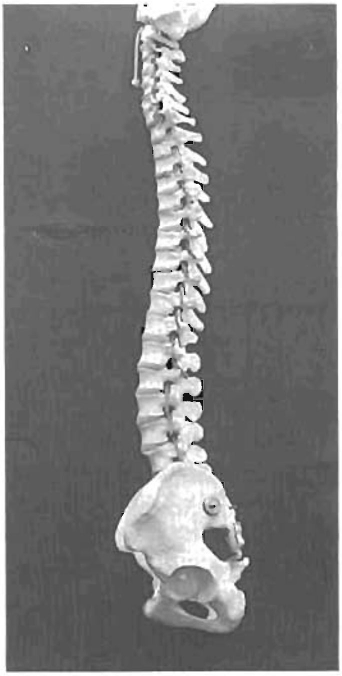


Fig 1:1.
The spine.

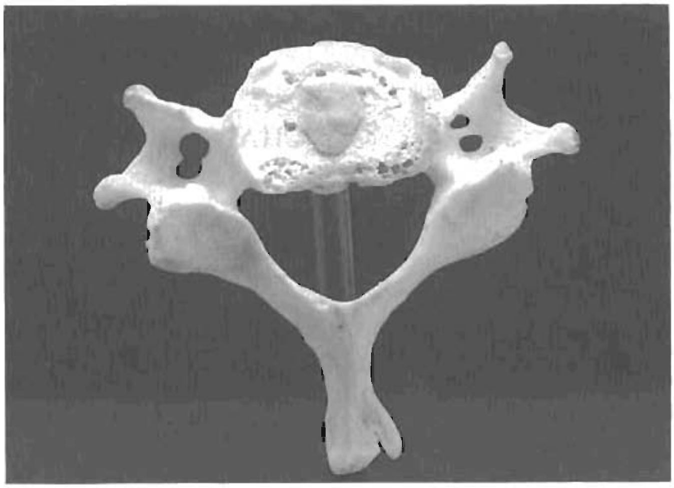


Fig 1:2. *Typical cervical vertebrae.*

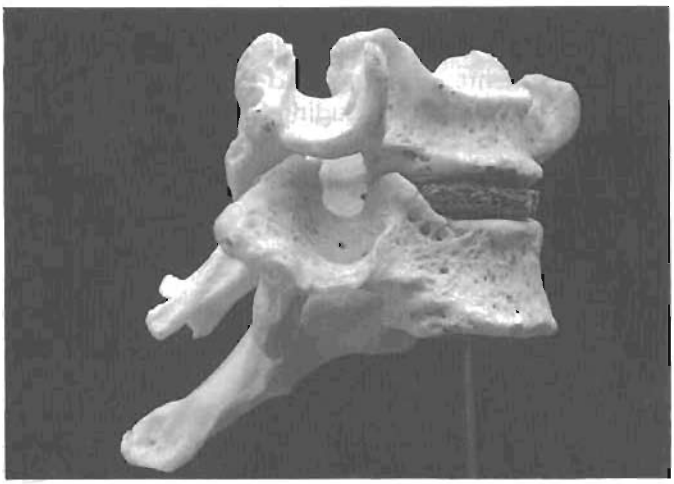


Fig 1:3. *Cervical motion segment.*

The seven cervical vertebrae articulate with the occiput above and the first thoracic vertebrae below. Intervertebral discs bind the segments from C2 to T1. Joints between the occiput and atlas and between the atlas and axis have no intervertebral disc and the articulations are synovial. On either side, the two atlanto-occipital joints lie between the superior articular facet of the lateral mass of the atlas and the condyle of the occipital bone. Capsular and anterior and posterior ligaments provide strong supportive reinforcement. The movements available at the atlanto occipital joint are flexion and extension and, to a lesser degree, lateral flexion. Werne[161] states that rotation in the atlanto-occipital joint is impossible.

The atlanto-axial articulations are three in number. The lateral articulations are plane joints and the central joint is between the odontoid process and the anterior arch of the atlas. The main stabilising ligament is the transverse ligament, a strong band connecting the odontoid process with the arch of the atlas. Rotation, the essential movement at this level is of the order of 35 degrees in each direction and is limited by the alar ligaments.[133]

The cervical vertebrae are smaller than their counterparts in the thoracic and lumbar region and the cervical intervertebral discs are formed proportionately. The annulus fibrosus is a dense fibrous structure surrounding the centrally contained nucleus pulposus. The cartilage end plates above and below form the superior and inferior boundaries of the intervertebral disc. The annulus is less well developed posteriorly than laterally.[120]

The discs are contained more closely in the cervical spine than in other areas by the depth of the concave superior surface of the underlying vertebrae. The upward projections of this concavity on either side are called the uncinate processes which, although absent at birth, develop with degeneration of the annulus and are usually well formed in the early part of the second decade. They are really false joints, commonly referred to as the uncovertebral joints or joints of Von Lushka. Flexion and extension are facilitated and guided by the uncinate processes which permit movements in the sagittal plane. The uncinate processes can be compared to rails. They limit extreme rotations of the cervical spine which would put the intervertebral discs under too great a strain, and prevent a sliding movement in a lateral direction.[133]

Tondury[145-7] and Ecklin[44] made an extensive study of the embryology and anatomy of the uncovertebral joints. Their investigations revealed that in the first two decades of life no joint spaces exist. Thereafter joint-like spaces are regularly found, lined by fibrous or hyaline cartilage and enclosed by a capsule and meniscoid structures. The spaces are believed to be the result of fissuring of the annular fibres, which are secondarily transformed into cartilaginous joint surfaces.

The cervical apophyseal joints are diarthrodial and synovial in nature. (Fig 1:4) They are oriented at a 45 degree plane relative to the longitudinal axis of the spine. The plane is more horizontal in the upper and more vertical in the lower cervical segments.

The capsular ligaments are rather thick fibrous structures firmly attached to the bony prominence above and below. Each joint capsule is loose and permits a wide excursion of movement. Rotation is always combined with lateral flexion. Likewise lateral flexion is impossible without rotation.[133]

All joints of the cervical spine contain meniscoid structures. Penning and Tondury[121] concluded that the meniscoid structures of the cervical spine consist of loose vascular connective tissue comparable to folds of joint capsule. Their function is to compensate for the incongruity of the joint surfaces, changing during movements of the spine.

Zukschwerdt et al[174] and Hadley[68] relate a sudden onset of pain in the neck or low back to a pinching of these structures. Zukschwerdt draws a parallel with the menisci of the knee joint and suggests that normal movement is obstructed and the joint remains locked in the end range position.

Keller[83, 84] and Penning[120] reject the theory that these structures could be responsible for sudden impairment of normal movement in the cervical segments. Bogduk[9] considers meniscoid structures in the lumbar spine are unlikely to contribute to LBP.

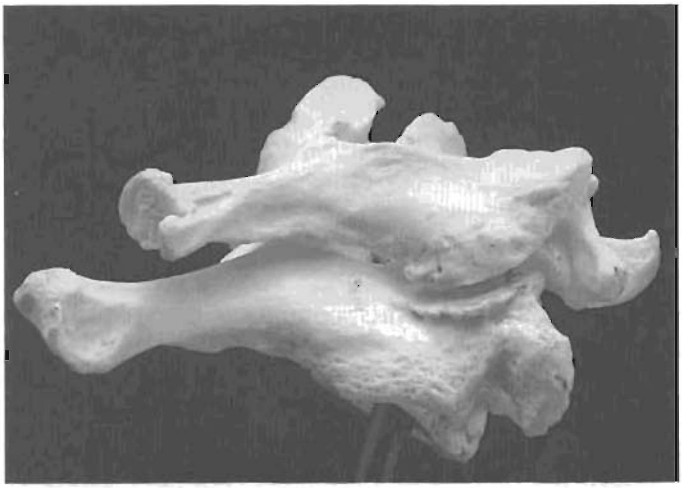


Fig 1:4. *Cervical apophyseal joint.*

A cervical lordosis is normally present which flattens on flexion and accentuates on extension.

The upper cervical segments tend to allow more rotation and the lower segments less rotation but more lateral flexion. This is determined by the orientation of the apophyseal joints and capsular ligaments. The greatest movement of the lower cervical spine occurs in the C4-C7 segments.

Motion studies of the cervical spine demonstrate that with retraction of the head (axial extension), the upper cervical segments flex while the lower cervical segments extend. (Fig 1:5) A greater range of upper cervical flexion is obtained by performing the movement of head retraction than by simply flexing the head and neck.[120]

At radiography a steplike arrangement of the posterior parts of the vertebrae can be observed. Flexion from the neutral position is combined with anterior translation of some 2-3 mm of the superior on the inferior vertebra. Extension causes a displacement of some 1-2 mm.[120]

In the lumbar spine the nucleus pulposus acts as a ball bearing. The vertebral bodies undergo slight anterior translation in flexion and then roll over. The opposite occurs in extension. The apophyseal joints guide and steady, bearing some of the weight and preventing excessive motion. With development of degenerative changes, uneven and irregular motion can develop especially immediately following disc prolapse when excessive anterior and posterior shear occur. Motion studies of the cervical spine demonstrate a similar mechanical behaviour. On flexion the vertebral canal lengthens, and the spinal cord elongates and thins. At the same time the root filaments are stretched.

On extension the vertebral canal shortens, the spinal cord becomes shorter and thicker, and the root filaments slacken.[133]

Fig 1:5.
In retraction of the head, the upper cervical segments flex and the lower segments extend.

Moffat,[114] studied cineradiographic recordings of motions of the cervical spine. "On each x-ray, the position of every vertebra was traced. By comparing successive x-rays, the change in position of each vertebra from one head position to the next was plotted. It became immediately obvious that even a slight change in the position of the head changed the positions of all the vertebrae relative to one another. The final analysis of this data studied the sequential order in which the vertebrae moved relative to one another. Of particular interest was whether the upper vertebrae moved before or after the lower vertebrae or if they all moved simultaneously. The motions of all the vertebrae appear to begin simultaneously."[114] It is therefore not possible to apply active exercise specifically to one area of the cervical spine without also causing motion to occur at other more remote segments.

Bhalla et al,[7] found that there are only two levels, C6-7 and C7-T1, which demonstrate greater movement during extension than during flexion from the neutral position. At all other levels from C2 to C6 the movement is greater during flexion. At C7-T1 the movement in flexion was negligible while there was a fair range of motion during extension. Bhalla observed that the maximum range of total movement occurred at the C4-5 level. Analysis of motion at individual levels shows that at the C5-6 level the average range of flexion is 15 degrees and extension only 3 degrees. Bhalla's findings may explain why cervical intervertebral disc pathology is most frequent at the lower levels which do not have the available range of flexion to cope with the forward head posture so often required for sedentary modern man.[7]

LIGAMENTS

It is the function of the ligaments of the cervical spine to limit movements of the head and neck and to maintain a postural equilibrium between the vertebrae.

The anterior longitudinal ligament compared with that in the lumbar spine is relatively thin and rather weak. The posterior longitudinal ligament, dense, thick and wide gives some protection to the spinal cord from a posterior disc protrusion but offers no such protection to the nerve roots laterally. The elasticity of the superficial layer prevents too much folding of the posterior wall of the spinal canal in extension. According to Breig,[17] the bulges of the flaval ligaments protruding into the spinal canal in extension are very small — too small to account for the protuberances into the spinal canal as seen on myelograms.

The anterior part of the annulus fibrosus and the anterior longitudinal ligament control extension of the motion segments; the posterior part of the annulus fibrosus, the posterior longitudinal ligament and the flaval ligaments control flexion. In combination they account for the postural equilibrium of the cervical spine.[133]

NERVE ROOTS AND SLEEVES

The dura mater which surrounds the spinal cord, sheathes the emergent nerve roots to the point of exit from the spinal canal. The nerve roots pass directly laterally to emerge from the intervertebral foramen at the same level of origin from the cord.[133]

MUSCLES

The following muscles are responsible for the motions described below:[133]

Extension Rotation and Lateral Flexion

Splenius capitis Sternocleidomastoid
Splenius cervicis Scalene group
Semispinalis capitis Splenius capitis
Semispinalis cervicis Splenius cervicis
Longissimus capitis Longissimus capitis
Longissimus cervicis Levator scapulae
Trapezius Longus colli
Interspinalis Iliocostalis cervicis
Rectus capitis post major Multifidi
Obliquus capitis superior Intertransversarii

Sternocleidomastoid post Obliquus capitis inferior
Obliquus capitis superior
Rectus capitis lateralis

Flexion

Sternocleidomastoid (ant)
Longus colli
Longus capitis
Rectus capitis anterior

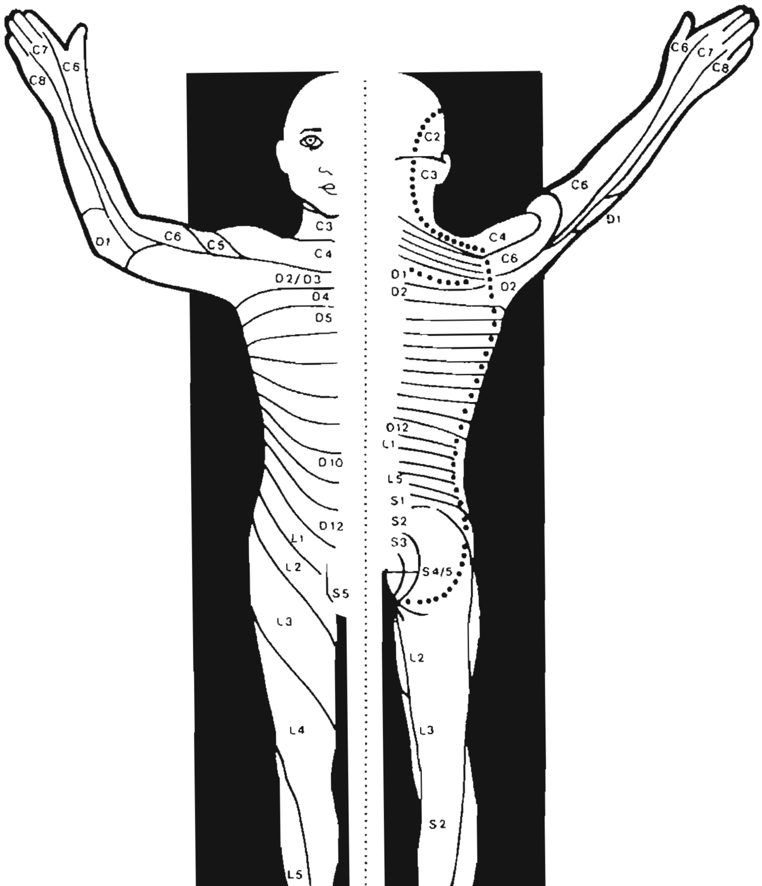


Fig 1:6.
The sensory distribution of the spinal nerves.

SPINAL CORD, NERVES AND VESSELS

The bony elements of the cervical spine contain and protect the spinal cord and the two vertebral arteries which lie on either side of the cord. Together these arteries provide the cord and the brainstem with their arterial supply. The ascending arteries come together after entering the foramen magnum where they join to form the basilar artery.[133]

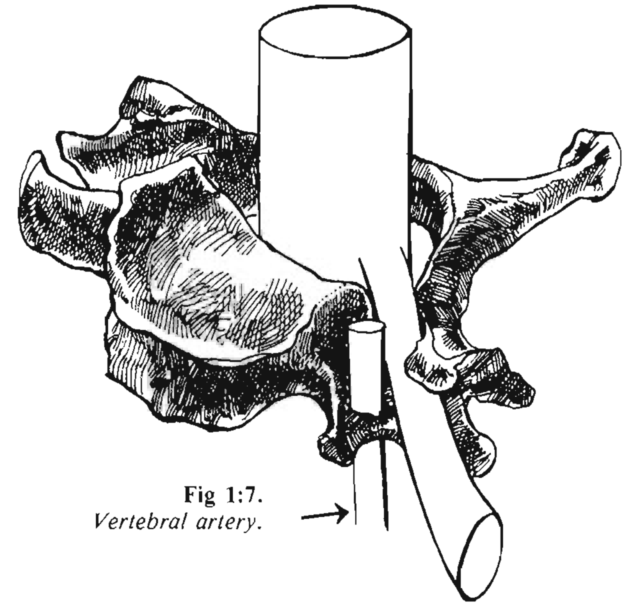


Fig 1:7.
Vertebral artery.

CHAPTER TWO

Biomechanics and Pathophysiology

The movements of the cervical spine in the sagittal plane are called flexion and extension; those in the coronal plane, lateral flexion to the right and to the left; and those in the horizontal plane, rotation to the right and to the left. By the term rotation, for example of the motion segment C1/2 to the right, it is meant that the atlas is rotated to the right with respect to the axis, or the axis to the left with respect to the atlas. Movements in all directions, especially in rotation and lateral flexion, will cause movement to occur in other planes. For example. it is not possible to laterally flex the vertebrae without rotation occuring at the same time. Such movements are called coupled movements.

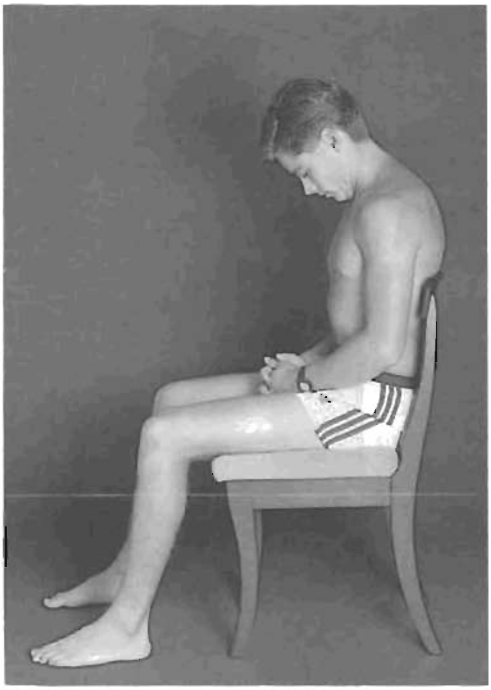


Fig 2:1.
Cervical flexion

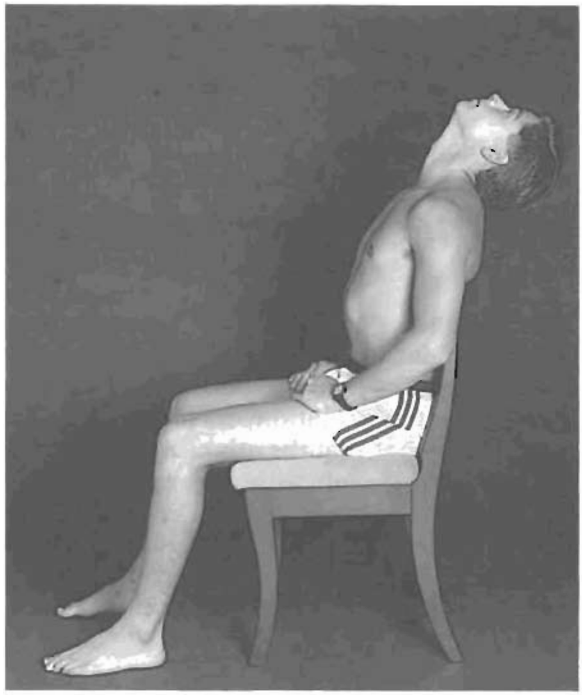


Fig 2:2. *Extension*

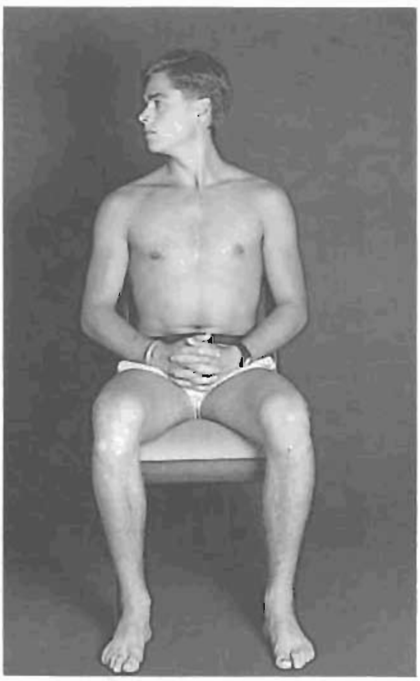


Fig 2:3. *Rotation*

Fig 2:4. *Lateral Flexion*

BIOMECHANICS OF THE INTERVERTEBRAL DISC

The study of biomechanics, a term introduced by Breig,[17] is closely related to functional anatomy. It means the study of changes in the anatomical structures occurring during movement of the body. Of most relevance to the concept presented here are the biomechanics of the intervertebral disc, and the effects of morphologic ageing and trauma on these biomechanics.

In a previous publication, I have discussed the theory that trunk movements influence the location and/or displacement of the lumbar nucleus pulposus within the intervertebral disc.[100] Supporting scientific evidence available at that time was also presented. Since then, additional scientific information has been published which confirms that posterior migration of the nucleus occurs with spinal flexion and anterior migration with spinal extension.[91, 92, 129, 141, 158]

Kramer,[92] describes experiments carried out in vitro on both lumbar and cervical discs by Vogel,[158] and Stahl,[141]. "In radiologic investigations, which were made in our department, Vogel and Stahl studied the intradiskal movements on symmetric and asymmetric loading. A metal pin was placed in the nucleus pulposus (lumbar). The pin was placed so that it could not move by itself but only followed the movements of tissue. It was found that in symmetric and axial loading the nucleus expands and is retained only by the elastic annulus fibrosis. The nucleus returns to its initial central form and location on removal of the pressure."

However, "In asymmetric loading, the central part of the disk containing the nucleus pulposus will migrate toward the area of least load. Thus, in bending forward there will be a posterior migration, in hyperextension an anterior, and in lateral inclination the migration will consequently be opposite to the direction of the movement."

"Within the first three minutes of loading the greatest migration took place and was registered at 0.6 mm per minute. With continued asymmetric compression, the nucleus pulposus was observed to migrate slowly, in a matter of hours, toward the area of least load." *It is important to note that similar experiments on cervical discs yielded the same results.* These findings are in agreement with the results of in vitro experiments by Adams and Hutton who described gradual disc prolapse as a result of off-centre loading in 1986,[2].

"Postures involving unequal loading of the intervertebral disk cause the nucleus pulposus to become situated in an ever increasing eccentric position. This is of utmost importance in the development of discogenic discomfort and suggests its prevention."[92]

Kramer describes that on the removal of asymmetric loading the nucleus pulposus remains in a displaced condition and will only very slowly return to its original central location. The more prolonged and the heavier asymmetrical loading is applied, the more likelihood there is of the nucleus pulposus remaining in the decentralised location. Kramer points out that the time for relocation to a more central position *can be accelerated by compression*

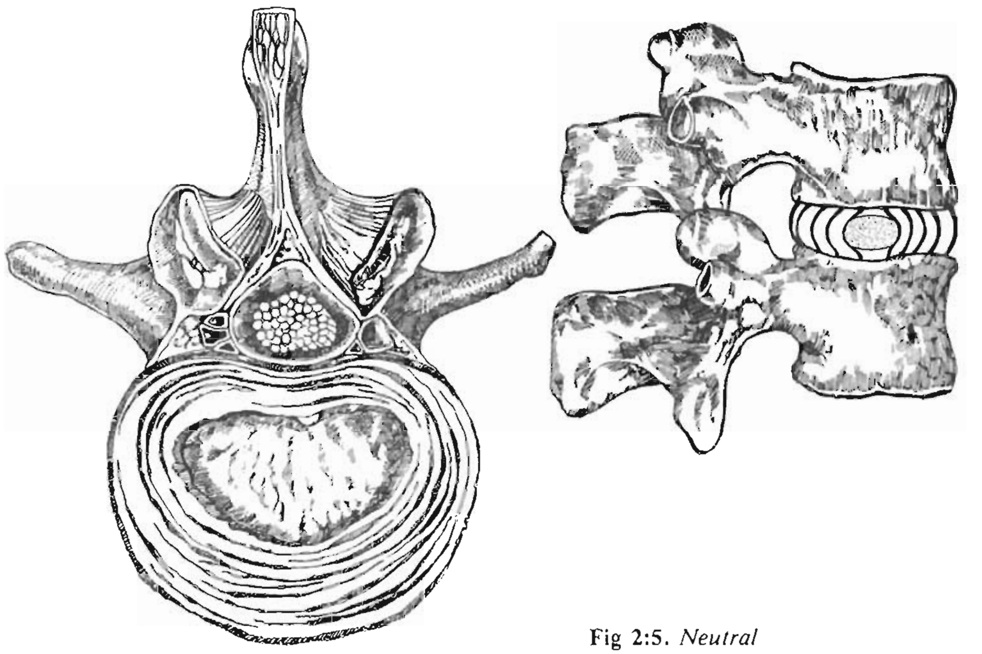


Fig 2:5. *Neutral*

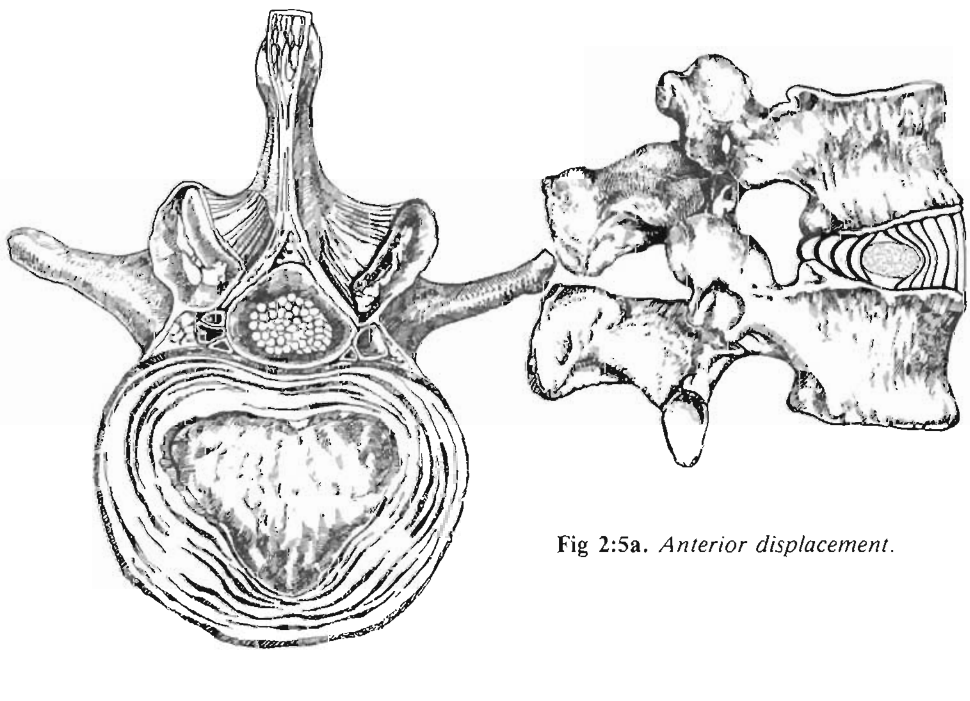
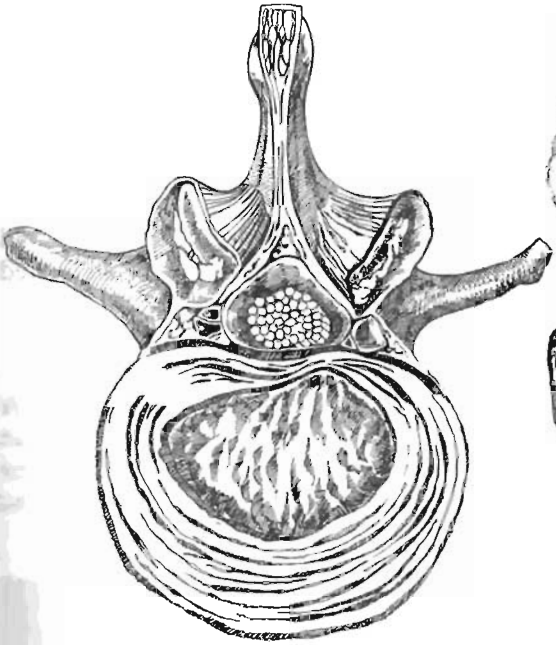


Fig 2:5a. *Anterior displacement.*



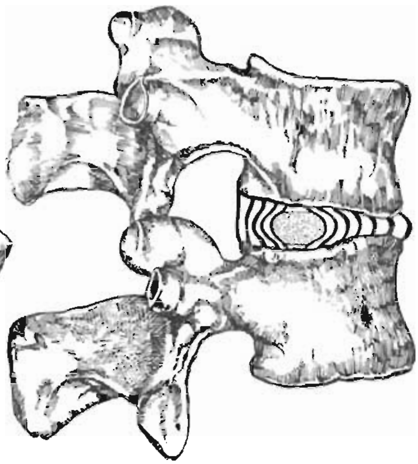


Fig 2:6. *Posterior displacement.*

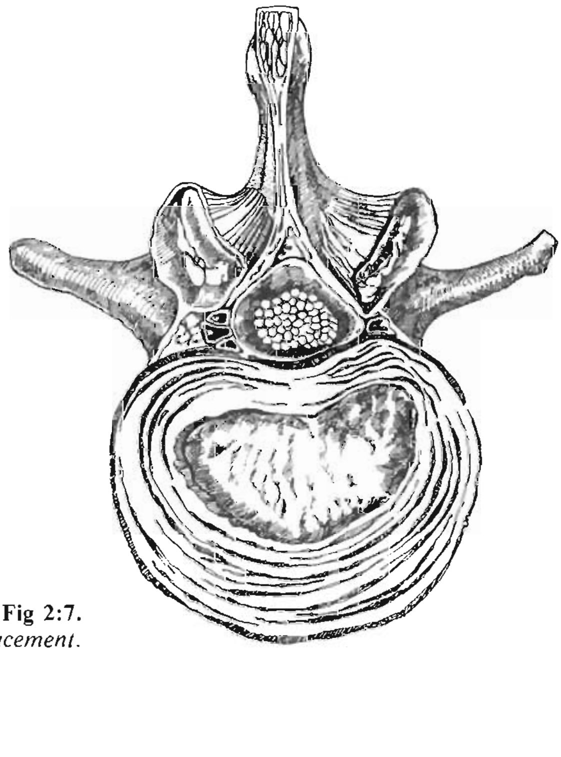


Fig 2:7.
Postero-lateral displacement.

in the opposite direction or by traction. Kramer reports that with increasing age the risk of migration occurring diminishes.

"The normal healthy intervertebral disc allows the nucleus to change its shape and position, always being controlled however by the restraining influence of the elastic annulus. However, the intervertebral disc becomes susceptible to injury once the annulus fibrosus is weakened by loss of elasticity. Fissures and ruptures develop which allow the degenerated nucleus to migrate."

The findings of Vogel,[158] and Stahl,[141] support the hypothesis proposed in 1981,[100] to explain why patients with acute low back pain can be locked in one of three commonly seen postures:

Kyphosis

1. The patient can be locked in a position of *lumbar kyphosis and is unable to extend.* Conceptually the patient in this situation has developed an *obstruction to extension* caused by *excessive posterior flow* or displacement of fluid, nucleus or sequestrum. The *displacement obstructs curve reversal and locks the patient in flexion.*

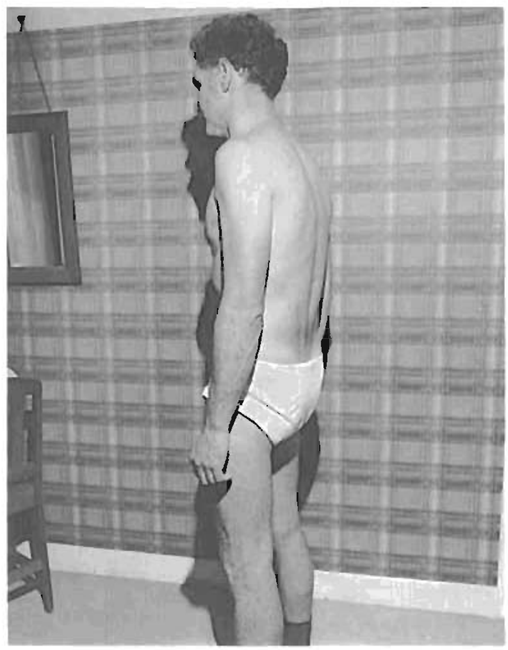


Fig 2:8.
Posterior displacement causing lumbar kyphosis.

Lordosis

2. The patient can be locked in a position of *extension and is unable to flex.* Conceptually, the patient in this situation has developed an *obstruction to flexion* caused by *excessive anterior flow* or displacement of fluid, nucleus or sequestrum. The *displacement obstructs curve reversal and locks the patient in extension.*

Fig 2:9.
Anterior displacement causing fixed lordosis.

Lateral shift

3. The patient can be locked in a position of *list or lateral shift to the right* for example, and cannot straighten or *laterally flex to the left*. Conceptually the patient in this situation has developed an *obstruction to left lateral flexion* caused by *excessive posterolateral flow* or displacement of fluid, nucleus or

sequestrum to the left. The *displacement obstructs curve reversal and locks the patient in right lateral flexion.*

In all three of these situations the excessive flow or displacement of fluid or nucleus towards the convex side holds the segment in that position and prevents curve reversal or movement in the opposite direction. This is akin to the locked knee arising from internal derangement within that joint. Deformities occurring in the lumbar spine as a result of such displacements are easily recognised. Similar deformities and obstruction to movement are also encountered in the cervical spine, acute torticollis being the most common.

In this conceptual model deformity results from *significant* displacement. The greater the displacement, the greater the deformity. It is unlikely that these deformities are caused by muscle spasm. Tilting arising from internal displacement of disc fluid or nucleus, as described by Krag et al, would more readily account for deformity.[91]

The deformities described above are manifestations of significant displacement. Displacement may occur to a maximum point which, if exceeded, will cause rupture of the annulus and perhaps even extrusion of disc material. Such displacements develop from an embroyonic stage when only minor symptoms of spinal pain will be experienced. Being well contained by a relatively healthy annulus, minor displacements are shortlived and rapidly reversible.

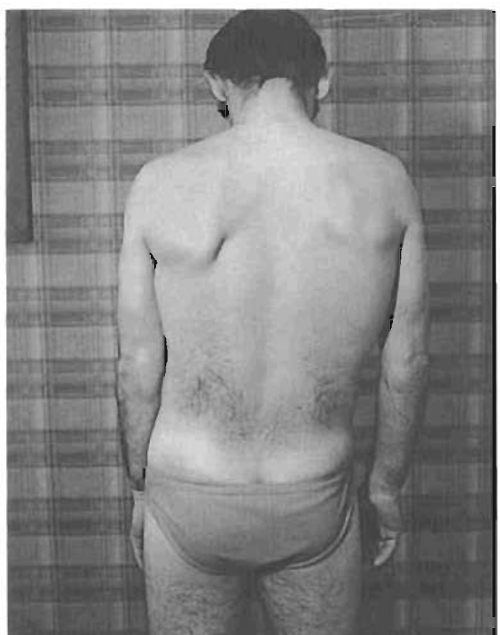


Fig 2:10.
Postero-lateral displacement causing list.

This conceptual model, when applied to the clinical situation, becomes an effective and reliable diagnostic and therapeutic tool. It allows the clinician to predetermine the direction of therapeutic motion with a high degree of reliability in both the lumbar and cervical spine.

BIOMECHANICAL CAUSES OF DISC PROLAPSE

Metabolic and biochemical changes resulting from ageing and trauma eventually lead to degeneration of the human intervertebral disc. Increasing intradiscal pressure in a degenerated intervertebral disc may alter the biomechanical properties which in turn can cause displacement of the disc tissue. This is most likely to occur in young adults. There are thus displacements, as well as protrusions and prolapses.[92] Fissures and ruptures appear in the annulus fibrosus in early adulthood and between the ages of 30 and 35 years their frequency increases. Most pathoanatomical studies have shown that fissures and ruptures increase with advancing age.[27, 93, 50, 150, 156, 157] Despite this, the frequency of protrusions and prolapses diminishes with ageing. The expansive forces of the nucleus pulposus decrease with ageing and consequently there is a diminished tendency to displacement.[92]

Besides the combination of increased pressure and lowered resistance of the annulus fibrosus, other biomechanical factors contribute toward the development of a prolapse. For instance, as a result of change in chemical composition, softening and loosening of the disc structure occurs with formation of fragments. Fragments can become displaced and can migrate independently as so-called sequestra. These fragments migrate in the direction of least resistance and thus penetrate into the tissues and bulge backwards and appear as disc protrusions and prolapses. This is mostly due to the increase in intradiscal pressure and to the influence of compressive and shear forces.

Exterior forces, often seen as the causative factor of spinal pathology and pain, only have a precipitating effect on structures already affected by age-related changes. The age-related changes in themselves are usually painless.

DISTORTION OF THE MOTION SEGMENT

According to Kramer, "The simplest lesion of a motion segment is distortion. There is an overstretching of the ligaments and joint capsules without rupture. This is comparable to distortions of other joints. The range of movement exceeds that of the normal. Distortions develop easily in the cervical spine. Excessive flexion and extension of the spine resulting in distortion are uncommon in the thoracic spine as this area is well stabilized. Low back strain is a frequent diagnosis often covering up the real condition which is a lumbago due to intervertebral disc disease. Simple distortion must be distinguished from the traumatic intradiscal displacement caused by a pre-existing degeneration of the intervertebral disc."[92] Here the need to separate the patient with symptoms caused from prolonged or excessive stretching of soft tissues from those with intradiscal displacement is recognised.

PATHOPHYSIOLOGY

The precise nature of the process of disc degeneration is unclear. Although the causes are probably multiple, two possibilities are often debated. Do the joints deteriorate as a result of repetitive minor stresses and strains incurred in daily living, or are the structures breaking down from degeneration alone? It appears that both factors combined are responsible for the decay.[157] Farfan,[50] indicates that degenerative signs are evidence of the body adapting to stresses and strains and repairing damage.

Degenerative changes alone are not a primary cause of pain. That severely degenerated spinal joints occur in individuals who have never experienced pain, is widely reported. The opposite is true as well, and severe pain can be experienced by individuals whose radiological status is normal. In a study of 200 asymptomatic men and women between the age of 20 and 65,[61] it was found from one lateral radiograph that by the age of 60 to 65, 95% of the men and 70% of the women demonstrated at least one degenerative change. Similar changes occur in symptomatic cervical spine patients.

Degenerative changes appear early in the lower segments of the cervical spine. They are, however, detectable at radiography only in later stages. In Kramer's view[92] the common cause for degenerative change is the mechanical influence on the intervertebral discs by the extensive movements which can be carried out in the cervical spine in relation to the rigid thoracic spine. The comparatively high loading per cm^2 by the head on the cervical discs exceeds that of the thoracic and lumbar spines. Continuous loading and the great mobility, in particular torsion, combine in attenuating the annulus fibrosus of the cervical discs, which become ruptured and cause protrusion and displacement of disc tissue.

The location for initial pathologic changes in the cervical discs are the horizontal fissures normally present adjacent to the uncovertebral joints from early adolescence. The horizontal fissures arise in completely normal cervical disc tissue in contrast to the fissures which develop as a sign of degeneration in the discs of other spine segments. The clefts are laterally closed but penetrate medially and widen towards the centre of the disc. They are in contact with the nucleus pulposus and therefore parts of the nucleus are able to escape laterally.[145] Thus an escape route for nuclear material is already in existence from an early age. Kramer,[92] and Tondury,[145] both consider it possibe that acute torticollis may result from such displacement. In histologic sections Tondury,[145] observed intradiscal protrusions in the uncovertebral region in children. Tondury,[146] only found large cervical protrusions in adolescents. In the dessicated discs in older patients there was no penetration of tissue in the horizontal fissures.

"Laterally, protrusions will interfere with the intervertebral foramen. Disc tissue can pass through the fissure and protrude outside the disc border despite the passage being very narrow. Attenuated fibres are forced from the interior through the ruptured exterior lamellae without necessarily extruding outside the intervertebral disc space. In adults parts of the nucleus pulposus were found to penetrate through the horizontal fissure and be either contained within the intervertebral disc by the annulus or penetrate, producing true prolapses. The dislocation of intervertebral disc tissue is due to the increased intradiscal pressure which is always encountered in adolescents."[92]

On review of these extracts from well respected sources, the argument in favour of displacement of disc tissue as a frequent cause of spinal problems is a logical one. The rapid reversibility, (for the better or for the worse) of signs and symptoms in patients with such disorders when treated by the methods prescribed in this book also adds credibility to the conceptual model of displacement described earlier.

With ageing, progressive degenerative changes cause a reduction in disc height. This results in contact between the uncinate processes and the apophyseal joints are placed under increasing load. As the uncinate processes develop osseous lippings, a reactive osseous density appears on adjacent vertebral body areas. The uncovertebral region thus provides a supporting function and Ecklin,[44] has desscribed these regions as having a joint-like function.

The uncinate processes cannot respond to these demands and consequently degenerative changes develop.[92] The intervertebral foramen becomes narrowed by the osteophytic reactions of the uncinate processes and by the diminished height of the disc space. This narrowing is due in part to an increase of soft tissues surrounding the osseous spurs not demonstrable on radiographs. Most often these soft tissues are responsible for the cervical root syndromes. This may explain the presence of signs and symptoms in those cases where radiography discloses a normal width of the intervertebral foramen.

Besides uncovertebral exostoses the apophyseal joints take part in the narrowing of the foramina. Following disc degeneration apophyseal joint damage is likely to develop because of overloading. The degenerative changes occurring in the intervertebral disc lead to a loss of shock-absorbing capacity and this allows the transmission of abnormal forces to the apophyseal joints. They become more closely placed together as a result of the osteochondrotic disc impaction which in turn narrows the upper part of the intervertebral foramen. Thus apophyseal joint degeneration follows intervertebral disc degeneration.[92, 50, 156]

Osteoarthrosis of the apophyseal joints is not as common as previously believed. With the decrease of the cervical disc height the uncinate processes of two adjacent vertebrae come in contact with each other before any larger forces are distributed to the apophyseal joint. Osteoarthrosis of the vertebral joints is most often encountered in the upper and middle cervical spine. A fibrous ankylosis may develop, and finally there is an increased rigidity of the involved segment. Osteophytes, lippings and increased osseous density diminish when the disc tissue softening has ceased.

The functional deficit which follows the immobilization of individual segments can be well tolerated by older individuals especially when the larger part of the mobility can be retained in the two uppermost segments.[92]

It can thus be seen that extensive degenerative changes occuring in the uncinate processes and the apophyseal joints following disc degeneration eventually result in significant loss of function and range of motion. Chronic symptoms resulting from these changes abound in patients with symptoms arising from the cervical spine. Their identification and treatment are described in later chapters which deal with the dysfunction syndrome. The treatment of patients with cervical nerve root syndromes is described in Chapter 20 under the heading "Derangement Five" and "Derangement Six".

CHAPTER THREE

The Causes of Pain

NOCICEPTIVE RECEPTOR SYSTEM

Most tissues in the body possess a system of nerve endings which may be referred to as nociceptive receptors.[171] The free nerve endings of the nociceptive system provide the means by which we are made aware of pain. These receptors are in effect the body's pain warning system. The nociceptors advise us of impending danger, as may occur when moving a joint beyond its normal limits. Or they indicate that damage has already occurred, as may result from an ankle sprain.

Nerve endings are found in the skin and subcutaneous tissue; throughout the fibrous capsule of all the synovial apophyseal joints; in the longitudinal ligaments, the flaval and interspinous ligaments; in the periosteum covering the vertebral bodies and arches; in the fasciae, aponeuroses and tendons attached thereto; in the spinal dura mater, including the dural sleeves surrounding the nerve roots; and in the annulus fibrosus of the intervertebral discs.

Wyke,[171] reported a total absence of nociceptive receptors in the annulus and nucleus of lumbar intervertebral discs. This unfortunately created the widespread belief that the intervertebral disc was incapable of causing pain, a belief that still persists today. Both Bogduk,[8] and Yoshizawa,[172] confirmed the existence of circumferential innervation in the outer half of the lumbar annulus fibrosis. The frequent occurrence of pain reproduction caused by distension tests of the intervertebral disc suggests that the structure in itself can be responsible for back pain as well as referred pain.[153]

The wide distribution of the nociceptive receptor system in the cervical area makes it almost impossible to devise testing procedures which selectively stress individual components of the spinal segment. Bogduk,[10] suggests that specific diagnosis of articular ligamentous and capsular disorders of the spinal column is merely a matter of progressive exclusion. The validity of this optimism has yet to be demonstrated and is not supported by the QTF Report.

MECHANISM OF PAIN PRODUCTION

Pain is produced either by chemical or mechanical stimulation of free nerve endings.

Chemical cause of pain

Pain is produced by chemical irritation as soon as the concentration of chemical substances is sufficient to irritate free nerve endings in the involved soft tissues. Pain of chemical origin is of lesser interest to those of us dispensing mechanical therapies, as chemical pain is usually associated with inflammatory or infective processes, such as active rheumatoid arthritis, ankylosing spondylitis, tuberculous and other bacterial infections. However, it also occurs for up to twenty to thirty days following trauma. This will be discussed later.

Mechanical cause of pain

Pain is experienced as soon as mechanical deformation of innervated structures is sufficient to irritate free nerve endings. Pain will arise by the application of forces sufficient to stress or deform the structures. It is not necessary to actually damage tissues containing the free nerve endings in order to provoke pain. Pain will disappear when the application of that force is terminated, and this often occurs by a mere change of position. A good example is the pain incurred during prolonged sitting which disappears on standing upright.

Another simple example of mechanical articular pain is readily at hand. Bend your left forefinger backwards, using your right forefinger to apply overpressure. Keep applying this pressure until the nociceptive receptor system indicates its enhanced active state by the arrival of pain. This is simple mechanical deformation of pain sensitive structures. If you bend the finger backwards further, the intensity of the pain will increase; and if you maintain the painful position longer, the pain will become more diffuse, widespread and difficult to define. Thus, pain alters with increasing and prolonged mechanical deformation. If you now slowly return the finger to its normal resting position, the pain will disappear. This example has one significant implication: the finger is obviously being moved in the wrong direction as the pain increases, and in the correct direction as the pain decreases.

Fig 3:1.
The Bent Finger syndrome.

When the finger is used as an example, the mechanism of pain production is easy to understand. But the same concept applied to the spine is more difficult to accept. In the spine the same mechanism is involved, but there are more structures which may give rise to pain and the mechanics are more complicated. Nevertheless, ligaments, apophyseal joint capsules and the annulus fibrosus all have the capacity to develop pain from stretching. Overstretching of some or all of these structures must commonly give rise to pain felt adjacent to the spinal column. In addition, displacement of intervertebral disc tissue itself may cause pain to persist long after the trunk position has altered and end range stress has been removed. Even though the patient avoids postures that create tension in the affected tissue, pain from displacement will persist until the displaced tissue is relocated.

The intervertebral disc and its potential for displacement dictates that our treatment principles for spinal joints must be modified from the principles we use to treat the extremity joints. This fundamental difference between the biomechanical behaviour of the intervertebral segments and the extremity joints is responsible for the poor development of treatment for spinal mechanical disorders compared with the treatment of mechanical disorders of the extremity joints.

Let us return to the forefinger once more. Bend the finger backwards until you feel pain and then release it suddenly. The pain ceases at once. What was the pathology in the finger at the moment the pain appeared? Of course, the answer is that no pathology need exist at all under these circumstances. The sensation of pain does not depend on the existence of pathology. The example cited above is one of the most common causes of articular pain. The pain described here was produced by mechanical forces sufficient to stress or deform tissues and activate the nociceptive receptor system. The activity of the system was merely enhanced by the application of the stress, and as soon as the stress was withdrawn the activity returned to its normal rest level. Intermittent neck and shoulder pain is frequently caused in this manner. No chemical treatment will rectify or prevent pain arising from mechanical deformation. When intermittent mechanical pain is the main presenting symptom, drugs should never be the treatment of choice.

Trauma as a cause of pain

Pain due to trauma is produced by a combination of mechanical deformation and chemical irritation. Initially, mechanical forces cause overstretching and damage to soft tissues, and pain of mechanical origin will be felt. In most instances this is a sharp pain. When, in the cervical spine, mechanical deformation is severe enough to traumatise soft tissues, it is usually the result of an external force – for example, a fall from a ladder, a motor vehicle accident, a sudden unexpected step from the pavement, or a kick in the back during football.

Shortly after injury chemical substances accumulate in the damaged tissues. As soon as the concentration of these chemical irritants is sufficient to enhance the activity of the nociceptive receptor system in the surrounding tissues, pain will be felt. In most instances, pain of chemical origin will be experienced as a persistent discomfort or dull aching as long as the chemicals are present in sufficient quantities and the presence of pain is not dependent on position. In addition, the chemical irritants excite the nociceptive receptor system in such a way that the application of relatively minor mechanical stresses causes pain which, under normal circumstances, would not occur. Thus, at this stage there is a constant pain which will never cease by positioning and may be enhanced by movement.

In the later stages of healing when movements are performed more willingly, loss of movement caused by contraction and adaptive shortening of scar tissue may be exposed. Thus, after two or three weeks, the constant pain due to chemical irritation will have been replaced by intermittent pain which is felt only when the recently repaired but shortened structures are stretched.

TISSUE REPAIR

Injury, the medical term for cellular damage, is followed by repair by the layering of fibrous collagen. The cells damaged by injury die and the resultant necrosis sets in train an inflammatory response which lasts for about five days. In this period a mesh of fibrin forms and seals the injury. During this time the application of ice is indicated to reduce the inflammatory exudate to a minimum. The greater the amount of exudate, the more fibrin will be formed and the more thickened and inextensible will be the repair. Ice is of little value after the fifth day as fibrous collagen appears and local dormant cells spring to life and divide.[49, 69]

To encourage good quality repair gentle natural tension should be applied to recent injuries, commencing at about the fifth day. From then a progressive increase in movement should be encouraged so that full range is possible by the third or fourth week.[49]

After three weeks to a month the fibrous repair should be established. Unfortunately, a characteristic of collagen repair is that it will contract with ageing. Recently formed scar tissue will commence shortening unless it is repeatedly stretched. Provided the stretching process is commenced in the early stages following injury and continued well after full recovery has been achieved, no soft tissue shortening is likely to develop.

In some patients contracture resulting from previous injury may now prevent the performance of full range of motion. In such cases the remodelling of collagen by applying a long term structured exercise programme will be necessary. By applying regular stress sufficient to provide tension without damage, collagen undergoes chemical and structural changes that allow elongation and strengthening of the affected tissue. Evans,[49] reports that some patients may have to exercise for the remaining years of their life. Stretching of old injuries should be routinely practised, especially prior to participation in sporting activities.

No injury can be made to heal faster than its natural rate. We can avoid delay to the healing process and we can ensure that the climate for repair is favourable.[49] During the process of repair the application of mechanical treatment should not be so vigorous as to delay healing. Strenuous mechanical therapy applied when the pain from injury is essentially chemical, will delay recovery. This often means withholding the more vigorous mechanical procedures at our disposal until we have established the integrity of the repair.

TISSUE DEFORMATION

Sufficient tissue deformation caused by mechanical forces will lead to pain alone or pain and damage under certain circumstances.

Prolonged stress applied to normal tissue will *eventually* cause pain without tissue damage. This is the postural pain caused by prolonged static loading. This pain ceases on change from a painful position. (The Bent Finger Syndrome).

Stress applied to adaptively shortened structures contractures, fibrosis or scarring will often cause pain *immediately* the stretch is applied. This pain also ceases on change from the painful position. Pain from this cause will not appear if the patient avoids the end range of available movement.

Prolonged loading, especially by asymmetrical compression of the intervertebral disc, may cause sufficient displacement within that tissue to cause pain and obstruction of movement.

Excessive force applied to any tissue will cause damage and pain which will persist until repair is complete and function is made full and free.

It is a mistake to think that as long as pain persists, repair is incomplete. It is also incorrect to think that once repair is complete, pain should cease. Pain persists long after repair is complete in many musculo-skeletal conditions and is produced whenever end range stress is applied to the shortened repair itself.

Mechanical stresses sufficient to cause pain are usually created either by postural distortion or by abnormal forces.

Postural stresses

These are, according to Wyke,[171] by far the most often encountered and their importance is generally under-estimated.

When a relaxed position is assumed for more than a few minutes, the muscular control required to hold the individual in that particular position diminishes, the body sags and the support is derived from joint capsules and ligaments. Essentially the muscles relax slowly in order to relieve themselves of the burden of maintaining an upright posture, and of opposing gravity or any other forces at work. In the fully relaxed position, muscular activity ceases and the stresses are transferred to capsules and ligaments. The inherent elastic property of the ligaments is sufficient to support most positions for a limited period of time, but eventually the ligaments and capsules become over-stretched and eventually damaged. The ligaments bear nearly the entire load, which in the upper back and neck consists of the weight of the head, neck and shoulders. The process of relaxation of the musculature is a gradual one, occurring unconsciously over several minutes and varying in time for each individual.

Several investigators have commented on the effects of prolonged loading of spinal soft tissues. Hickey and Hukins,[73] reported that if overstretching of ligaments excedes 4% of the resting length, irreversible damage will follow.

Adams and Hutton,[2] describe gradual disc prolapse and annular failure following prolonged flexion loading of cadaveric specimens. Twomey and Taylor,[149] reported that the ammount of flexion creep deformation in cadaveric lumbar spines, increases with load and progresses with time irrespective of age.

The positions which most frequently stress the upper back and neck are those resulting from the simultaneous adoption of various forms of flexion and/or extension of the upper and lower segments of the cervical spine. Combinations of these various positions occur especially when we adopt a protruded head posture. This commonly takes place when we drive motor vehicles, especially during adverse weather conditions or when the seating is poorly designed; when we work at video terminals and typewriters; when we eat, watch television, converse or read, knit, sew, or simply relax in a lounge chair.

It is clear that purely postural or positional mechanisms may produce pain. (Fig 3:2) Thus, neck pain is frequently caused or enhanced by overstretching of soft tissues brought about by positions of prolonged loading. Harms-Ringdahl,[70] found that previously asymptomatic individuals all experienced pain after various periods of prolonged flexion loading of the cervical spine.

All patients who suffer pain emanating from the upper spine, irrespective of the underlying pathology, experience additional painful stresses from postural loading that make an accurate assessment of the underlying condition impossible. The underlying cause of the basic problem remains obscure until such time as postural stresses are removed. Then and only then can a dynamic mechanical evaluation be interpreted with confidence. Furthermore, without removing these postural stresses, the patient with pain in either the upper or lower back is unlikely to receive long-term benefit from any treatment, irrespective of its initial value. The importance of the postural factor and its place in the causation of spinal pains has not been understood fully by the medical and physiotherapy professions. These causative and perpetuating factors can nearly all be dealt with by example and education.

Abnormal forces

Abnormal forces applied to the stationary body or developed during movement are the cause of most other mechanical back pains. Forces become abnormal when the duration or amplitude of force applied is excessive. Forces applied in directions contrary to those the structure was designed to withstand will also cause failure. Abnormal forces most commonly occur when heavy loads are manually controlled; when comparatively light weights are handled in great numbers and frequently; or when comparatively simple movements are performed after prolonged and flexed static loading. Activities involving sudden unexpected movements, such as occur in football, cricket, tennis, athletics, and gymnastics, may cause sufficient mechanical stresses to produce upper back and neck pain.

Fig 3:2. *Common slouched postures.*

CHAPTER FOUR

Cervical Syndrome and Brachial Neuralgia

CERVICAL SYNDROME

In the great majority of patients with cervical problems a specific diagnosis is impossible and we resort to the terms cervical syndrome or non-specific neck pain.[139] These disorders may give rise to symptoms in the neck itself or may cause symptoms to radiate to the region of the mid scapula, shoulder or arm. In addition, headache, vertigo, tinnitus and nausea are frequently reported. If the distribution of pain or parasthaesiae conveniently allows the identification of the affected root, a specific diagnosis may be made.

Kramer,[92] states that it is not possible to make a distinction of upper, middle, and lower cervical syndromes, as it may then be believed that these can be related locally to upper, middle and lower cervical segments. Over the last few years discography and distension tests have verified that almost all cervical syndromes arise from the lower cervical spine in which also degeneration is most common.

In the cervical syndrome, as in the lumbar syndrome, symptoms of non specific neck pain may appear insidiously over a period of weeks or months or they may arise spontaneously overnight. Sometimes they commence during or after prolonged positioning such as may occur with a long car drive or many hours spent at desk work. In these situations the head posture becomes protruded with the lower cervical spine flexed and the upper cervical segments placed in a position of extension. (Fig 4:1) Patients frequently but mistakenly attribute their symptoms to activity performed the previous day, or blame a change in the weather or a draught.

Once cervical syndrome symptoms have developed, the performance of simple movements or the adoption of prolonged positions readily increases the intensity of symptoms and movements previously full and free suddenly become obstructed and at times acutely painful.

Frequency of cervical syndrome

According to Kramer,[92] 37.8% of patients seen in orthopaedic practice attend for intervertebral disc disease. Of all disorders of the vertebral column 92.7% are due to disc degeneration. Of these 36.1% have cervical, 1.96%

thoracic, and 61.94% have lumbar problems. Every fifth patient consulting an orthopaedic surgeon does so because of cervical intervertebral disc syndrome. Knepel,[87] found that in general practice every tenth patient had intervertebral disc degeneration as the cause of back complaints. The same reason was found in every third patient who consulted an orthopaedic outpatient department.

In my own experience about 22% of any particular population will have felt neck pain within the previous week whilst those who have had low back pain number about 18%. These figures have not been gathered in a scientifically acceptable manner, but they are remarkably consistent over many years of collection from public audiences.

Cervical mechanical disorders are more benign than similar problems occuring in the lumbar spine. Symptoms arising from the cervical spine seldom cause hospitalisation or confinement to bed and do not cause the loss of time from work associated with low back problems.

According to Kramer,[92] intervertebral disc syndromes occur mostly in middle-age groups, 68% being aged between 30 and 60. The maximum is reached in the forties and fifties. Cervical syndromes affect more women than men up to the age of 60. From age 60-70 men predominate, after that women and men are equally affected. This is in contrast to the lumbar syndrome where men are affected more than women.

The incidence of neck pain peaks about the age of 45-50 then reduces with ageing, whereas the degenerative process continues progressively throughout life. Thus a relationship between increasing degeneration and increasing pain cannot be established.

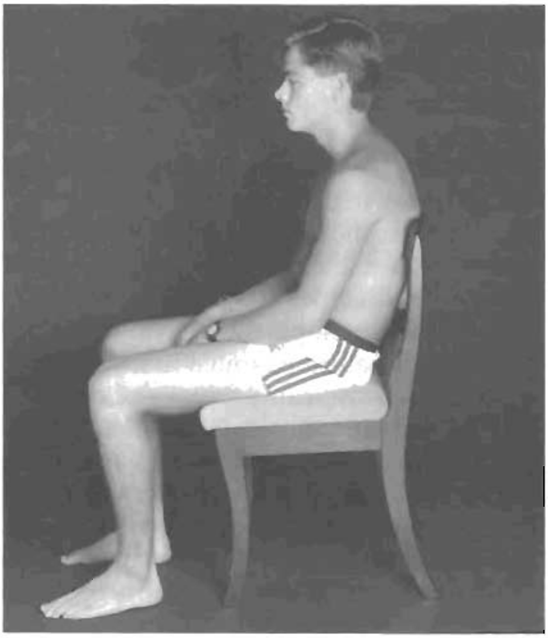


Fig 4:1.
Protruded head posture.

Acute conditions such as wry neck occur more often in adolescents while persistent chronic and recurrent conditions predominate in adults. As is the case with low back problems, the incidence does not vary between light and heavy workers.

The incidence of recurrence of low back pain has been reported by Horal,[77] to be as high as 90%. Others also report high figures in the range of 70 to 80%[32, 74] According to Hult,[79] the incidence of recurrence in the cervical spine is also high. My own impression is that the incidence may be higher in the cervical than in the lumbar spine.

Natural history of the cervical syndrome

The natural history of any disease must be fully understood before the effectiveness of any therapy can be honestly evaluated. Acute problems affecting the cervical spine, especially in those aged under thirty, are extremely short-lived. In three to five days most problems will be resolved. Even the patient with acute torticollis will usually become symptom free in that period of time. The successful application of almost any ointment, pill or remedy, no matter how innocuous, is assured. Thus it seems that all of the common problems relating to the human spine are ripe for exploitation and this is reflected in the large number of heterodox practitioners working in the field.

Although the natural history of an episode of acute cervical pain can be measured in days,[80] the incidence of recurrence is commonly very high.[79] Many patients experience recurrent episodes of such frequency that in describing their disorder they create the impression it has continued uninterrupted for many years and is chronic.

A high incidence of recurrence of cervical symptoms can resemble a continuous rather than an episodic disorder. Careful questioning is vital in order to separate the truly chronic conditions from the episodic recurrent problems. This is necessary because chronic mechanical disorders require a more aggressive treatment approach, whilst the frequently recurring disorder calls for sophisticated education to learn the sequence of reductive movements necessary to make the patient independent of therapy and therapists.

By the mid forties frequent recurrence of acute neck problems eventually leads to the development of symptoms of brachial neuralgia. It is my own view that the patient educated in self-treatment while he has symptoms confined to the neck only, can prevent the onset of radicular symptoms.

Gore,[62] reported that 205 patients with neck pain were evaluated for a minimum of 10 years after onset of symptoms and 57% still had persisting symptoms. 33% were suffering moderate to severe symptoms. Severe pain caused by injury was more likely to lead to long term problems. It is therefore clear that cervical disorders are not necessarily self-resolving. This study does not determine whether those with persistent symptoms were suffering from chronic or recurring pain.

BRACHIAL NEURALGIA

Brachial neuralgia or cervical radiculopathy may be defined as pain in the distribution of a specific cervical nerve root as a result of compressive pathology.[38]

Brachial neuralgia is seldom short-lived and in its most acute form causes incapacitating pain and many sleepless nights. Attacks of neuralgia can last up to sixteen weeks before natural resolution of the problem occurs. Residual weakness may remain in some individuals for the rest of their life.

It is not insignificant that brachial neuralgia is often preceded by episodic neck pain recurring over many years. Hult found the same situation in the lumbar spine. Sciatica is preceded by recurrent low back pain.[80] The embryonic internal derangement giving rise to recurrent lumbago and neck pain progresses and finally emerges in full bloom as disc protrusion or herniation, the most common cause of brachial neuralgia. Consequences of disc rupture are not usually easily resolved and the natural history of this disorder is measured in months.

Symptoms of brachial neuralgia may develop slowly over several weeks or may develop suddenly, usually by the application of external forces. In the former case the patient may complain that many weeks ago the pain commenced in the neck and since onset has progressively moved further into the arm so that more recently the fingers have become numb. The patient will hold the neck in a somewhat flexed and laterally flexed position (away from the affected side) and sometimes holds the affected arm firmly with the other hand. Motor weakness and sensory deficit invariably develop, especially when the referred symptoms are constant.

Pain in the upper extremity due to cervical disc disease generally originates in the C5-C7 segments.[145, 92, 120] Pain parasthaesiae or numbness felt in the distribution of the affected roots should enable precise identification of the affected level.

Kramer,[92] reports that the C4/5 disc (C5 root) is affected in 4.1% of patients and pain is felt over the shoulder to the proximal half of the upper arm. There is neither pain nor any sensory loss in the lower arm and the hand.

Symptoms from lesions of the disc between C5/6 occur in 36.1% of patients and is the level most commonly affected. The C6 dermatome supplies the radial side of the arm and includes the thumb and occasionally the index finger and there may occur a weakness of biceps and brachialis.

Symptoms from disturbances within the disc at C6/7 appear in 34.6% of patients.[92] Pain is felt over the posterolateral part of the shoulder and the upper arm down over the posterior part of the lower arm to the second and third and partly the fourth finger. The muscles involved are the triceps, pronator teres and the thenar muscles. The most characteristic power loss occurs at the triceps which usually demonstrates altered reflex activity.

Problems arising from the C7/T1 intervertebral disc are present in 25.2% of patients,[92] and involve the ulnar side of the arm including the fourth and fifth fingers. Motor deficit of the finger flexors, the interosseous and hypothenar muscles is seen frequently.

Frequency of brachial neuralgia

Cervical radiculopathy is not an uncommon condition. Hult estimated that 51% of the adult population will experience neck and arm pain at some point.[80] Recently Kelsey et al,[86] have analysed acute cervical disc disease and found the incidence to be significantly higher in those individuals who lift heavy objects, smoke cigarettes, and dive. The operation of vibrating equipment and riding in cars was also a contributing factor.

Natural history of brachial neuralgia

Lees and Turner,[94] analysed the natural history of cervical radiculopathy and found that continuous symptomatology was not unusual. Two-thirds of patients treated conservatively had persistent symptoms

Rothman,[128] reported that those patients with radiating symptoms did not do as well as those without radiating symptoms. Hohl,[76] found that the presence of numbness, pain, or both, in an upper extremity correlated positively with a poor result. Greenfield and Ilfeld,[64] found that patients with upper-back and interscapular pain did not recover as well as those without these symptoms; however, they also found that initial radicular pain was not related to a poor final result.

Approximately one-third of the patients in a study by Rothman,[127] had moderate or severe pain at final evaluation. "It does not appear that cervical disc degeneration is a brief self-limiting disorder but rather a chronic disease, productive of significant pain and incapacity over an extended period of time."

According to Dillin,[38] "Relief of pain did not differ in those with and without treatment; however, a uniform approach to conservative treatment was not used so it is not possible to determine if a specific regimen of conservative treatment is of long-term value. We are unaware of any evidence that conservative treatment of symptoms has any long-term effect on the natural history of a patient's problem and agree with Lees and Turner,[94] in that treatment may alleviate symptoms without influencing the natural history."

It can be concluded that persistent radiation of pain after many years is a common finding in patients with brachialgia. A well structured trial of the procedures described for the treatment of Derangement Five and Six and for nerve root adherence should be considered an appropriate alternative for this patient population.

Natural history of motor deficit

The natural history of motor deficit due to cervical disc pathology is unknown. In a series of 846 consecutive cases, Henderson and Hennessy found the incidence of neuromuscular deficit to be 37% for the triceps muscles, 28% for the biceps, 1.9% for the deltoid, and 0.6% for those muscles involved in grip[72]. Both Henderson and Hennessy and Lunsford et al,[97] respectively identified approximately 68 and 61% of patients who had preoperative motor weakness with disc herniation. The recovery of full motor function as a result of decompressive surgery is excellent. In Henderson and Hennessy's series,[72] 96% returned to full function and excellent results have been cited in most series for recovery of motor function after cervical disc surgery.

CHAPTER FIVE

Subgroups in Non Specific Spinal Disorders

Within the spectrum of non-specific spinal disorders, I have identified three specific sub-groups and developed conceptual models to describe the disorders.

I propose that as a result of poor postural habit and predominantly sedentary flexed lifestyles, maintained almost from childhood, we overstretch certain structures.

The consequences resulting from the flexed lifestyle provide the basis for the models that follow.

CONCEPTUAL MODELS OF MECHANICAL DISORDERS

The postural model

In the early stages of life, poor postural and frequent flexion habits cause stretching and minor pains arising from local periarticular structures in the spine. The resulting pain disappears once the structure is released from tension. Postural pains initially arise near the midline of the spine and do not radiate to the extremities. Postural pains do not persist after removal of the strain.

Pain resulting from these stresses behaves characteristically and allows us to identify the Postural Syndrome.

The dysfunction model

With time and persisting poor postural habit (by the mid twenties or thirties) the annulus and other overstretched ligamentous and capsular structures begin to suffer from minor tearing as the flexion forces in our lifestyle "pull us apart". The majority of these tears probably heal quickly and little consequence is felt at the time. However, minor but recurring micro trauma and repair eventually leads to loss of elasticity and a reduction of the range of motion. Alternatively, a significant injury is sustained by the disc and eventually this too recovers by fibrous repair, but full function does not return. In either case the patient has lost full range of motion and experiences discomfort or pain should he move to his now limited end range.

We have no way of knowing which structures are affected at this stage in the disease process. All we can say with confidence is that something has contracted, fibrosed or become adherent. When nerve root adherence or tethering is present, the loss of function is more readily determined and the cause is identified more precisely.

Pain resulting from stretching of adaptively shortened or contracted soft tissues behaves characteristically and allows us to identify the Dysfunction Syndrome.

The derangement model

So long as the annulus fibrosus remains intact and unaffected by the static loading present in everyday life, the patient will experience no more than the normal postural back or neck pains experienced by us all. The annulus fibrosus will restrain the fluid nucleus pulposus from any tendency to displace beyond its normal inner boundaries.

However, with progressive overstretching, creep and then hysteresis weaken the annulus and its ability to contain the nucleus is impaired. The process of displacement can now begin.

The embryonic stages of displacement are manifest in complaints of minor back or neck pain which arise intermittently and last only for a few days. This pain is now not simply the pain of overstretching, for it persists long after the patient alters his position. The majority of such episodes arise from minor well contained posterior or postero-lateral displacements caused by prolonged or repeated flexion. At this stage they are rapidly reversible. Displacement causes tension in the annulus, provoking pain which may sometimes appear in the centre of the back, or to the right or left sides depending on the site of the displacement. When the patient reports that the location of his pain can change from day to day, it is my contention that the location of the displacement has also changed.

In the early stages of the development of displacement, patients have no gross loss of function but will experience pain during movement which subsides within a few days. More often than not, they spontaneously become symptom free and fully functional.

With the passage of time and progressive increase in the degree of internal displacement, episodes of recurring pain are experienced. These inflict increasingly severe symptoms and may indicate the rupture of successive layers of the annulus. Each episode takes longer to resolve and leaves the patient a little more restricted in the range of motion. The function, without special effort, will not fully return.

Pain resulting from displacement behaves characteristically and allows us to identify the Derangement Syndrome.

Unless the frequency of flexion in this patient's lifestyle is interrupted, recurrence and progressive displacement will continue. The available space created by the developing fissure will be occupied by fluid, gel, or sequestrum. Some movements will become obstructed by the volume or nature of the displacement within the intact annulus and fix the patient in positions of kyphosis, (posterior displacement) lordosis, (anterior displacement), or list or acute scoliosis or torticollis, (posterolateral displacement). In each case respectively the movements of extension, flexion, and extension and lateral flexion to the opposite side, will be obstructed.

The patients in each of these apparently different disorders will all suffer an obstruction to curve reversal. Indeed, it is this obstruction to curve reversal that is the common factor in all acute disorders, thus providing a clue as to the likely causative mechanism in acute non specific spinal disorders.

As a consequence of continuing insult the annulus will eventually fail completely and either rupture, allowing the extrusion of disc material into the spinal canal, or protrude excessively and irreversibly onto the dura and or nerve root. In both these situations the incompetency of the annulus rules out the possibility of reversal of the displacement and the application of mechanical therapy is futile and contra-indicated at this stage. With time, repair, fibrosis, and nerve root adherence will develop and the patient's symptoms will subside or change in nature.

Each of the above models describes a pathology and rationale for the origin of the patient's pain and more importantly, indicates the treatment required. Imprecise as the models may be, they suggest the existence of syndromes within the non specific spectrum that can be identified for therapeutic advantage. If the reader can accept that these models could provide the explanation for the patient's problem, a logical treatment strategy can now be implemented.

In the case of the Derangement Syndrome, acceptance of the conceptual model will allow us to predetermine with good reliability the direction of the required therapeutic motion. A better explanation may exist and the present model may eventually be altered but in the meantime, until that new explanation is forthcoming, this is a reasonable and reliable model upon which to base mechanical therapy.

Whilst there is as yet no positive evidence to prove that the model for the derangement syndrome is correct, in practice it provides the basis for the efficient and rapid treatment of problems that have hitherto taken many weeks or months to resolve. Several studies now demonstrate the efficacy of the system when used to treat disorders of the lower back.[4, 122, 118, 89, 41, 142, 126, 152] Similar studies have yet to be completed in upper spinal regions.

The three syndromes presented are completely different from each other and can be identified and separated by using repetitive end range motion. This separation is most easily made during the application of either loaded or unloaded saggital movements. When identical forces are applied to a group of patients with apparently similar complaints, dissimilar pain responses will emerge depending on the syndrome present. This allows a division into subgroups to be made, the most common of which is derangement.

It will be seen that when subjects in one group are subjected to identical forces they demonstrate similar pain responses, but subjects in one group will describe different pain responses to subjects in the other two groups.

Each syndrome must be treated as a separate entity, requiring special procedures which are often unsuitable for the other syndromes. However, *it must be emphasised that most patients develop pain and seek assistance as* *a result of derangement. On examination it will be found that they also have poor postural habit. In some patients after reduction of the derangement and resolution of the symptoms, an underlying loss of function will be exposed which may be traced to some earlier injury.*

In order to apply mechanical therapy in a logical fashion, it seems clear that we should: correct posture to relieve painful tension from normal tissues in patients with the Postural Syndrome; stretch to remodel shortened or contracted tissue in the Dysfunction Syndrome; and apply reductive pressures to relocate displaced tissue in the Derangement Syndrome.

The means by which we can identify these subgroups is discussed in following chapters.

CHAPTER SIX

Predisposing and Precipitating Factors

PREDISPOSING FACTORS

Prolonged sitting

Although predisposing factors causing pain in the cervical spine have not been studied as extensively as have those factors relating to the lower back it is likely that they are similar.[139]

As proposed earlier,[100] I believe that poor sitting postures are the most common cause for failure of the articular supportive structures in the spinal column, They therefore become the number one predisposing factor in the development of mechanical disorders of the back and neck.

Epidemiological and laboratory studies suggest that a close connection exists between prolonged sitting and the development of back pain. Studies by Kelsey,[86a] and Magora,[104] show that car driving and prolonged sitting are associated with a high incidence of herniated nucleus pulposus in the lumbar spine. Cadaveric experiments,[2, 167, 73] caused failure of the annulus in simulated sitting and flexed postures. Wilder,[167] found that one hour of simulated sitting predisposed the lumbar posterior annulus to failure. Although similar investigations of these factors in the cervical spine await completion, regular and prolonged static loading are likely to produce failure in this region of the spine as they do in the lumbar area.

Harms-Ringdahl,[70] studied pain provoked by end range position of the head and neck, in this case prolonged protruded head posture. Ten asymptomatic subjects maintained this posture and all reported pain within 2-15 minutes. The pain increased with time after adopting the provoking posture. Sixteen to 57 minutes after the onset of the initial pain, the subjects declined to continue the protruded head posture because of the level of pain. In all subjects, the pain passed off within 15 minutes after removal of the provocation but was again experienced by nine subjects the same evening or the next morning and in some lasted up to four days. It was found that the myoelectric activity was low in this position and the pain was therefore likely to arise from the ligaments and capsules rather than from the musculature.

Protruded head postures, especially those acquired while driving a motor vehicle or working at video terminals, and prolonged bending of the neck, especially in the sitting position, are commonly reported causes of neck pain. There is also a high incidence of pain in the neck felt on waking after a night's rest. Static loading in faulty sitting or lying postures will lead eventually to problems within the cervical spine.

Statistics from my own clinic show that the great majority of patients developing pain from mechanical disorders of the vertebral column, do so without the application of a recognised external force. They describe that their symptoms appeared for no apparent reason. Kramer,[92] reports that the majority (58%) of patients in his clinic developed pain for no apparent reason. Whenever the patient is unable to describe or recollect a cause for the onset of his symptoms, it is necessary to consider the possibility that the symptoms are caused largely, if not entirely, by environmental factors. Prolonged sitting has been identified as one of these factors.[86a, 99, 104]

Living on the planet the way we do in the twentieth century has created environments hostile to the well-being of our bodies. In western societies, sitting for prolonged periods has replaced activity as a major function of daily living. Certain faulty sitting postures will allow excessive and damaging static forces to persist for lengthy periods in every day of our life. Eventually supportive soft tissues succumb to these stresses and fail without being subjected to violent external forces.[2, 73, 92, 167] By adopting correct postures we remove the possibility of damage from such causes.

What is a correct sitting posture? Opinions vary, but my own view is that a good sitting posture maintains the spinal curves normally present in the erect, active, and alert standing position described by Tucker.[148] (Fig 6:1) Postures which reduce or accentuate the normal curves sufficient to place the ligamentous and capsular structures under tension at end range will eventually produce pain. Such postures are referred to as poor sitting postures.

Poor sitting postures alone, without any additional factors, may *produce* pains in and around the neck and may *produce* headaches. Poor sitting postures will always *enhance* and *perpetuate* existing problems in patients who have developed cervical pains from other causes such as whiplash injury.

Once we have been sitting for more than a few minutes, we relax and the spine is permitted to adopt a slouched flexed position. If we are conversing or watching television, we adopt a position with the neck relaxed and the head protruded. In this position the lower cervical segments will be flexed and the upper cervical segments extended to an extreme position. As Harms-Ringdahl,[70] has demonstrated, this position will become painful if maintained for a prolonged period.

Patients adopting slouched, relaxed or flexed postures, "hang" on ligamentous and capsular structures at the end of the available range of movement. If allowed to continue for hours this strain can in itself become painful without necessarily causing damage. If maintained for months or years, such postural stresses will result in overstretching and damage. Eventually,

Fig 6:1.
Active alerted standing posture. (Tucker)

with the development of damage, displacement of material into annular fissures may occur as the process of internal disruption and derangement progresses.

After prolonged sitting, standing or fully flexed postures, the support from the musculature is reduced as the muscles relax and transfer the responsibility for providing support to ligaments and capsules.[171] Andersson,[5] found that the myoelectric activity in the para-vertebral lumbar muscles was reduced to zero in the relaxed sitting and fully flexed postures and that in these positions the intradiscal pressures were raised. No corresponding studies have been completed in the cervical or thoracic spine, but it is probable that similar mechanisms and consequences prevail.

Frequency of flexion

The second most common predisposing factor in the production of symptoms from the cervical spine is the frequency with which the neck is flexed in daily living.

From the time we arise in the morning to the time we retire at night, the head and neck are constantly placed in positions of protrusion and flexion. We wake in the morning and slouch in flexion perhaps on the toilet. We shower or bathe, and flex to dry ourselves. We bend to look down to get into underwear, pantyhose, trousers, socks, and shoes. We protrude our head to shave and put on makeup. We sit slouched in flexion to have breakfast, sit slouched in flexion in the bus, train or car to go to work. We work either sitting slouched or bending forward to work at a desk or computer terminal for four hours and then sit in flexion to have lunch. We repeat the cycle in the afternoon, return home in the same vehicle in flexion, sit in the same chair to dine, and collapse in the lounge chair in order to view television, read, knit or sew. Finally, to add insult to injury, we return to bed at the close of the evening, curl up into a ball, and spend the night in flexion. Being constantly flexed is, in my opinion, the reason for the prevalence of back pain in modern western society.

The first predisposing factor of prolonged sitting leads to postural static loading at end range of flexion in the lower and extension in the upper cervical segments. When this is added to the frequency with which we are required to perform neck flexion, it is inevitable that creep, deformation, and eventually damage and displacement will follow.

Fig 6:2.
Working, sitting and bending postures.

PRECIPITATING FACTORS

Although the majority of patients develop symptoms from the cervical spine for no apparent reason, there are those who clearly recollect the circumstances surrounding the onset of their problem and can attribute this to a specific event or trauma. These patients often recall having been in a position of prolonged static loading immediately prior to the onset of symptoms and state that the pain first appeared after moving from the previously held position. The precipitating movements can be as simple as a turn of the head or raising the head after prolonged flexion, such as would occur after working at a typewriter or computer-terminal. A similar situation can develop overnight, especially in those patients who sleep prone. With the head maintained in a position of end range rotation throughout the night, the patient is predisposed to deformation of the cervical segments if the first movements on waking are incautious.

Lateral flexion or rotation of the head and neck performed *whilst the head is in a protruded position*, especially if the protruded position has been prolonged, can cause immediate symptoms. Movements performed at the time of onset of neck pain are often as simple as combing hair, brushing teeth, sneezing, and even kissing!

Trauma is a common cause of cervical spine problems. Patients subjected to whiplash forces during motor vehicle accidents, and patients participating in a variety of sports where physical contact or falls are common, frequently develop persistent cervical symptoms. The analysis of these injuries is often difficult and where trauma is a cause of the presenting symptoms, rapid reversibility of the disorder is not assured.

In previous publications,[100, 101] I noted that acute problems affecting the lower back commonly arise in the first few hours of the day. The same applies in the cervical region. Adams & Hutton,[3] have demonstrated that the nocturnal imbibation of fluid causes the intervertebral disc to become stiffer and the patient is at risk until compressive forces reduce the fluid volume. Thus patients with *recurrent* lumbar or cervical problems should be warned to be cautious and avoid prolonged end range positions or extreme movements in the first few hours of their day.

CHAPTER SEVEN

The Phenomenon of Pain Centralisation

DEFINITION OF CENTRALISATION

Centralisation is the phenomenon whereby as a result of the performance of certain repeated movements or the adoption of certain positions, radiating symptoms originating from the spine and referred distally, are caused to move proximally towards the mid line of the spine. Movements that cause this phenomenon, once identified, can be used to abolish radiating and referred symptoms. Where patients have pain of recent origin this process can be extremely rapid and can in many cases occur in a few minutes. (Fig 7:1)

Centralisation of pain occurs only in the derangement syndrome during the reductive process. As centralisation takes place there may be a significant increase of localised central pain adjacent to or in the spine itself.

My first experience with what I have chosen to call the "Centralisation Phenomenon" occurred in 1956. A patient, "Mr Smith", (Fig 7:2) who had pain to the right of the low back, extending into the buttock and thigh to the knee, had undergone treatment for three weeks without improvement. He could flex, but could extend only with difficulty. He was told to undress and lie face down on the treatment table, the end of which had been raised for a previous patient. Without adjusting the table he lay in a hyperextended position unknown to any personnel in the clinic. On discovery some five minutes later, he reported that this was the best he had been in three weeks. All pain had disappeared from his leg. Furthermore, the pain in the back had moved from the right side to the centre. In addition, his restricted range of extension had markedly improved. After standing upright, the patient remained improved with no recurrence of leg pain. The position was adopted again the following day and resulted in complete resolution of central low back pain.

During the following two or three years, every patient with low back pain or pain referred to the leg was placed in either the extended position or was asked to repeat extension ten or fifteen times while lying in the prone position. There emerged a consistency of response to these exercises that could not be coincidental.

Patients with certain referred pain patterns would become symptom-free within two or three days. Whenever rapid resolution of symptoms occurred, complete recovery was preceded by change in location of pain from a referred

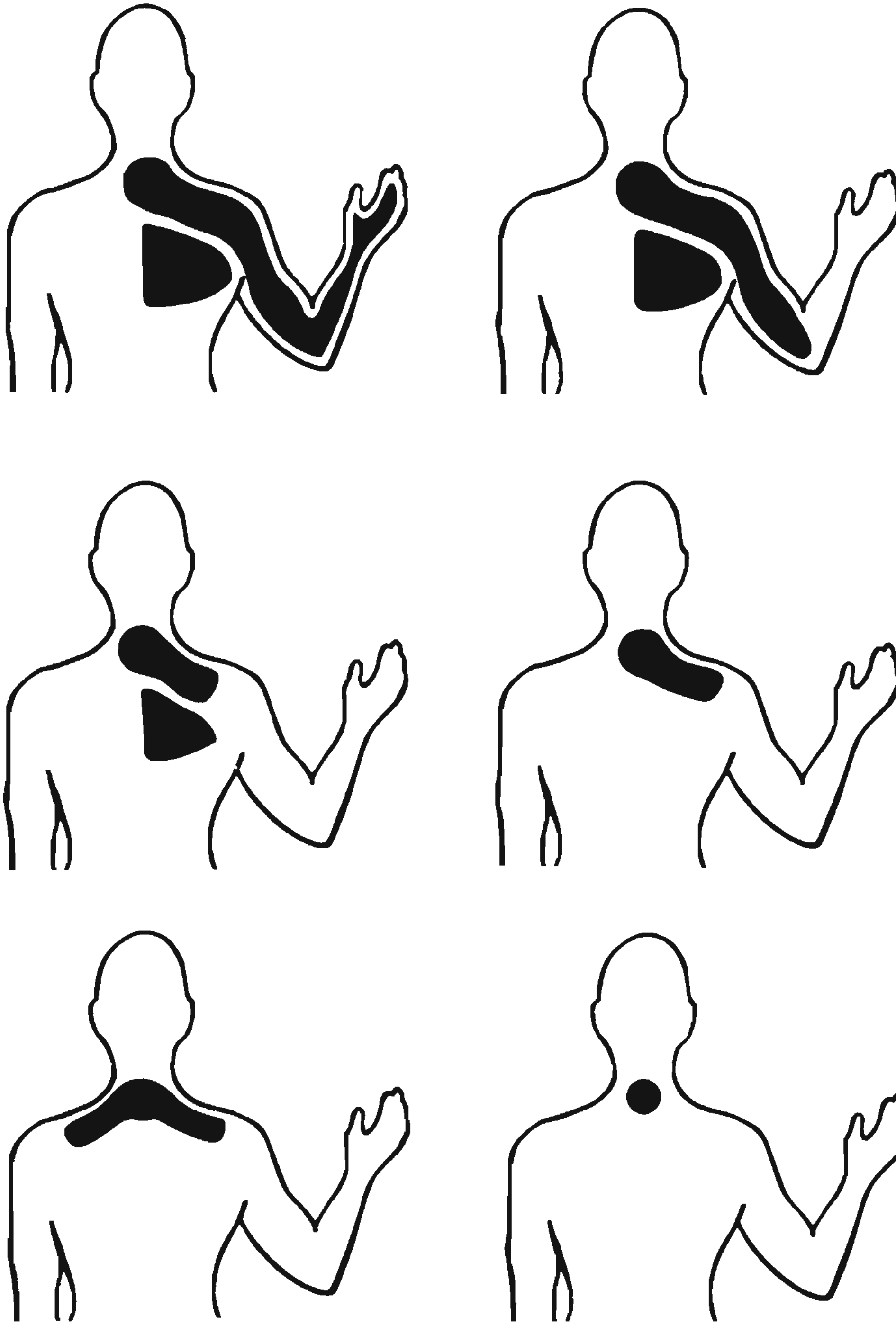


Fig 7:1. *Centralisation of pain.*

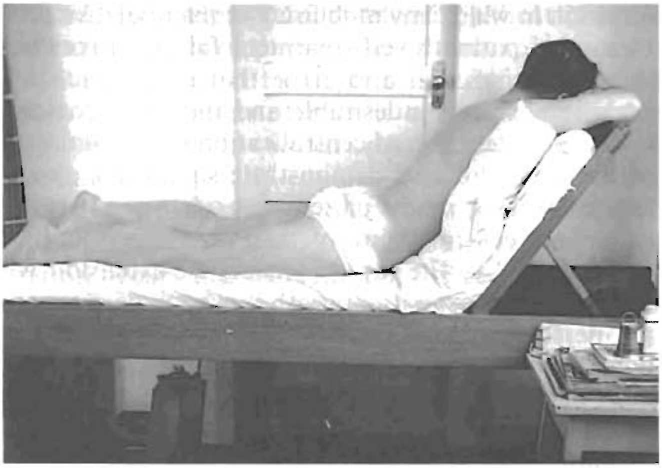


Fig 7:2.
Mr Smith.

to a near central midline position. Referred symptoms were seen to rapidly disappear at the same time as localised central back pain appeared or increased. Once symptoms centralised, referred symptoms would not reappear providing the patient avoided flexed postures. Continuation of the centralising manoeuvre caused rapid resolution of the central low back pain. Consistently, concomitant restriction of extension mobility improved and patients *remained better as a result* of performing the manoeuvres.

Some individuals with unilateral pain would not experience any centralisation as a result of sagittal extension movements, and only after applying lateral flexion in a loaded position would centralisation follow.[100] In others, when lateral flexion was applied perhaps too vigorously, the pain would disappear on one side and appear on the other. Because this change in the location of pain occured regularly, I concluded that by performing certain movements one could influence the site of pain and by experimentation eventually cause the pain to move to, or very close to the mid line. If centralisation of pain occurred, it was my experience that the prognosis was invariably excellent and a rapid response would naturally follow.

Patients whose symptoms were constant and extended below the knee reacted in an unpredictable fashion, many being significantly aggravated rather than improved by these manoeuvres. Referred pain and peripheral symptoms were sometimes exacerbated rather than improved and some patients developed numbness or parasthaesia. If extension was maintained for an excessive period of time or if the exercise was forced to an excessive degree, some of these patients in the experimental years remained worse as a result of the procedures. Many of these patients did not respond to mechanical therapy.

When I realised that movements which cause pain to centralise are desirable and therapeutic, the prognostic significance of centralisation became apparent. It soon followed that movements causing centralisation also indicate the direction in which any mobilising or manipulative procedures should be applied in case of patient's self-treatment failure. Likewise, it became clear during these years of trial and error that movements which cause symptoms to peripheralise are undesirable and therefore contraindicated.

The phenomenon of centralisation most commonly occurs in a population of patients who also demonstrate significant obstruction to a full range of extension. When these patients are subjected to repetitive end range unloaded extension, centralisation of pain develops in conjunction with and directly proportional to the rapid recovery of extension which follows.

Although most patients with low back pain experience centralisation from the performance of extension exercises carried out in the prone unloaded position, there are others, identified by dynamic mechanical evaluation, who must perform extension from a prone laterally flexed position. A further group of patients must repeat flexion movements in order to cause centralisation of pain.

During the experimental years when I was still exploring movements that would cause centralisation, it became clear that change in pain location was even more easily achieved during treatment of the cervical spine. This appeared to be so because of the greater control most patients could exert over their head and neck compared with the lower trunk.

In treating patients with cervical symptoms it was apparent that reduction of derangement remained stabilised only if patients avoided the movements opposite to those that caused centralisation. Patients with cervical derangement could visibly demonstrate rapid deterioration simply by adopting inappropriate positions or making inappropriate movements.

To date, studies on centralisation have been completed only on the lumbar spine. One such study examined the effects of repetitive exercise on pain location in patients with referred pain. Donelson,[41] assessed patients' response to test movements and treatment after the method of McKenzie.[100]

Donelson reported, "Centralisation typically occurs rapidly and can be maintained. In a review of 87 patients centralisation occurred in 76 (87%). It's occurrence during initial mechanical evaluation is a very accurate predictor of successful treatment outcome and reliably determines the appropriate direction of therapeutic exercise. Non occurrence of centralisation accurately predicts poor treatment outcome and is a helpful early predictor for the need for surgical treatment."

"These methods are safe, reproducible, and would appear to be quite effective when directed by an examiner well-trained in the McKenzie evaluation and treatment techniques."

A second study compared the effects of two sitting postures on low back and referred pain.[168] It was found that sitting in lordosis caused a significant shift of referred pain towards the low back. No such change was demonstrated in the kyphotic sitting group.

I am proposing that when pain changes its location, there is change in the location or degree of internal displacement or deformation. Centralisation of pain is a diagnostic tool and outcome predictor in selecting patients suitable for mechanical therapy. Centralisation of pain in the lumbar spine is most commonly, but not exclusively, achieved by applying extension exercises described elsewhere.[100] Non-centralisation of pain is useful in identifying patients who may have pathology in which mechanical therapy is contraindicated or at best unhelpful.

The centralisation phenomenon can be seen to occur when repetitive motion, especially but not exclusively extension, is applied to the other regions of the spinal column. Centralisation occurs just as readily in the cervical spine as it does in the lumbar region. The only difference that exists between applying motion to the lumbar and cervical regions is that, solely because of the anatomical variations between the areas, different movements are required in each region to cause centralisation of pain.

What could possibly account for the rapid change in the location of the patient's pain following the performance of comparatively simple movements or the adoption of everyday postures?

In the conceptual model for internal derangement described earlier in this book, I have proposed that prolonged or repetitive flexion will cause progressive posterior deformation or displacement of intervertebral disc fluids or nucleus pulposus. As displacement develops and increases posteriorly, pressure will be exerted on the postero-central annulus or posterior longitudinal ligament thus causing central mid line or symmetrical bilateral symptoms. Should the patient then perform any type of asymmetrical movement, the displacement will, if still contained, move towards the area of least resistance and least compression, usually posterolaterally within the annulus. This in turn would cause the pain to move from the centre to a posterolateral location. Should bulging of the annulus continue unchecked, the patient would subsequently experience dural and root irritation, and radicular signs and symptoms would appear.

Smith and Wright,[138] have demonstrated that in nerve root compression, the extent of radiation is directly proportional to the degree of pressure on the nerve root. Light compression of the nerve root will cause sciatica reaching down only as far as the thigh whereas stronger compression will cause the sciatica to extend as far as the foot and toes. Thus it follows that a centralisation of pain would occur as the pressure on the nerve root is reduced.

In the conceptual model, centralisation of pain occurs during the performance of precisely controlled repetitive movements which cause a reversal of the displacement process. This reduces the pressure against the inner annulus which in turn decreases distension in the outermost fibres thus diminishing nerve root compression or irritation. This sequence results in the abolition of peripheral symptoms. The conceptual model suggests that as the peripheral symptoms subside the patient may well experience a return or increase of his symptoms in the *central location*. It is my hypothesis that as the displacement is reduced *posterolaterally and moves to a central location*, pressure against the *postero-central annulus and the posterior longitudinal ligament* is temporarily increased, resulting in *more back* pain but *less referred* pain.

Several investigations provide support for the displacement or derangement model,[1, 2, 91, 92, 129, 141, 158] but there are to date no studies that relate displacement to the production of pain nor to the change in the location of pain that has been described in this chapter.

If the phenomenon of centralisation of pain is related to the reduction of displacement within the intervertebral disc, such a process could only occur if the restraining annulus is reasonably competent.

Support for the theory that change in location of pain is related to change in location of mechanical deformation within the intact intervertebral annulus, is provided by one of the pioneering studies of Cloward.[26] At operation under local anaesthetic the anterior surface of the lower cervical discs was stimulated by pressure with a blunt instrument and a weak electric current. When the disc was stimulated in the exact centre, i.e., in the mid line, the patient localised the pain in "the middle of my back" or "between my shoulders on both sides". When the stimulus was applied laterally to the mid line of the disc, even as little as two to three millimetres from the midline, the pain was localised immediately at the "shoulder blade" on the same side. Unilateral pain along the vertebral border of the scapula was located in a focal area about the size of a silver dollar.

Referred pains from the posterior surfaces of the lower cervical discs were localised to the region of the superior angle of the vertebral border of the scapula, the region of the thoracic spinous process, along the anterior border of the trapezius muscle, the shoulder joint, the upper arm as far as the elbow.

Cloward,[26] reported that the same patterns of pain were experienced whether the disc was stimulated externally by the blunt instrument or whether the disc was injected internally. Both anterior and posterior stimulation of the midline of the annulus caused midline or symmetrical bilateral pain to develop posteriorly. Both anterolateral and posterolateral stimulation caused pain to appear unilaterally on the same side as the stimulation.

Cloward's findings indicate that pain arising from the intervertebral disc can change location depending on the site of irritation. These findings allow us to consider the likelihood that repetitive motion producing change in the location of pain, is also causing changes in the location of material loosened within the internally disrupted intervertebral disc.

We do not yet have absolute proof that directly connects displacement within the intervertebral disc to the production of symptoms in patients with non-specific spinal pain. However one recent study,[154] incriminates the disc as the source of pain in a large group of patients with non-specific back pain whose symptoms were reproduced by discography.

CHAPTER EIGHT

Diagnosis

In spite of the technological advances that have been made in the past twenty or thirty years, we are still unable to precisely identify the origin of mechanical spinal pain in the vast majority of patients. Even with the improved imaging technology from computerised axial tomography (CAT) scanning, and with the advent of magnetic resonance imaging (MRI), our knowledge of the precise structure affected and the exact nature of the pathology affecting it is extremely limited.

A special supplement of the journal Spine,[139] is dedicated to "The Report of the Quebec Task Force on Activity Related Spinal Disorders. A Monograph for Physicians". This report was commissioned and funded by the Institute for Workers' Health and Safety of Quebec which was concerned at the increasing cost of treating spinal disorders, especially the cost of physical therapy. The problems of diagnosis are highlighted in the Report which states:

> "Pain is the primordial, and often the only, symptom of the vast majority of spinal disorders. During the acute phase, pain is of nociceptive origin, but the influence of psychologic and social factors on the continuation of pain toward a chronic phase is now increasingly recognised."
>
> "Although there are considerably more clinical studies on patients suffering from problems of the lumbar area than there are on patients with problems in the cervical region, pain develops because of the irritation of structures sensitive to pain, and these are the same for all segments of the spine. These structures are bones, discs, joints, nerves, muscles, and soft tissues. They may be affected by an inflammatory, infectious, neoplastic, or traumatic disease or be the site of a congenital or developmental mechanical defect."
>
> "Nevertheless, it is difficult to identify precisely the origin of the pain, because even if its characteristics may sometimes point to a given structure, the pain often remains unspecific. In addition, it is generally impossible to corroborate clinical observations through histologic studies, because on one hand the usual benignity of spinal disorders does not justify that tissue be removed and, on the other, there is often no modification of tissue identifiable through current methods."
>
> "Of the numerous pathologic conditions of the spine, non-specific ailments of back pain in the lumbar, dorsal, and cervical regions, with or without radiation of pain, comprise the vast majority of problems found among workers (and the incidence in general populations can only be greater)".

It is estimated that 85% of back pain episodes are non specific.[163] Thus only 15% of patients can be specifically diagnosed with our present technology and understanding.

In order to promote a better system of identification of spinal disorders, the QTF recommended that any classification meets the following criteria:

1. Biologic plausibility: the classification is compatible with current knowledge of vertebral physiopathology.
2. Exhaustive classification: it can encompass all clinical cases seen in occupational health.
3. Mutually exclusive categories: the great majority of clinical cases, at one point, shall fit into one and only one category; however, the patient may subsequently move into another category.
4. Reliability: a given case of a vertebral disorder shall be classified in the same manner by two or several practitioners.
5. Clinical usefulness: it will facilitate the making of clinical decisions as well as the evaluation of care.
6. Simplicity: its use will be simple and will neither call for complex paraclinical examinations nor encourage superfluous investigations.

Using these criteria as a guide the QTF has recommended the following classification be universally adopted:

1. Pain in the lumbar, dorsal, or cervical areas, without radiation below the gluteal fold or beyond the shoulder, respectively, and in the absence of neurologic signs.

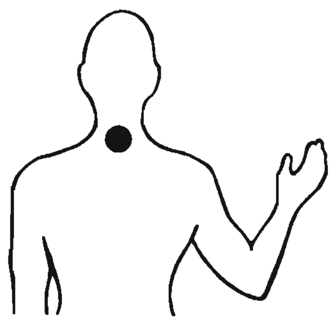
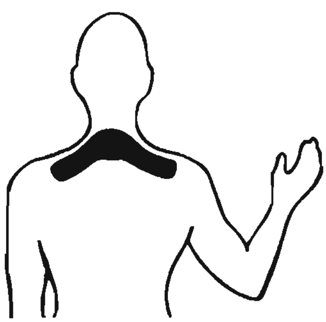
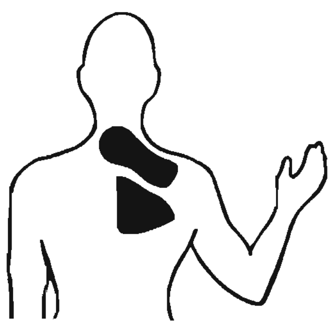


Fig 8:1.
QTF Classification 1





The Report states, "We believe that this category represents most cases. The pain is intermittent or constant, its intensity varying with the patient's tolerance, and is almost always aggravated by mechanical factors."

2. Pain in the lumbar, dorsal, or cervical areas, with radiation proximally (i.e., to an upper or lower limb but not beyond the knee or the elbow, respectively) and not accompanied by neurologic signs.

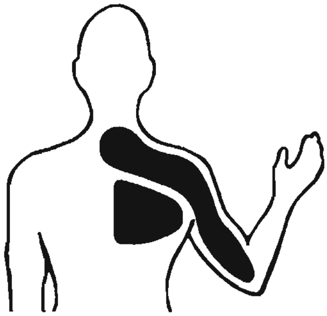


Fig 8:2.
QTF Classification 2

In this category the pain that radiates to the proximal part of the limb can be neurogenic, but it originates most often from the deep structures of the rachis, as demonstrated by the studies of Kellgren,[85] and McCall et al.[98]

3. Pain in the lumbar, dorsal, or cervical areas, with radiation distally (i.e., beyond the knee or the elbow, respectively) but without neurologic signs.

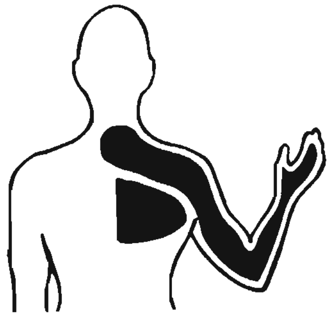


Fig 8:3.
QTF Classification 3

In this instance the pain radiates to the whole limb. It may occupy a specific dermatome, thereby suggesting a radicular origin, or it may be more diffuse. In the latter case it may also be of a vascular or metameric type (pseudosciatica).

4. Pain in the lumbar, dorsal, or cervical areas, with radiation to a limb and with the presence of neurologic signs (e.g., focal muscular weakness, asymmetry of reflexes, sensory loss in a dermatome, or specific loss of intestinal, bladder, or sexual function).

"This category includes the radicular syndromes, which are well described in classic textbooks. These radicular syndromes may be due to various affections, the most frequent one being the discal hernia. However, other mechanical distortions of the spine may trigger an irritation or a radicular deficit."

5. Presumptive compression of a spinal nerve root, on the basis of simple roentgenograms of the spine (eg, instability or fracture of the vertebral column). Simple roentgenograms are of little help in diagnosing a radicular compression, especially of discal origin. It is well known that the narrowing of an intervertebral space, although indicative of disc degeneration, in no way indicates a radicular compression. On the other hand, a normal radiologic image of the intervertebral space does not exclude the possibility of a discal protrusion at that level.

In rare cases of fractures, infectious or neoplastic osseous lesions, reduction in the diameter of the foramen, or vertebral instability, however, simple radiographs may allow the assumption of a radicular compression. A diagnosis of instability must nevertheless be made with caution and must be limited to cases in which radiographs in flexion and in extension show an obvious increase of the angle drawn by the adjacent vertebral plates and/or a motion of 4mm or more. It is therefore evident that simple radiographs do not provide information adequate to justify discal surgery.

6. Compression of a spinal nerve root confirmed with either specific imaging techniques (computerised axial tomography, myelography, discography, venography, or magnetic resonance imaging) or other methods (EMG, nerve blocks). The relatively low specificity of diagnostic imaging techniques should nevertheless be noted. For example, 20-30% of asymptomatic subjects may have a disc protrusion, as demonstrated with myelography or computerised axial tomography. However, in prospective studies of subjects with radicular pain and neurologic signs, myelography and computerised axial tomography had high sensitivity and specificity.[55, 65]

Electrodiagnosis, including electrostimulating techniques (F wave, H reflex) can detect a radicular lesion. Studies referring to surgical observations have an 85% correlation with myelography. Also, electrodiagnosis allows for differential diagnosis between a radicular lesion and other neurologic disorders.[13, 16, 47, 88, 106, 107]

Thermography, sometimes used to demonstrate a radicular compression, still has not been evaluated scientifically in a satisfactory manner.

7. Spinal stenosis, confirmed objectively with the use of computerised axial tomography or myelography. The spinal stenosis syndrome generally affects patients aged 50 years or older. It is characterised by a lumbar pain increasing during the day, pain in one or both legs, and parethesias triggered and increased by walking. Degenerative changes are generally seen on ordinary roentgenograms, and the diagnosis is confirmed with the use of myelography or axial tomography.[155]

8. Postsurgical status within 6 months after surgical interventions (eg, discectomy, laminectomy). This category refers to patients who had surgery in the preceding 6 months. It includes 1) patients who do not suffer from pain but are still going through a rehabilitation program with the objective of resuming their usual work; and 2) patients for whom

surgery has been unsuccessful. Generaly, patients who have had a laminectomy and/or discectomy return to work after approximately 3 months, whereas patients who have had a vertebral arthrodesis do so after about 6 months.

9. Postsurgical status more than 6 months after surgical intervention.
9.1. Asymptomatic. Patients who were operated upon and either became asymptomatic or suffer from occasional pain not sufficient to interfere with their work.
9.2. Symptomatic. Patients who still suffer from spinal and/or radicular pain, which has persisted after the operation or recurred after an asymptomatic period. In the former instance, the possibility of another discal hernia is less than 20%; in the latter, with the usual diagnostic evidence, a second surgical intervention will confirm the diagnosis in 70-80% of cases. However, there is no certain means to distinguish a new discal hernia from a compression due to perineural fibrosis.

10. Chronic pain syndrome. The presence of a treatable active disease has been carefully eliminated. Pain, with its consequences, has become the patient's main preoccupation, limiting his/her daily activities. Some psychologists,[53] maintain that this pain represents a behaviour reaction, whereas neurophysiologists lean toward the hypothesis that nervous structures irritated for a prolonged period generate new mechanisms of pain generation. Chronic pain has also been described as a variant of depression. The chronic pain syndrome is sometimes associated with objective signs (ie, limitation of motion, hyperesthesia, muscular weakness, etc). However, in the majority (70-80%) of patients, there is no evident major objective sign.[151] To this category is attached the suffix W (working) or I (idle) as in Categories 1-4.

11. All other diagnoses (eg, metastases, visceral disease, compression fracture, spondylitis).

The QTF recommendations support the concept of classification of the non-specific spinal disorders by utilising pain patterns. The first four categories of the Task Force classification are very similar to the pain pattern classification system adopted by myself in 1972.[100] *The reader will find the same descriptions in place in later chapters in this book.*

The QTF classifications 1-4 describe progressively more complex and by inference more complicated pathology of unknown aetiology. (Classification 1 being the least complicated and 4 the most severe) As the extent of radiation increases the classification of the patient's problem changes from a less to a more complex one. For example the patient with simple back pain (Classification 1) is placed in a more severe category if that pain is later felt as far as the knee. (Classification 2) The category becomes even more severe if the pain is felt below the knee (Classification 3).

Peripheralisation of pain may result from increasing compression of the nerve root as well as from increasing deformation of articular structures. Repeated movements that produce increasing peripheral symptoms are therefore contraindicated. Conversely it is clear that centralisation of pain results from a reduction in the degree of deformation or compression of the nerve root and movements and positions that cause centralisation are therefore indicated.

By causing tingling in the outer toes to cease and pain felt below the knee to change location to the vicinity of the buttock and mid back, we reduce the severity of the condition as it changes from QTF classification 4 to 2.

Thus we must develop our skills in identifying procedures that consistently cause pain centralisation as I believe it to be the most reliable clinical sign available.

DIFFERENTIAL DIAGNOSIS

The first four categories of the QTF classification describe the patients that are most commonly referred for conservative physiotherapy by physicians. It has always been my belief that the differential diagnosis should be established by the patient's family practitioner who, according to Deyo,[33] provides the most common source of care in the United States of America. A similar situation exists in New Zealand.[21] The patient, once screened by the medical practitioner, should have had unsuitable pathologies excluded. We may then proceed with the patient evaluation and identify the appropriate syndrome and treatment strategy.

PATIENT SELECTION

The first three groupings of the classification of the QTF are those ideally suitable for a dynamic mechanical evaluation by repetitive end range motion. The effect of the dynamic evaluation on pain patterns can determine, usually on day one, the status of the spinal structures and their potential to react to certain manoeuvres. By using such an assessment we are able to classify subgroups in the non-specific spectrum of spinal disorders. This in turn allows us to identify those patients who may be helped and eliminate those who are unlikely to respond to mechanical therapy.

Patients in QTF classification 4 demonstrating significant motor deficit and severe pain, constant in nature, are less appropriate for this system of therapy but identification of exceptions to this are described under Derangement Five and Six, Chapter 17.

In general it can be said that patients in Task Force categories 5, 6, and 11 are totally unsuitable for mechanical evaluation of this type. However, the mechanical evaluation should not necessarily be withheld from patients in group 7, 8, 9.2 and 10, for useful diagnostic information can be obtained using repetitive motion or by the provocation of certain symptoms. This is especially applicable to classification 9.2.

I have reservations regarding the QTF classification 10, Chronic Pain Syndromes. Although the statement is made that treatable active disease has been ruled out in this classification, the question arises: if we accept that patients symptoms are genuine and the functional impairment real, into which category do we place patients whose treatable disorder has so far failed to resolve with current measures? The QTF classification suggests that preoccupation with pain is the reason patients symptoms persist. This suggests that all patients must respond sooner or later to our expertise, and if they do not they are preoccupied with pain. It suggests that if pain persists after we have exhausted our treatment options it is the patient' psyche that needs attention. The QTF classification 10 provides for us a convenient dumping ground for patients who refuse to respond to our treatments. Is the patient's preoccupation with pain the real problem? Or is the real problem our inability or negligence or both? Or is the problem caused by inappropriate compensation laws?

INDICATIONS

Of the patients selected for treatment using the QTF classification, the presence of additional factors identify those particularly responsive to the treatment protocols described in this text.

Recurrence

The first group includes those patients who experience recurring episodes of pain felt in the neck itself or referred to the upper scapula, mid scapula or the limb proximally, as well as patients who suffer from headache of cervical origin. These patients describe periods when, for perhaps weeks or months at a time, they are symptom free and then, unexpectedly, they develop a further bout of the familiar problem. Data gathered in my own clinic,[99] indicated that patients with recurring episodes of low back and referred pain can be taught self reductive procedures that diminish the degree of pain and disability and the incidence of recurrence, thus demonstrating that a long-term benefit could be obtained from treatment. Although I gathered no similar information from patients with cervical problems, my experience with the upper spine has been that similar or slightly better results can be achieved in this area.

Intermittence

The second and perhaps largest group of responsive patients are those whose symptoms are felt intermittently: that is, there are times in the day when, as a result of adopting certain positions or performing certain movements or for no apparent reason, the patient has no pain. Even in those patients whose symptoms have been present for months or years and in those who have been diagnosed as chronic, intermittent symptoms indicate the likelihood of good prognosis.

Most patients with symptoms referred below the elbow intermittently should respond well to the recommended procedures. Should constant pain or parasthaesia develop below the elbow with accompanying neurological motor weakness, rapid resolution is a much less likely event, and failure to respond directly to conservative care is common.

Generally speaking, symptoms felt intermittently respond rapidly to appropriate mechanical therapy, whereas symptoms of a constant nature, in particular when present over a longer time period, tend to respond slowly. However, patients with constant symptoms, even when referred, respond rapidly with sufficient frequency to make a dynamic assessment well worthwhile.

A good indication of patient suitability for this approach to treatment is often obtained on day one during the process of evaluation itself. If, during the initial testing procedures, pain centralisation or a change in location or intensity of pain occurs, it is invariably indicative of good prognosis.

CONTRA-INDICATIONS TO MECHANICAL THERAPY

The following conditions are contra-indicated in mechanical therapy.

1. Malignancies, primary and secondary.
2. Infections of all sorts.
3. Active inflammatory diseases: rheumatoid arthritis, ankylosing spondylitis, gout.
4. Central nervous system involvement: cauda equina lesions, cord signs and symptoms, neurological diseases such as transverse myelitis.
5. Severe bone weakening diseases: osteoporosis, advanced osteomalacia, Paget's disease.
6. Fractures, dislocations and ligamentous ruptures.
7. Instability: last two months of pregnancy, the upper cervical spine in Rheumatoid arthritis, children.
8. Vascular abnormalities: vertebro basilar artery involvement, visceral arterial disease, haemophilia.
9. Advanced diabetes—low tissue vitality.
10. Increasing and peripheralising signs and symptoms.
11. Severe pain, severe spasm.
12. Psychological conditions.

CHAPTER NINE

The History

Taking an accurate history is the most important part of the initial consultation when one is dealing with any medical or surgical problem. Unfortunately, when we are required to manage common mechanical spinal problems there is still lack of understanding regarding the nature of the questions that should be asked, the reasons for asking them, and the conclusions to be drawn from the answers.

Some recommended systems of examination have a multitude of questions to be answered and, after careful scrutiny, one can only wonder at the relevance of many. We should ask ourselves constantly, "Will the answer to the question on the assessment form provide information of practical value in the treatment of this patient?"

Some clinicians obtain large amounts of detailed information, which is idealistically appropriate, but may not be helpful. We are told that the clinician has a simple choice. If he or she wishes to obtain a large range of detailed information it must be realised that much of it will be irrelevant or unreliable. (117) If we limit the ammount of information, we will increase its reliability and relevance.

The questions described here *provide essential information and must be answered accurately*, if one is to reach a meaningful conclusion following the examination of patients with mechanical spinal pain. Every question has been designed to provide relevant information and I have attempted to explain the reasoning behind the questions and the possible implications of various common responses.

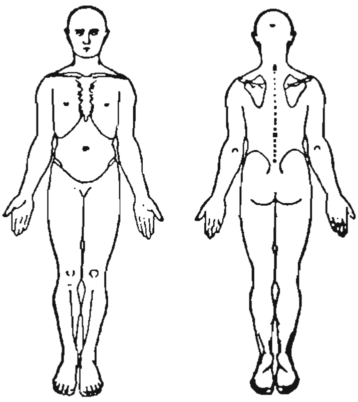
THE INTERVIEW

As well as the usual questions regarding name, age and address, one should enquire as to the occupation of the patient with particular regard to the nature of the working posture. This provides us with important and relevant information regarding the static or dynamic forces present in the patient's daily environment, some or all of which may need to be modified. Managers are not always sitting down as we tend to believe, and postmen are not always walking.

In what areas have you felt pain during this episode?

We need to know the precise location of all pain experienced during the current

THE McKENZIE INSTITUTE
CERVICAL SPINE ASSESSMENT



Date ....
Name ....
Address ....
Telephone ....
Date of birth ....
Occupation ....
Postures / stresses ....
Doctor ....

HISTORY

NECK PAIN

No Pain — Worst Possible Pain

ARM PAIN

Symptoms now ....
Present for ....
At onset ....
Improving / unchanged / worsening
Commenced as a result of ....

Commenced for no apparent reason ☐
Symptoms constant ....Intermittent ....
Worse
sitting prolonged bending turning lying / rising
am / as day progresses / pm stationary / on the move
other ....
Better
sitting prolonged bending turning lying / rising
am / as day progresses / pm stationary / on the move
other ....
Disturbed sleep ....Pillows ....
Sleeping postures ....prone / supine / sidely
Cough / sneeze / swallow + ve / − ve Gait ....
Dizziness / tinnitus / nausea ....Motion sickness ....
Previous history ....

Previous treatment ....
X-Rays ....
General Health ....Weight loss ....
Meds ....Steroids ....
Recent surgery ....
Accidents ....

Fig 9:1. *Cervical assessment form — history* sode and the location of these should be marked clearly on the body outline the assessment form.

Details about the location of the pain will give us some indication of the el involved, the extent of the lesion and its severity. If there are any ociated symptoms such as weakness felt in the upper extremity, raesthesiae, numbness, or pins and needles, their location must be noted well. Referred pain of recent onset indicates that derangement is present.

At this stage we must determine whether the symptoms are central, bilateral unilateral in origin, as this is an important factor in the classification of patient and consequently in his treatment. Bilateral symptoms indicate entral origin, whereas central symptoms are most unlikely to arise from inilateral structure.

Pain which changes its location or appears and disappears is easily treated d the prognosis good. Pain which appears in a particular area and never oves or ceases is usually difficult to treat and the prognosis less certain.

ow long has the pain been present?

e Report of the Quebec Task Force recommends the adoption of a revised mula for classifying acuteness of spinal disorders.

ute – Pain present for less than seven days.
b-acute – Pain present for seven days to seven weeks.
ronic – Pain present for longer than than seven weeks.

s important to determine whether we are dealing with an acute, sub-acute chronic condition. In recurrent disorders affecting the upper spine and neck, want to know how long the present episode has been evident. (We should t allow ourselves to be distracted by the past history at this point in the erview for it can cause much confusion and we may prejudge the issue.)

Symptoms present for seven weeks or less, even though they may not have ontaneously improved during this time, are usually rapidly reversible and prognosis is good except where referred pain appears below the elbow d is truly constant in nature.

Do not make the mistake of classifying the patient as chronic merely because symptoms have recurred over a period of many months or years. Pain esent daily over such a period is chronic, but where recurring episodic pain pears and disappears with monotonous regularity and with extended periods en no pain at all is felt, the patient is not suffering from a chronic condition t is experiencing regular recurrences of the same or similar displacement. cause many people have the common cold once or twice a year, every year, do not suggest that they have a chronic cold. Patients with episodic spinal in recurring over several years can have an excellent prognosis in contrast those patients whose pain is truly constant over such a period and who en have poor prognosis.

The length of time that the condition has been present and a description the recent behaviour of pain may assist us to determine the stability of aling following a disc prolapse. It may also indicate the development of dysfunction which is likely to occur following trauma or derangement. The longer the symptoms have been present, the greater are the chances that adaptive changes will have occurred.

The length of time that the patient has had symptoms can also guide us in deciding how vigorous we can be with our examining procedures. If a patient has had symptoms for several months and maintained activity during this time, he will probably have placed more stress on the joints at fault than is likely to occur during our examination, which means that we can be fairly vigorous. If, on the other hand, the patient had a sudden onset of pain within the past two weeks, we could be dealing with a fragile derangement and may well increase the degree of derangement with our test procedures which, if applied too vigorously, may significantly worsen the patients condition.

Generally speaking, if the problem has been present only for a few days to two or three weeks, we must take great care in handling and exercising the patient; but if the present pain has been evident for months, we can be rather vigorous with our procedures.

Where was the pain at onset?

The location of the initial pain must be established as early as possible in the examination, for a change in location may indicate that centralisation or peripheralisation can occur, which in turn is the key to mechanical diagnosis.

The pain may have been present in the same location or locations since the onset or it may have moved more distally or proximally during that period. The location of the pain can and very often does change rapidly in many patients and it is necessary to determine the areas to and from which it may move. Rapid changes in pain intensity and location indicate the presence of derangement.

Is the pain improving, worsening or unchanging?

If the symptoms have been present for an extended period of time as is often the case, we must find out whether the patient feels that his condition is improving, unchanging, or worsening.

In the case of rapidly improving symptoms we can take advantage of the situation by avoiding anything that may delay recovery (such as commencing manipulative procedures).

If recovery is slowly proceeding or if the symptoms are unchanged, assessment and treatment should proceed in a routine fashion.

In cases where the patient's condition is worsening there is no doubt that extra care in the assessment process is vital and treatment should be monitored constantly during the first few days.

How did the pain commence?

Just living on the planet the way we do in this modern age can give us a pain in the neck! During the early 1970's I had cause to assess the number of patients with pain of spinal origin who recalled causative factors. When compared with those who reported symptoms arising for no apparent reason, it was found that only one in every three patients,[102] recognised a causative factor. A high incidence of symptoms appearing for no apparent reason would suggest that environmental factors play an even greater role than trauma in the production of mechanical spinal disorders. However, this question may not always evoke a straightforward answer where litigation or compensation is too readily available and inadequately administered.

Basically we want to find out if there was an apparent or obvious cause for the onset of the problem. Where external forces have been experienced and trauma is likely, we may have to allow more time for healing and we must exercise more caution in the delivery of external forces during the treatment process.

Fortunately, environmental strains can be reduced by correcting various faults in sitting, lying and bending postures and by performing corrective movements regularly throughout the day.

However, if the pain commenced for no apparent reason and is gradually and insidiously worsening, we may well suspect serious pathology, particularly if the patient feels or looks unwell at the time of interrogation.

Careful evaluation of the patient's history regarding the onset of symptoms is necessary in order to avoid faulty conclusions. There are situations in which the patient thinks that his pain commenced for no apparent reason, whereas we may recognise a causative strain; alternatively the patient may wrongfully relate the onset to certain activities in an attempt to find a cause for his pain, which in fact appeared for quite different reasons.

Is the pain constant or intermittent?

It is my observation that over seventy percent of patients with non specific mechanical spinal problems have intermittent pain, and only thirty percent have truly constant pain. Patients with constant mechanical pain are likely to belong to the derangement category. Derangement alters the tension in the structures about the segment involved, increasing mechanical deformation in some tissues and decreasing it in others. Increased tension produces constant pain which will remain so until the tension is either decreased by a reduction of the derangement or by adaptive lengthening of shortened tissues. Increased tissue tension resulting from a derangement can be resolved rapidly, whereas increased tissue tension resulting from adaptively shortened structures resolves slowly.

If the patient's pain is intermittent, it is unlikely to be chemical in origin. If the pain is constant it may be mechanical, but it could also be chemical. As the appropriate treatment can only be commenced after the true cause has been established, the above question must be answered with absolute certainty.

Many patients with symptoms persisting over several months have lost their objectivity. Because the pain is felt at some time in every day, they consider their pain to be constant when in fact there are times in the day, under certain circumstances and in certain positions, when no pain is present. To clarify the situation, I usually ask, "Is there any time in the day or night during waking hours when you have no pain or discomfort?"

Pain that ceases when the patient adopts certain postures must arise from mechanical and not chemical sources. Intermittent pain of this type is always produced by mechanical deformation. The presence of intermittent symptoms appearing only under mechanical loading excludes inflammatory causes and allows for a completely mechanical approach to treatment.

Should the patient's pain be constant, it is possibly mechanical and produced by constant mechanical deformation as occurs in internal derangement. Constant mechanical pain arising from this cause will frequently become intermittent when movements or positions are adopted which sufficiently reduce the derangement and the resulting mechanical stresses. The pain will remain better as a result providing the patient avoids provocative movements or positions which increase the derangement and resulting mechanical stresses, which in turn allows the pain to reappear and perhaps worsen.

Chemical pain is usually described by the patient as an ache which is present all the time irrespective of positions or movements. Chemical pain will develop when chemical irritants are present in sufficient concentrations, and arises in the presence of inflammatory and infective disorders or up to twenty days following trauma. Chemical pain following trauma reduces steadily as healing progresses. Chemical irritants do not appear and disappear during the course of the day. Therefore, pain of chemical origin is always constant, and patients who describe periods in the day when no pain is present have intermittent pain which must be of mechanical and not chemical origin.

Mechanical stresses that would normally be painless, can become painful where chemical irritation has raised the threshold of excitation of the nociceptive receptors. *Thus movements superimpose mechanical forces on an existing chemical pain and may enhance it, but they will never reduce or abolish chemical pain.* This is significant when analysing the effects of repeated movements in the differentiation process.

Pain of chemical origin will be constant and no mechanical means can be found to significantly reduce it. It will never reduce and remain reduced as a result of positioning or exercise. Five days of treatment and observation should be sufficient to clarify the situation.

Pain must be classified as being intermittent even if the patient states that there is only half an hour in the day when he or she feels completely pain-free. In that half hour there is no mechanical deformation present. We must examine the circumstances in which the patient is pain-free and utilise this information for treatment purposes. If there is one hour in the day when no mechanical deformation is present, it is possible to gradually extend that pain-free time period after identifying the positions or movements that produce the relief. Constant pain, on the other hand, is difficult to treat because finding a position or movement that significantly reduces the pain is sometimes impossible.

Patients with the postural and dysfunction syndromes will experience intermittent pain. Patients with the derangement syndrome, may experience constant or intermittent pain.

What makes the pain worse? What makes the pain better?

Essentially this question is asking, "What increases and what reduces mechanical deformation of the affected structure?" Put more simply, "What pulls you apart?", and "What reduces or stops that process?".

We must specifically ask about prolonged sitting, lying, and activities which involve prolonged bending. Besides rotary movements, these postures usually have significant effects on the symptoms of patients with upper back and cervical problems and a description of their effects on pain provide the best source of information. In these positions the biomechanical stresses in the upper thoracic and cervical spine are relatively well understood, and therefore we will be able to determine which situations increase and which decrease mechanical deformation. We must carefully record any position or activity reported to reduce or relieve the pain, as we will utilise this information in our initial treatment. We must also identify those positions and activities which cause an increase in symptoms, and thus educate the patient from day one in avoiding damaging situations.

Sitting:

In relaxed or prolonged sitting the head and cervical spine fall into a protruded position causing anterior translation and flexion in the lower segments and extension in the upper segments of the cervical spine, the effects of which are described in detail in Chapter 13 – The Postural Syndrome. If a patient tells us that sitting increases his symptoms, we know that maintaining a protruded head posture is producing mechanical deformation of the cervical segments. But if a patient finds relief in sitting, this posture must be reducing mechanical deformation.

Activities which involve bending:

In bending or prolonged bending the upper thoracic and cervical segments are flexed. Thus if prolonged or intermittent bending are increasing the patient's symptoms, it becomes obvious that flexed postures and exercises are to be avoided.

Patients who have had pain for a long time may have difficulty in determining what makes their pain better or worse: they are no longer able to observe objectively their own pain patterns because of the length of time the pain has been present. It is necessary to spend extra time to extract detailed information regarding the pain behaviour, because without this we cannot proceed to an adequate conclusion and appropriate treatment.

Occasionally a patient will tell us that there is no position or movement which affects the pain. In this case, the information obtained from the history is insufficient, and during the examination we must try to produce a change in the patient's symptoms by using repetitive end range testing movements or sustained positions.

Turning:

As rotation of the head and neck is often acutely restricted in some and unaffected in other patients, we must establish the presence or otherwise of this problem. Markedly painful and restricted rotation usually arises from upper cervical spine problems rather than from the lower segments.

Lying:

There are three basic positions which may be adopted while lying; prone, supine and side lying.

Many variations exist between these which make evaluation of the effects of lying rather difficult. Apart from the lying position itself, the effects on the cervical spine depend on the nature of the surface on which one lies and the type of pillow in use. It is therefore necessary to identify the number of pillows used and their construction (kapok, feathers, foam or rubber, moulded or chipped).

Lying prone generally causes the head to be fixed for long periods in a position of extreme rotation and, depending on whether a pillow is in place or not, in extension as well.

Lying supine with a pillow in place will cause flexion of the neck, and this is likely to be increased when more than one pillow is used.

Side lying will cause excessive lateral flexion if too many pillows are in place or if the pillow in use is too thin. Side lying also allows a significant ammount of both flexion and extension to occur and the extent of this must be determined.

Are you better or worse on waking in the morning?

Patients who wake in the morning with symptoms that were not present the night before, or patients whose pain is worse in the morning than when they retired the night before, are probably either using an unsuitable pillow or are adopting an inappropriate posture overnight.

Patients who wake in the morning with pain much reduced from that present the night before, usually deteriorate as the day progresses. Poor postural work habits are usually responsible for this situation.

Are you better or worse as the day progresses?

Patients whose pain worsens as the day progresses or in the evening, and who recover after a night's rest, are describing the typical history associated with poor postural habit. As the day passes they tire easily, slouch and eventually "hang" on the supporting structures.

Are you better or worse when moving? Are you better or worse when still?

If the patient is better when moving and worse when still, he is describing the consequences of static loading (usually in poor postures) and the need he has to constantly change position to unload the affected area.

Patients with the Postural and Dysfunction Syndromes will usually develop symptoms only at the end range of postures and have no symptoms when upright and moving.

Usually when walking briskly we adopt an upright and purposeful posture. When we stop to converse or observe, our posture changes and within two or three minutes we fall into a slouched position with the the head and neck protruded, the thoracic spine flexed and the lumbo sacral joints in a position of extension.

Patients with the derangement syndrome who have constant pain, will increase loading on that displacement in any position maintained for more than ten minutes or so. Pain will increase to such a degree that they must resort to frequent change of position to obtain relief. Unless they happen by chance to recognise the signs, they rarely identify the position that will actually reduce the displacement.

Patients with severe acute pain and associated deformity such as kyphosis or torticollis usually state that they are better when still, once they have found a comfortable position, and are worse with movement.

Patients with acute pain from brachialgia are usually better resting and become worse with activity.

Is the present problem disturbing your sleep?

If the patient's sleep is disturbed by pain during the night, either an unresolved derangement should be suspected, or the sleeping surface or pillow in use is unsuitable and requires change. Disturbed sleep experienced over many nights can severely test the patient's tolerance and can eventually disrupt the domestic harmony and lifestyle. It is therefore important to identify the causes in the first few days of treatment.

Does it hurt to cough, sneeze or swallow?

Localised neck pain which is felt when the patient coughs or sneezes may be produced by the involuntary movements occurring at the time or may arise from the increased pressure in the intervertebral disc, but the differentiation is sometimes difficult to make.

Pain is sometimes reported to be felt at the anterior or anterolateral aspect of the throat and in such cases it is suggestive of the anterior derangement.

Do you experience dizziness, ringing in the ears or nausea?

If the patient is experiencing, or has experienced in the past, dizziness, tinnitus or nausea, especially related to certain movements or positions, it will be necessary to investigate the origin of these symptoms. More often than not such symptoms arise from a disturbance within the vestibular apparatus (semicircular canals) and can be ignored in these cases.

The possibility that such symptoms may arise from vertebral artery or basilar insufficiency must be constantly borne in mind and the appropriate tests completed to exclude this possibility, for the condition absolutely contra indicates any form of mechanical therapy. (See Cervical Headache Syndrome)

Have there been previous episodes of upper back or neck pain?

We should enquire about the nature of any previous symptoms in the region of the upper back and neck, the time span over which they have occurred, and their frequency.

An episodic history indicates recurring derangement. Recurrent derangement leads to the insidious development of dysfunction when episodes have occurred over an extended period of time. With each episode, minor damage and accumulative repair alters the elastic properties of the tissues involved and mobility is progressively reduced.

Underlying dysfunction from previous episodes may be the predisposing factor in any present episode. Underlying dysfunction may also co-exist with, but be masked by, the derangement causing the present consultation. Its presence will be revealed after the resolution of pain resulting from the derangement.

Significant dysfunction may follow the resolution of a severe bout of brachialgia.

Previous treatment?

Essential details of previous treatment may or may not be of value but should be recorded. If previous treatment was apparently successful, but was carried out over several weeks, it may well have played no part in the recovery process.

If the previous treatment consisted of a mixture of manipulation and exercises, it is important to ascertain whether these were applied sequentially or were blended from the first treatment. It is difficult to identify the therapeutic procedure of value in the latter case.

Radiological findings and their importance

Based upon the literature reviewed by the QTF,[139] diagnostic radiology is of limited value in the first evaluation of the majority of spinal disorders.

However, as reports of radiological investigations are frequently routine and readily available we should be aware of any significant anomalies or pathologies. Whenever atypical features appear in the patient's history, and an associated atypical response arises from the test movements, it is wise to have radiological investigations completed.

Routine radiological examination of any patients should follow where the application of significant forces preceded the onset of pain.

Dillin,[38] found "Plain roentgenograms are not helpful because the incidence of disc degeneration in patients over the age of 55 is 82% and there is little correlation between symptomatic and asymptomatic groups and structure change on roentgenographic examination.

Penning[120] reports that routine radiological examination of the cervical spine provides some view of the degree of degenerative change present, but gives no information regarding functional or dynamic impairment. Routine x-rays exclude serious pathologies, but do not disclose the presence of instability.

A recent study showed that radiographs, whether analysed by a chiropractor or a radiologist, have little value in determining the presence or absence of back pain.[58]

With the advent of Computerised Axial Tomography, (CAT Scan) Magnetic Resonance Imaging (MRI) and discograms, the sophistication of investigations has advanced rapidly with enormous benefits for the patients and clinicians alike. Where available, these procedures have an important place in the diagnosis of the complex patient.

Deyo,[34] recommends that X-Rays be taken if any of the following circumstances apply:

1. Age over 50 years
2. Significant trauma (fracture risk)
3. Neuromotor deficits (to rule out spondylolisthesis, tumor)
4. Unexplained weight loss (symptom of malignancy)
5. Suspicion of ankylosing spondylitis (based on clinical criteria such as those of Calin *et al.*[22]
6. Drug or alcohol abuse (risk factors for osteomyelitis, osteoporosis, trauma)
7. History of cancer (making metastatic disease more likely)
8. Use of corticosteroids (increased risk of infection, osteoporosis)
9. Fever (potentially a sign of osteomyelitis or epidural abcess)
10. Failure to improve with conservative therapy (since 80-90% of episodes of acute mechanical pain improve within weeks, those that do not are more likely due to infection, neoplasm, or inflammatory spondylitis)
11. Seeking compensation for back pain (x-rays usually needed for legal purposes; not necessarily for medical purposes).

It seems reasonable and prudent to adopt Deyo's recommendations in deciding whether radiological investigations should be undertaken.

Further questions

On medication at present? (May impair ability to accurately report pain change.)

Staggering gait, drop attacks, paraesthesiae in the lower limbs? (Could indicate spinal cord symptoms.)

On steroids? (Increased risk of infection or osteoporosis.)

General health? – recent weight loss? (Could indicate presence of more sinister pathology.)

Major surgery or accident, recently? (Could indicate the presence of significant complication to routine treatment.)

Saddle anaesthesias? Bladder control? (If abnormal indicates probable cauda equina lesion.)

Information gained from these questions may complete the picture of the conditions we are dealing with.

Although the referring medical practitioner will almost certainly have excluded any serious or unsuitable pathology, we must remain alert for its presence.

EXAMINATION

POSTURE

Posture sitting .... Posture standing ....

Protruded head posture ... yes / no Deformity ....

MOVEMENT LOSS	maj	mod	min	nil		maj	mod	min	nil
Protrusion					Sidebending (R)				
Flexion					Sidebending (L)				
Retraction					Rotation (R)				
Extension					Rotation (L)				

TEST MOVEMENTS

	Symptoms prior to testing	Symptoms after testing	Pain during motion	End range pain
	PRO			
Rep	PRO			
	FLEX			
Rep	FLEX			
	RET			
Rep	RET			
	RET EXT			
Rep	RET EXT			
	SB (R)			
Rep	SB (R)			
	SB (L)			
Rep	SB (L)			
	ROT (R)			
Rep	ROT (R)			
	ROT (L)			
Rep	ROT (L)			

STATIC TESTS ....

NEUROLOGICAL

Muscle strength .... Reflexes ....

Dural signs .... Sensation ....

OTHER

Shoulder girdle ....

Special tests ....

CONCLUSION

Posture Dysfunction Derangement no.

Other ....

PRINCIPLE OF TREATMENT

Posture Correction Extension Flexion

Other ....

Fig 9:2

CHAPTER TEN

Clinical Examination

To be successful, the clinical examiner must have a firm understanding of all the mechanical disorders that could possibly occur. The clinician must be able to relate the effects of the application of mechanical test movements on the pain behaviour to the mechanical disorders known to exist. It is the behaviour of pain in response to our mechanical evaluation that determines whether the patient is to be classified in one of the three syndromes (Posture, Dysfunction, or Derangement), or if recovery from trauma requires more time for complete healing. It may also be possible that a non mechanical disorder is present.

In order to apply appropriate therapy, the clinician must be able to determine the nature of the syndrome and have a complete comprehension of the underlying principles of treatment.

Having digested the information supplied by the referring doctor, extracted as much relevant information as possible from the patient, and checked the radiologist's report, we may proceed to the clinical examination proper.

EXAMINATION OF POSTURE

The posture that the patient naturally adopts while both sitting and standing will be observed and recorded. The patient should sit in an upright or straight-backed chair while the history is being taken. During this time the true nature of the sitting posture will be revealed. Usually after a few minutes of sitting the patient will assume his habitual sitting posture. (Fig 10:1) When the patient rises to undress after the interview we should observe the way he rises from sitting, his standing posture, his gait, the way he moves, and any deformity that may be obvious.

Posture sitting

If the patient has been sitting during history-taking, we will already have a good impression of his posture (Fig 10:1). We now ask him to sit on the edge of the examination table with his back unsupported. (Fig 10:2) In the majority of cases the patient will sit slouched with the head and neck protruding in a forward position. A few patients are more aware of the relationship between their posture and pain and have discovered that they can control their sitting pain by sitting upright.

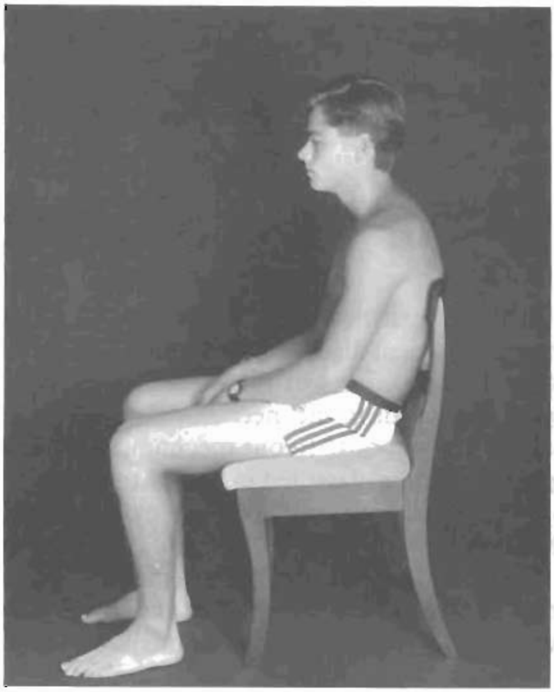


Fig 10:1.
Slouched sitting posture.

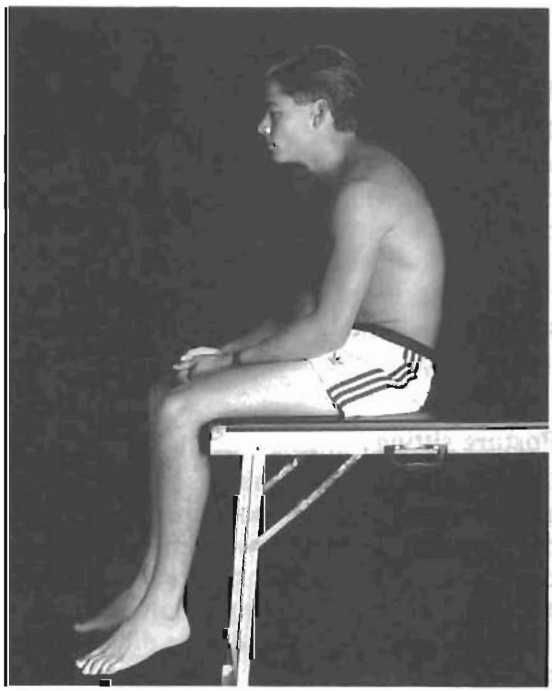


Fig 10:2.
Unsupported sitting.

We examine in particular the following features:

1. Does the patient hold the head upright or is the head protruded in a forward position? (Fig 10:2)
2. Is the head and neck held in a flexed position?
   Is there an accentuation of the kyphosis at the cervico-thoracic junction? (Dowager's Hump)
3. Is there any sign of torticollis? (the cervical equivalent of the lumbar list, lateral shift.)

Posture standing

Some patients who have poor posture in the seated position may hold themselves erect immediately on arising from sitting. Initially no evidence of a protruded head posture may be seen, and only after three to four minutes does the patient relax and allow the head to protrude.

Obvious deformity as seen frequently in the lumbar spine is less often encountered in the cervical spine. Cervical kyphosis and or scoliosis sometimes accompanies brachialgia and arises most often after the age of 45. Acute torticollis or acute wry neck is more common in adolescence.

We must bear in mind that asymmetry is very common, and may be unrelated to the presenting symptoms.

EXAMINATION OF MOVEMENT

The patient can be adequately assessed in the standing position if for some reason this becomes necessary. However, for the assessment of movement and function, I prefer to have the patient sitting upright with the back supported to the inferior border of the scapula so a chair with a rather high back is required. This provides greater stability for the thoracic spine and it becomes easier to control extraneous motion from the lower areas of the spine.

In order to satisfactorily assess cervical spine function it is necessary for the patient to sit in the neutral upright sitting posture during most of the testing procedures. Failure to correct the starting position can lead to the adoption of incorrect conclusions regarding the presenting syndrome.

If the quality of movement is assessed whilst the patient is sitting with the head protruded, the cervical segments will be translated anteriorly and the articulations will be at the limit of range. In this position capsular and ligamentous tension restricts motion in other planes and it will not be possible for the movements of extension, rotation or lateral flexion to occur normally to the full range.

From the protruded position extension of the lower cervical segments will be limited. The mid and upper cervical spine will be extended, but the segments C5 to T1 remain translated anteriorly and from this position full extension is not possible. Only after the patient's posture is corrected and the head retracted will extension in the lower segments be permitted to the full available range.

In the symptomatic patient movements of the head and neck performed from the protruded position can be extremely painful, but when performed with the head in the retracted position the same movements may be painless. In some patients, rotation is painful only because the patient habitually adopts a protruded head posture, thus causing pain to be experienced whenever simple rotation movements are made.

From the protruded position it will also be impossible to obtain a true assessment of the range of motion available in rotation or lateral flexion. *The performance of rotation or lateral flexion attempted from a position of anterior translation will cause overstretching and sometimes pain even in a normal subject.*

The architecture of the cervical segments dictates the manner in which extension, rotation and lateral flexion are performed. The best range of motion in extension, rotation and lateral flexion will occur when the head is in the upright posture, rather than in the protruded position.

Quality of movement

Here we are interested in observing the quality of the movement itself—that is, the range of movement and the movement pathway. We will determine if there is a movement loss and if deviation from the normal movement path takes place. The word "pain" should not be mentioned until we are ready to assess the effects of the movements on pain.

Only one movement will be performed in the direction to be evaluated and that movement must be made to the maximum attainable by the patient within his pain tolerance. The range should be estimated and restriction of motion recorded as being major, moderate, minor or nil.

Movements are examined in the following order.

Flexion:

The patient is instructed to bend the head as far forward as is possible so that the chin rests on the sternum. (Fig 10:3) The patient should then return to the neutral upright position. (Fig 10:4) The range of motion is recorded.

Extension:

The patient is instructed to bend the head as far backwards as possible and look upwards to the ceiling. (Fig 10:5) The patient should then return to the neutral upright position. (Fig 10:6) In particular, the range of motion occurring in the lower cervical spine is recorded.

As occurs in the lumbar spine, deviations in the pathway of saggital movement occur in the cervical spine. However in the cervical spine I have not been able to arrive at any firm conclusion or recommendation regarding their significance.

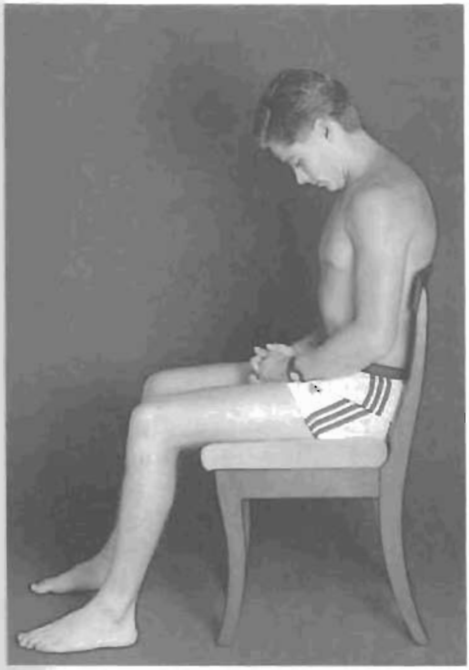


Fig 10:3. *Cervical flexion.*

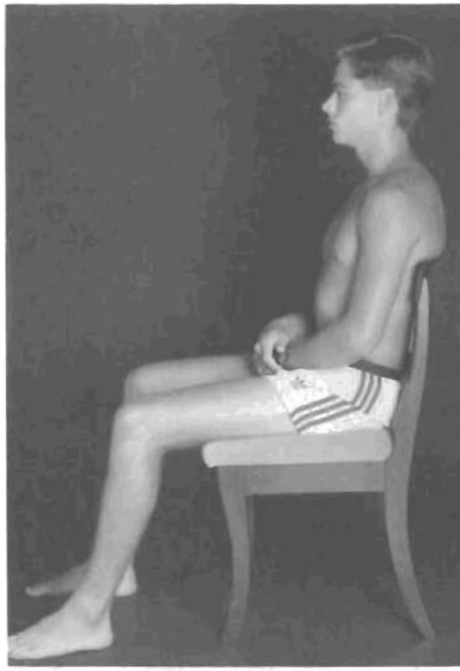


Fig 10:4. *Neutral upright posture.*

Fig 10:5. *Cervical extension.*

Fig 10:6. *Neutral upright posture.*

Rotation:

The patient is instructed to turn the head as far to the right as is possible. (Fig 10:7) The patient should then return to the midline. (Fig 10:8) The same sequence is then repeated to the left side. The range of motion present in both directions is recorded.

Lateral flexion:

The patient is instructed to laterally flex the head to the right as far as is possible. (Fig 10:9) The patient should then return to the upright position. (Fig 10:10) The same sequence is then repeated to the left side. The range of motion present in both directions is recorded.

We have now established the possible range of the movements performed on day one at the commencement of the examination. Information gathered from the initial assessment is the basis for determining future improvement or deterioration of the patients disorder. When comparing changes in the range of motion that may occur later in the examination or on successive days, we will be able to determine the appropriateness of our strategy and make a decision regarding the prognosis. A rapidly reversible disorder usually exhibits rapid changes in ranges of motion which can improve or lessen in the space of a few minutes depending on the direction of motion being assessed. Such rapid changes frequently occur during the first consultation. It is important therefore to establish the patient's movement status at the very beginning.

Movement and its effect on pain

After examining the cervical spine in relation to quality of movement, we must now investigate the effects of various repeated movements on the patient's pain.

In order to stress the joints in a controlled manner and avoid exacerbation I have devised a sequence of test movements, the mechanics of which are relatively well understood. By applying the test movements during the examination we will attempt to enhance pain under some circumstances and reduce it in others according to the syndrome present. Information gained by deliberately stressing the joints enables us to select and categorise patients into one of the three groups, ie: those who have pain arising from postural, dysfunctional or derangemental causes.

If we are to identify movements productive of pain, the test movements must be performed in such a way that they produce a change in the patient's symptoms. *The affected structure must be stressed sufficiently to produce or increase the symptoms.* Much depends on whether or not the pain is already present prior to the commencement of the test movements.

If prior to movement pain is already present, the test movement may *increase* or *reduce* its intensity; additionally, it may alter the site of the pain by centralisation, peripheralisation or by abolishing one pain and introducing another.

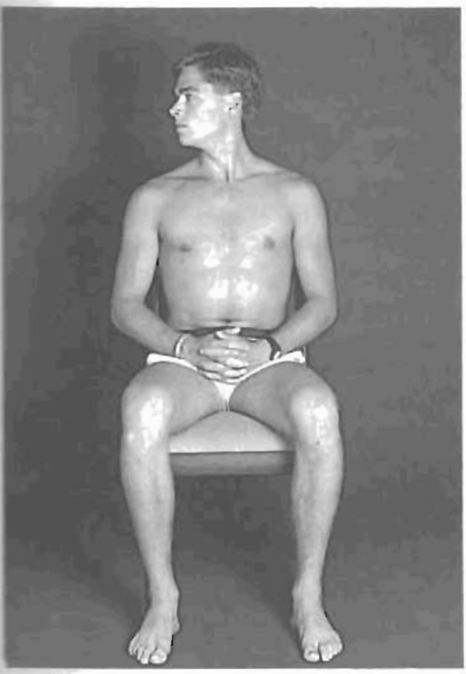


Fig 10:7. *Cervical rotation.*

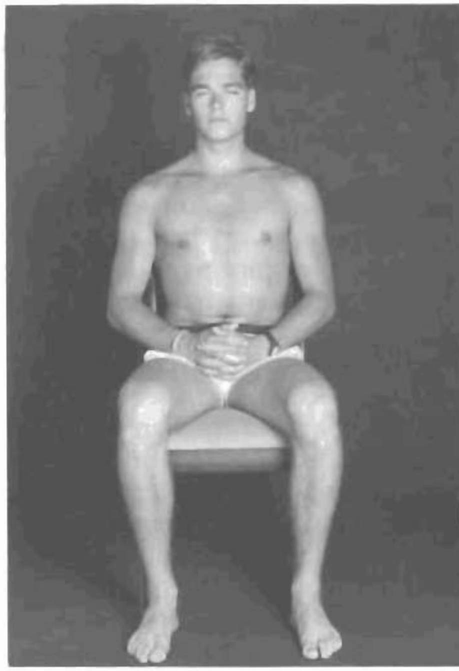


Fig 10:8. *Midline position.*

Fig 10:9. *Cervical lateral flexion.*

Fig 10:10. *Neutral upright posture.*

If no pain is present prior to movement, the test movement may *produce* the pain complained of or introduce new pains.

Sometimes the patient reports that a particular movement is not provoking the symptoms. If this occurs it may be that the structure involved in the production of the symptoms has not been stressed adequately to provoke pain. In the Derangement Syndrome the patient may have to repeat the movment many times, or flex or extend for prolonged periods before the pain is reproduced. Always bear in mind that patients with the Postural Syndrome will not experience pain *during or at the end range of movement* and only develop symptoms from static loading.

If there is no change in the patient's symptoms during or immediately following the test movements, the joints have not been stressed adequately and the process may have to be repeated more vigorously. It may also be that the pain is not of mechanical origin, because mechanical pain *must be and always is* affected by movement or position. Or, alternatively, the cervical spine is not causing the problems and other areas should be investigated.

In patients whose symptoms are severe and constant, repeated movements may cause little perceptible change. It can be difficult to evaluate a change in the location of pain under these circumstances. It may be necessary to retest such patients on following days before a final decision can be made regarding the suitability of the proposed treatment.

DYNAMIC MECHANICAL EVALUATION

Repeated movements

When evaluating the effects of repeated movements we are trying to identify differences in the patient's pain response that will indicate the presence of either derangement or dysfunction. The manner in which the pain behaves provides us with the clues required to solve that problem.

Patients with the postural syndrome will not experience pain with any of the test movements or their repetition. These patients must be positioned so that static loading is applied for a sufficient period of time to reproduce pain. (See Static Mechanical Evaluation.)

Mechanical evaluation based on the patient's available range of motion or on the performance of two or three movements in each direction, does not provide adequate information regarding the status of the structure or structures involved. It is sometimes impossible to differentiate between derangement and dysfunction unless movements are repeated many times.

In Dysfunction

Repeated movements, applied in the direction that stretches structures shortened, fibrosed or contracted, as in dysfunction, will cause pain to be felt only near the end of the reduced range. Repetition of the movement will not progressively increase or decrease the intensity of the pain. Repetition will not cause the short structure to lengthen and the range of motion will not increase. The pain will cease immediately the patient retreats from the end range position. The patient will be neither better nor worse as a result of repeating movement. No rapid changes occur. Thus repeated movements are diagnostic in dysfunction.

In Derangement

Repeated movements applied in the direction that *increases* displacement or flow of fluid, gel or sequestrum, will cause pain to *appear, increase, peripheralise or change location*. The pain will be felt *during* the movement itself. Repetition will make the patient progressively worse. At the same time a *rapid reduction in the range of motion* can occur. The patient will feel worse during repetition of the the movements and on returning to the neutral position will remain worse as a result.

On the other hand repeated movements that *reduce* displacement or flow of fluid, gel or sequestrum, will cause pain to *disappear, decrease, or centralise*. At the same time a *rapid improvement in the range of motion* can occur. The patient will feel better while repeating the movements and on returning to the neutral position will remain better as a result. Rapid changes occur. Thus repeated movements are diagnostic in derangement pathologies.

Apart from exposing the derangement and dysfunction syndromes, repeated movements are essential in determining whether the timing is appropriate to commence stretching procedures following trauma and derangement. *When repeated movements, applied to painful structures, produce less and less pain with each repetition, or pain is produced at mid to end range and does not progressively worsen, these structures should be exercised.* On the other hand, *when more and more pain is experienced with each repetition of movement performed in any direction, exercising is not indicated and more time should be allowed for the condition to heal. This fundamental response of pain sensitive structures to stress must be applied to soft tissue lesions throughout the musculo-skeletal system in order to determine whether a passive or active treatment approach should be developed.*

The test movements

In the long run and irrespective of the ammount of data obtained from the patient's history, clinical examination and paraclinical tests, the final decision with regard to the mechanical approach to be adopted is determined by the patient's response to the mechanical forces applied. The clinician's conception of the appropriate treatment is frequently and must always be overruled by the emergence of an adverse painful reaction in response to the initiation of that treatment.

A very few patients are unable to tolerate these movements because of dizziness or nausea. Before continuing with the evaluation of such patients it is necessary to exclude the likelihood that basilar artery insufficiency is responsible for the problems. In patients who experience these symptoms, the specific tests outlined in Chapter 17 should be applied.

Generally speaking, the movements or positions that produce the greatest amount of mechanical deformation and therefore pain can, when reversed or modified, be used to have the greatest effect on the reduction of that mechanical deformation and pain. The purpose of the dynamic evaluation is to identify these movements by symptom provocation.

The test movements may follow on immediately after the examination of the quality of movement. All patients should perform the test movements except when they are in such severe pain that it is intolerable to do so. This mainly occurs in acute derangements which force the deformity of torticollis or acute wry neck in the young, and in patients with kyphosis associated with acute brachialgia occurring more in older subjects.

All of the test movements may be completed with the patient seated in an upright chair with a rather high back. Exceptions are patients with acute pain or those whose symptoms are not changing with tests performed in the upright loaded posture. It may be necessary to test these patients in the unloaded position lying supine.

The intensity and location of any symptom present is recorded prior to the performance of any movement. In particular, always establish the location of the most distal symptom and constantly question the patient as to its behaviour. If symptoms are already located centrally, and there are no radiating pains one must nevertheless be watchful for the development of radiating pain particularly if the problem is acute or of recent onset.

Following each series of repeated movements it is necessary to determine whether as a result of the test movements the symptoms remain better or worse.

When, with repeated movement testing, symptoms are produced or increased we will enquire whether as a result the patient remains worse.

When, with repeated movement testing, symptoms are reduced or abolished we will enquire whether as a result the condition remains better.

Frequently, though symptoms may change during repeated movement testing, there is no lasting effect and once movement has stopped the patient's symptoms return.

Symptoms remaining better or worse as a result of movement testing indicate the presence of derangement. On the other hand, when there is no lasting change, dysfunction (or very minor derangement which is only exposed when static loading is added to testing) is likely to be the cause of the problem.

It is obligatory to discontinue with the repetition of any exercise should it be absolutely clear after a few movements that distal symptoms are being exacerbated.

The test movements for the cervical spine are as follows:

Test 1. *Protrusion*

The intensity and location of any pain and other symptoms present are recorded prior to the performance of the movement. In particular, always establish the location of the most distal symptom.

The seated patient should be instructed to sit against the back of the chair. (Fig 10:11) The patient is then instructed to move the head as far forward as is possible with the neck outstretched. (Fig 10:12) The head must remain horizontal and should be kept facing forward and inclined neither up nor down. On completion the patient returns to the neutral upright position. (Fig 10:11) The effects on the patient's pain by performing one movement should be recorded.

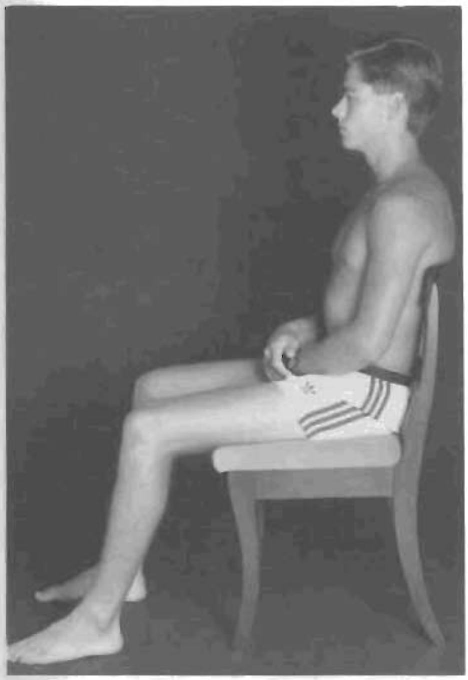


Fig 10:11. *Neutral upright posture.*

Fig 10:12. *Protrusion.*

The patient then repeats the movement from five to fifteen times. We must ensure that the maximum possible stretch is obtained during the last few movements. On completion of these it should be apparent that an effect has been obtained and the pain made to reduce or increase in intensity, or change its location. The patient should then be asked, "As a result of performing these movements do you have more pain or less pain than before?" The nature of the change is recorded.

For example: Protrusion – produces (R) scapula pain at end range.
Repeated protrusion worsens (R) scapula pain and produces (R) upper arm pain.
(R) scapula pain remains worse as a result of testing.

Test 2. *Retraction*

The intensity and location of any pain and other symptoms present are recorded prior to the performance of the movement. In particular, always establish the location of the most distal symptom.

The seated patient should be instructed to sit against the back of the chair. (Fig 10:13) The patient is then instructed to move the head backwards as far as is possible but at the same time maintain a forward facing position. The movement should be continued until the head is oriented in a more posterior position above the spinal column. (Fig 10:14) During the movement the head must remain horizontal and should be kept facing forward and inclined neither up nor down. *It is important that the movement be made to the maximum end range of retraction*. On completion the patient returns to the neutral rest position. (Fig 10:13)

Fig 10:13. *Neutral upright posture.*

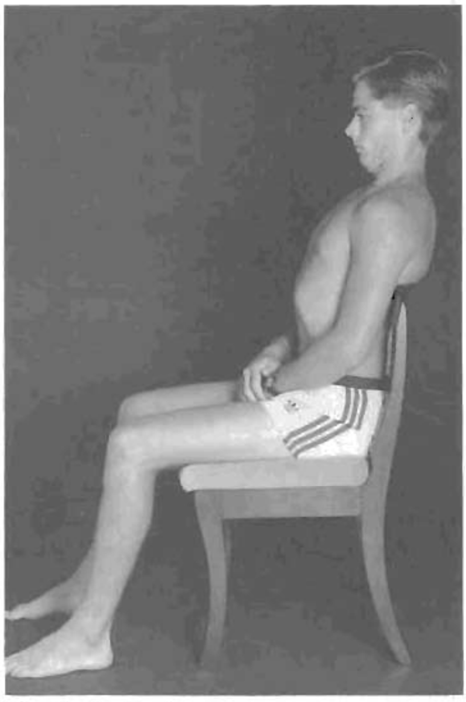


Fig 10:14. *Head retraction.*

The effects on the patient's pain by performing one movement should be recorded.

Any sign of peripheralisation of pain will sound a cautionary note and care must be taken during the application of the repeated movements. Any reduction or centralisation of pain will provide a clear indication of the suitability of the exercise.

The same movement should then be repeated rhythmically about five to fifteen times, always returning to the relaxed position after each retraction. With each excursion the patient should be encouraged to move even further than before, so that the maximum possible range of motion is achieved. Changes in the intensity and location of the pain are again recorded.

If testing in retraction has to this point produced no change, the patient should be taught to apply passive overpressure. This is achieved by pressing against the chin with the fingers and hand at the end range of the movement. (Fig 10:14a) This should be repeated five to fifteen times. The patient should then be asked, "As a result of performing these movements do you have more pain or less pain than before?" In resistant cases the therapist may need to apply the overpressure to determine the value of the manoeuvre. (Fig 10:14b) The effects on the pain are recorded.

Fig 10:14a. *Retraction with overpressure.*

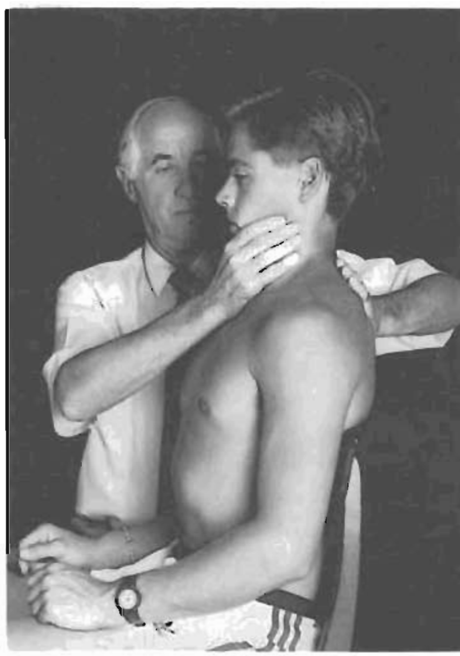


Fig 10:14b. *Retraction with therapist overpressure.*

For example: Retraction – no effect.

Retraction with overpressure produces (R) scapula and upper arm pain.

Repeated Retraction with overpressure reduces (R) scapula and upper arm pain.
Produces pain (R) C6/7 area.
(R) scapula and upper arm pain remain better as a result.

Should repetition have no effect, this fact should also be recorded.

Test 3. *Retraction and Extension (sitting)*

The intensity and location of any pain and other symptoms present are recorded prior to the performance of the movement. In particular, always establish the location of the most distal symptom.

Head and neck retraction and extension is the movement of retraction (as described above, see Fig 10:14) followed immediately by movement of the head and neck into the fully extended position. Although there are two movements involved, they should appear to be one motion continuing back from retraction until the neck is fully extended.

The seated patient should be instructed to sit against the back of the chair. (Fig 10:15) The patient must retract the head as far as is possible, or tolerable. (Fig 10:15a) Once the end range of retraction has been reached, the patient continues the movement by slowly and cautiously extending the head backwards as far as is possible or can be tolerated.(Fig 10:15b) The patient should then carefully raise the head and return to the upright neutral position. (Fig 10:15) The effects on the patient's pain by performing one movement should be recorded.

The patient then repeats the movement of retraction and extension, five to fifteen times in a rhythmical fashion and the effects of repetition are recorded. Should there be no significant change in the intensity and location of the symptoms and providing pain has not moved distally, the patient can repeat the cycle of movement with an additional motion introduced at the end of the range of extension. This movement consists of a rotation of the head and neck which is initiated in the fully extended position. (Fig 10:15c) The patient should rotate the head to alternate sides about four or five times so that *the nose moves only about half an inch to either side of the mid line.* The performance of this motion allows the patient to relax further and further into the extended position so that the weight of the head provides passive overpressure. This in turn produces a maximum range of motion. On completion the patient should be asked, "As a result of performing these movements do you have more pain or less pain than before?" The effects should then be recorded.

For example: Retraction and extension – increasespain (R) C5/6 area – reduces shoulder pain.

Repeated retraction extension and rotation abolishes shoulder pain and centralises at C5/6.

Shoulder pain remains better as a result.

Should repetition have no effect the fact should be recorded nevertheless.

In the event that retraction and extension produces no change in the symptoms or the patient cannot tolerate the procedure in the sitting position, it may be performed in the supine lying position. In lying, the weight of the head and neck provides traction during the test movement (rather than compression as occurs in the sitting posture) as well as better overpressure at the end of the movement range.

Fig **10:15**. *Neutral upright position.*

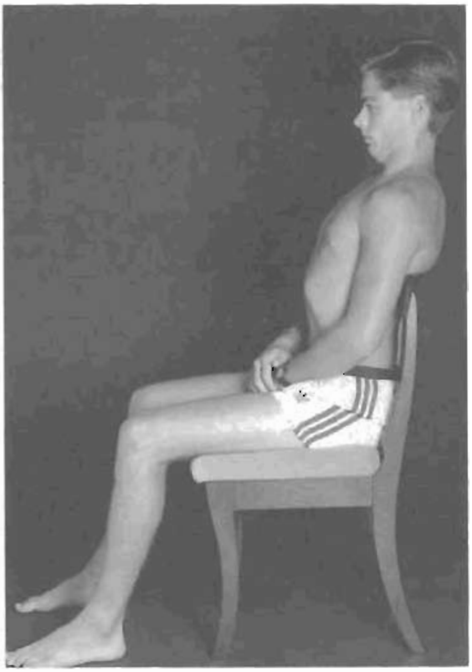


Fig 10:15a. *Head retraction.*

Fig 10:15b. *Cervical extension.*

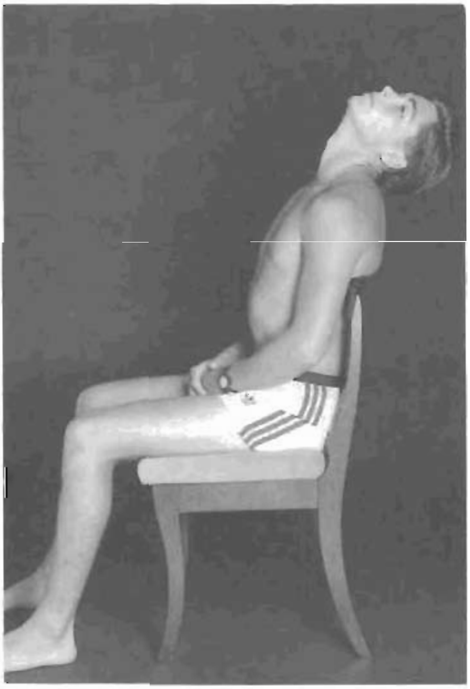


Fig 10:15c. *Rotation in extension.*

Lying

The patient lies supine on the treatment table with the head, neck and shoulders unsupported down to the level of the third or fourth thoracic vertebrae. The patient places one hand behind the occiput for support, (Fig 10:16) fully retracts the head, (Fig 10:16a) and then lowers it until the neck is fully extended and the head left hanging relaxed. (Fig 10:16b) *It is important that the movement be made to the maximum end range of extension.* The effects on the patient's pain by performing one movement should be recorded.

The patient then repeats the movement of retraction and extension five to fifteen times in a rhythmical fashion and the effects of repetition are recorded. Should there be no significant change in the intensity and location of the symptoms and providing pain has not moved distally, the patient can apply the additional rotary motion described above for retraction and extension in sitting. (Fig 10:16c) The patient should return to the upright position and the effects recorded.

These simple sagittal movements will have an effect on symptoms in the great majority of persons suffering from mechanical cervical disorders. They achieve change more rapidly and effectively than do the movements of lateral flexion and rotation.

Sagittal motion applies more direct pressure anteriorly and posteriorly in the intervertebral disc and therefore most easily affect the more common posterior derangement and the comparatively uncommon anterior derangements.

Sagittal motion however does not produce adequate pressures in the lateral compartments, thus postero-lateral displacements often require lateral compartment pressures. These are best provided by lateral flexion in the lower, and rotation in the upper cervical spine. In the event that no conclusion is forthcoming from the testing process using sagittal movements, it will be necessary to investigate the effects of movement in other planes.

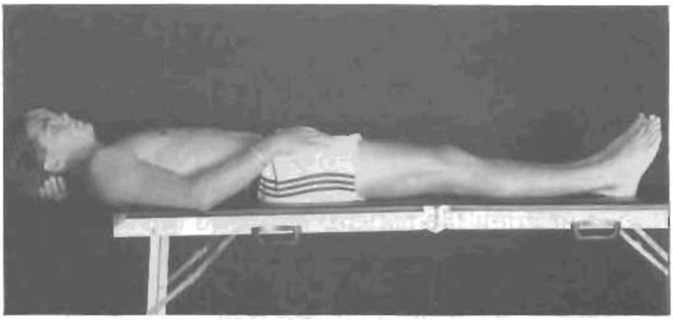


Fig 10:16. *Supine over the end of the treatment table.*

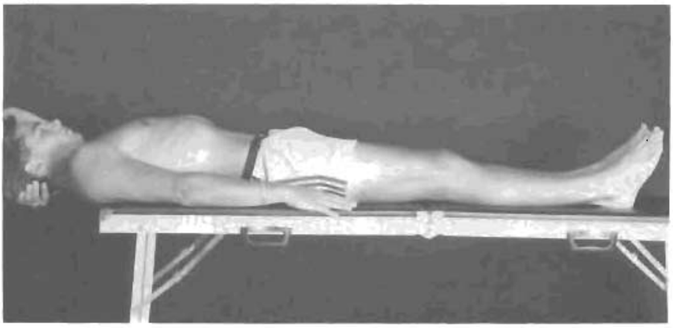


Fig 10:16a. *Retraction in lying.*

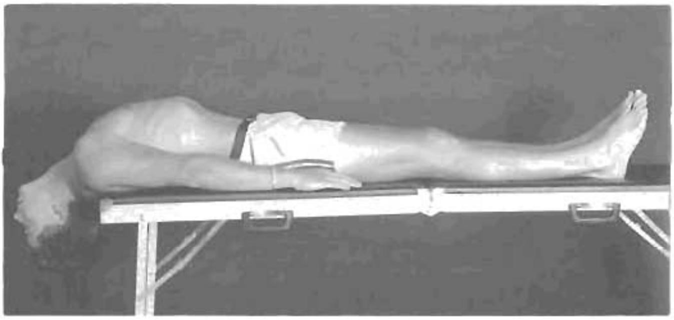


Fig 10:16b. *Extension in lying.*

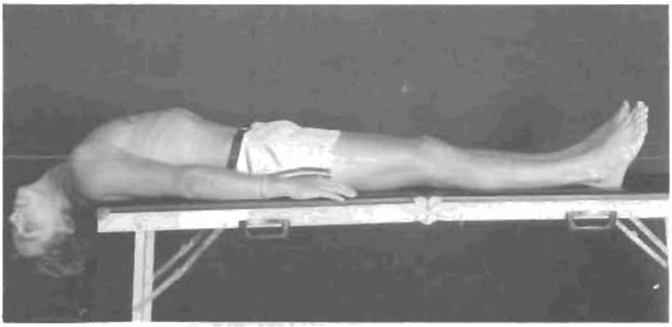


Fig 10:16c. *Rotation and extension in lying.*

Test 4. *Lateral Flexion.*

The intensity and location of any pain and other symptoms present are recorded prior to the performance of the movement. In particular, always establish the location of the most distal symptom.

The seated patient firstly retracts the head,(Fig 10:17) and then laterally flexes as far as possible towards the side of pain. (Fig 10:17a) After a second in that position the patient returns to the upright position. (Fig 10:17) The effects on the patient's pain by performing one movement should be recorded.

The same movement is then repeated rhythmically five to fifteen times always returning to the neutral upright position after each excursion and the effects on the pain recorded.

Should repetition have no effect, it may be necessary to apply more pressure. The seated patient, in order to stabilise the upper trunk, is instructed to hold onto the seat base with the hand opposite to the side of pain. The patient then places the other hand over the top of the head with the fingers reaching the ear. With the head still retracted the patient pulls the head towards the side of pain as far as possible thus adding a passive overpressure to the movement. (Fig 10:17b) After a second in this position, and while keeping the hand in place, the patient should return to the upright position. (Fig 10:17) The movement should be repeated rhythmically five to fifteen times and the effects on pain recorded.

Should the patient be unable to provide adequate pressure or the effect of the movement is still unclear, it may be necessary for the therapist to assist in this process. (Fig 10:17c) On completion, the patient should be asked, "As a result of performing these movements do you have more pain or less pain than before?" The effects should then be recorded.

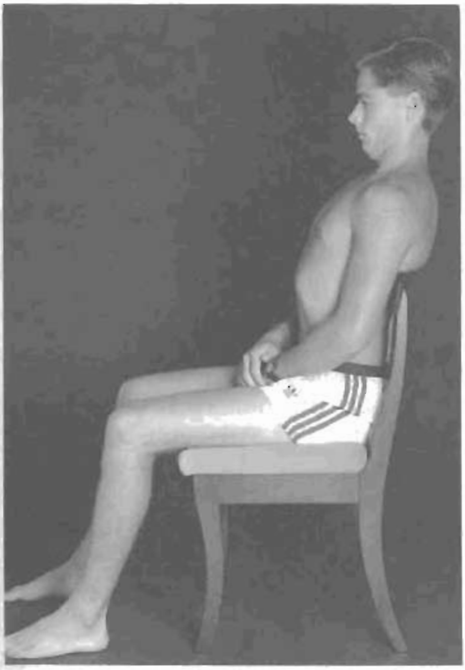


Fig 10:17. *Retraction.*

Fig 10:17a. *Lateral flexion.*

Fig 10:17b. *Lateral flexion with overpressure.*

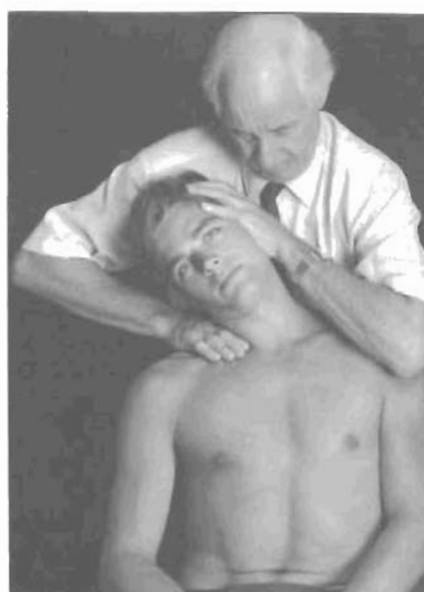


Fig 10:17c. *Lateral flexion with therapist overpressure.*

Test 5. *Rotation*

The intensity and location of any pain and other symptoms present are recorded prior to the performance of the movement. In particular, always establish the location of the most distal symptom.

The seated patient is instructed to retract the head, (Fig 10:18) and then rotate *towards the side of pain*. (Fig 10:18a) After a second in that position the patient returns to the neutral position. (Fig 10:18) The effects on the patient's symptoms from performing one movement are recorded.

The same movement is then repeated rhythmically five to fifteen times, always returning to the neutral position after each rotation, and the effects on the symptoms are recorded.

Should repetition have no effect, it may be necessary to add more pressure. To do this the patient retracts the head, and places one hand behind the head with the fingers over the ear on the opposite side. The other hand is placed against the chin. With the head still retracted the patient turns the head towards the side of pain as far as possible thus adding a passive overpressure to the movement. (Fig 10:18b) After a second in this position, and while keeping the hands in place, the patient should return to the neutral position. The movement should be repeated rhythmically five to fifteen times and the effects of repetition are recorded.

Should the patient be unable to provide adequate pressure, or the effect of the movement is still unclear, it may be necessary for the therapist to assist in this process. (Fig 10:18c) On completion, the patient should be asked, "As a result of performing these movements do you have more pain or less pain than before?" The effects should then be recorded.

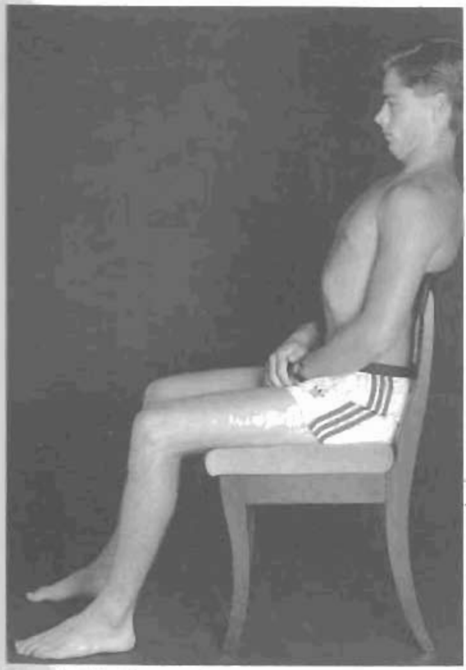


Fig 10:18. *Retraction.*

Fig 10:18a. *Rotation.*

Fig 10:18b.
Rotation with overpressure.

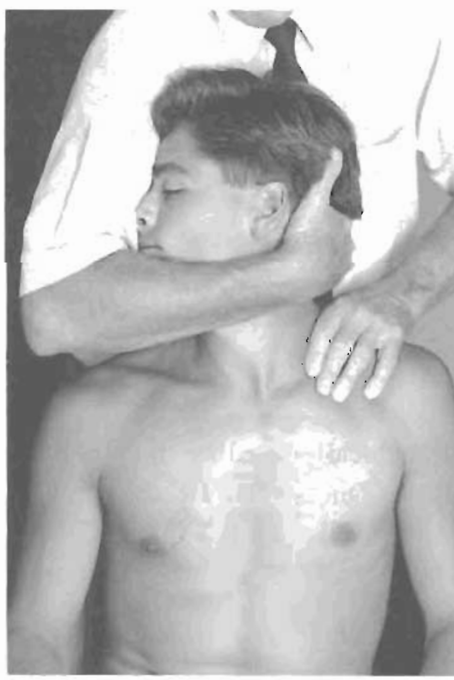


Fig 10:18c.
Rotation with therapist overpressure.

Test 6. *Flexion*

The majority of derangements in the cervical spine, as in the lumbar spine, are posteriorly or postero-laterally located. Flexion testing is therefore to be undertaken with care and only applied if it is not possible to produce or reduce the symptoms with the other test movements. In the cervical spine symptom provocation can usually be achieved without the use of repeated flexion, whereas in the lumbar spine the use of repeated flexion is frequently required to evoke a painful response.

The intensity and location of any pain and other symptoms present are recorded prior to the performance of the movement. In particular, always establish the location of the most distal symptom.

The seated patient sits slouched with the spine flexed. (Fig 10:19) The patient is then instructed to bend the head forward so that the chin is resting on the sternum. (Fig 10:19a) The patient then returns his head to the upright position. (Fig 10:19) The effects on the patient's symptoms from performing one movement are recorded.

The same movement is then rhythmically repeated five to fifteen times, the patient always returning to the upright position after each excursion, and the effects of repetition are recorded.

Should repetition have no effect it may be necessary to apply overpressure. The patient is instructed to clasp the interlocked fingers behind the neck and to slouch into a flexed posture with the hands applying passive overpressure. (Fig 10:19b) After a second in this position the patient should return to the upright position and the manoeuvre is repeated five to fifteen times. On completion, the patient should be asked, "As a result of performing these movements do you have more pain or less pain than before?" The effects should then be recorded.

Summary of the testing sequence

The following sequence should be routinely practised during any spinal mechanical evaluation or re-evaluation.

Step One	Patient is positioned	– record pain
Step Two	Move once	– record quality
Step Three	Move once	– record pain during motion or at end of range
Step Four	Repeat movement	– record change
Step Five	Return to position	– record pain better or worse

Fig 10:19. *Slouched and flexed spine.*

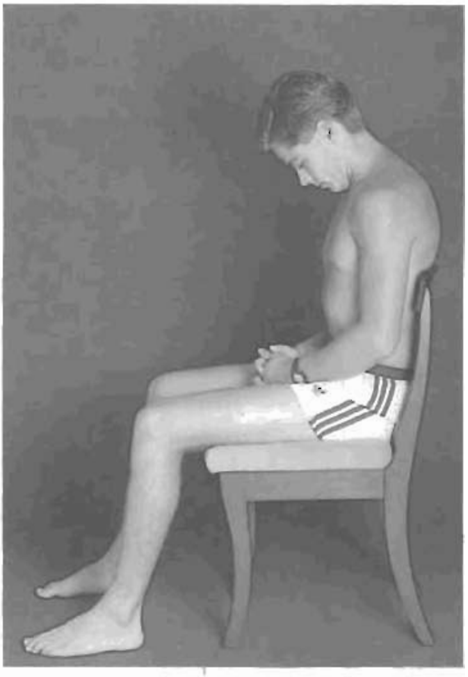


Fig 10:19a. *Flexion.*

Fig 10:19b. *Flexion with overpressure.*

STATIC MECHANICAL EVALUATION

So far we have concentrated on the assessment of the patient's function using dynamic tests that provoke or reduce the symptoms. Mostly we will succeed in identifying at least one movement that affects the patients pain.

However, some individuals with pain of purely postural origin, or pain arising from minor displacement will not experience pain provocation from the application of repeated movements and overpressure. In such patients it will be necessary to load the structures for a prolonged period of time before deformation is sufficient to reproduce the sensation of pain.

The test postures

Test 1. *Protrusion Sitting*

The intensity and location of any pain and other symptoms present are recorded prior to the adoption of the protruded head posture. In particular, always establish the location of the most distal symptom.

The seated patient should be instructed to sit slouched against the back of the chair and move the head as far forward as is possible with the neck outstretched. (Fig 10:20) The head must remain horizontal and should be kept facing forward and should be inclined neither up nor down. Record the nature and location of any symptoms present.

After a maximum of three minutes the effects on the symptoms felt in this position are recorded. The patient may then return to the neutral upright position. On return to the neutral position the patient should be asked again, "As a result of adopting that posture are you in more pain or less pain than before?" A check should also be made on whether or not the symptom location has altered. The effects of sustained protrusion are recorded.

Test 2. *Retraction*

The intensity and location of any pain and other symptoms present are recorded prior to the adoption of the retracted head posture. In particular, always establish the location of the most distal symptom.

The correctly seated patient should be instructed to move the head backwards as far as is possible but at the same time maintain a forward facing position. (Fig 10:21) The movement should be continued until the head is oriented in a more posterior position above the spinal column. During the movement the head must remain horizontal and inclined neither up nor down. It is important that the movement be made to the maximum end range of retraction. Record the nature and location of any symptoms present.

After a maximum of three minutes the effects on the symptoms felt in this position are recorded. The patient may then return to the neutral upright position. On return to the neutral position the patient should be asked again, "As a result of adopting that posture are you in more pain or less pain than before?" A check should also be made on whether or not the symptom location has altered. The effects of sustained retraction are recorded.

Fig 10:20.
Head protrusion.

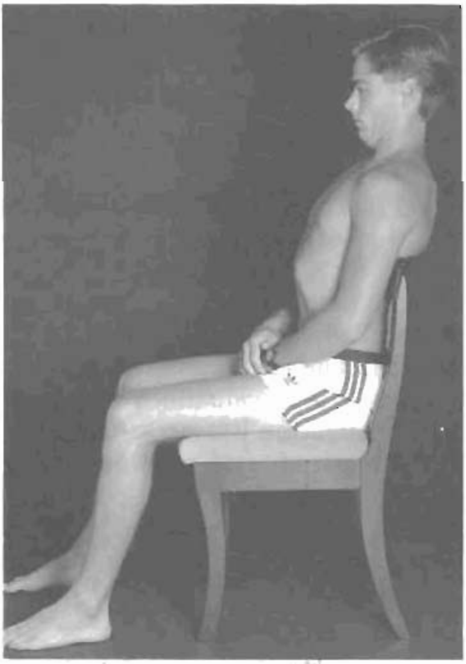


Fig 10:21.
Head retraction.

Test 3. *Lying supine in extension*

The intensity and location of any pain and other symptoms present are recorded prior to the adoption of the extended position. In particular, always establish the location of the most distal symptom.

The patient lies supine on the treatment table with the head, neck and shoulders unsupported down to the level of the third or fourth thoracic vertebra. The patient places one hand behind the occiput for support, fully retracts the head (Fig 10:22) and then lowers it until the neck is fully extended and the head left hanging relaxed. (Fig 10:23) *It is important that the movement be made to the maximum end range of extension.* Record the nature of any symptoms present.

After a maximum of three minutes the effects on the symptoms felt in this position are recorded. The patient may then return to the neutral position. On return to the neutral position the patient should be asked again, "As a result of adopting that posture are you in more pain or less pain than before?" A check should also be made on whether or not the symptom location has altered. The effects of sustained extension are recorded.

Should the patient be unable to perform this test in the supine position it should be completed lying prone.

Test 4. *Lying prone in extension*

The intensity and location of any pain and other symptoms present are recorded prior to the adoption of the extended position. In particular, always establish the location of the most distal symptom.

The patient lies prone on the treatment table leaning on the elbows and resting the chin on the outstretched finger tips with the head facing forwards and upwards. (Fig 10:24) It is important to have the patient as relaxed as possible in order that a passive overpressure can develop as the position is maintained. *It is important that the position be held to the maximum end range of extension.* Record the nature and location of any symptoms present.

After a maximum of three minutes the effects on the symptoms felt in this position are recorded. The patient may then return to the neutral position. On return to the neutral position the patient should be asked again, "As a result of adopting that posture are you in more pain or less pain than before?" A check should also be made on whether or not the symptom location has altered. The effects of sustained extension are recorded.

These static evaluations should suffice for most patients requiring this type of investigation but occasionally it may be necessary to apply similar tests for the extremes of rotation and lateral flexion.

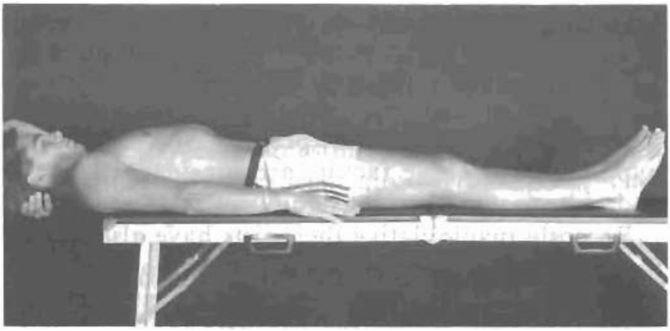


Fig 10:22. *Retraction in lying.*

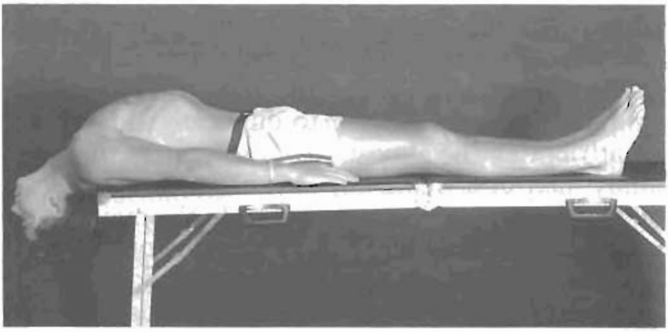


Fig 10:23. *Extension in lying.*

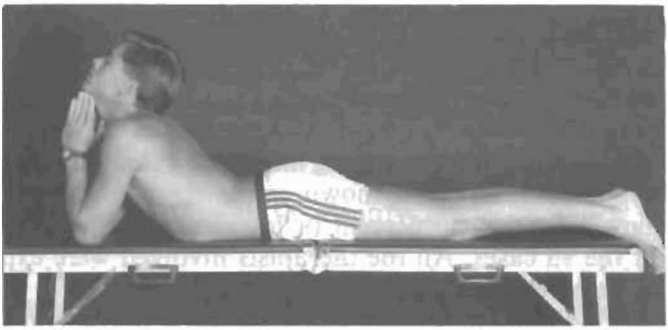


Fig 10:24. *Cervical extension prone.*

OTHER EXAMINATION PROCEDURES

Palpation:

Traditional manual therapy examinations rely very much on the use of palpation to detect the presence of asymmetry, hypermobility and hypomobility. These factors are considered by some (especially osteopaths and chiropractors) to be significant in the production of back pain.

Recently manipulative therapists have also adopted palpation as a prime diagnostic tool. Some even claim to be able to determine by palpation alone the levels of existing pathology. While it is the experience of many that rather gross losses of movement are detectable by palpation, it has yet to be demonstrated that *tactile assessment alone can identify the level of restriction of intervertebral motion or the level of the pathology* in the intervertebral segments of patients with non specific spinal disorders. One study,[82] has shown palpatory reliability in identification of symptomatic levels. The findings of this study may be difficult to duplicate and the investigators stopped short of attributing the almost 100% agreement to palpatory skills alone. In this study intertester reliability was not measured.

Those who base their diagnosis in the main on palpatory findings tend to confuse the issue of whether the information they receive is derived from tactile sources, a claim which is frequently made, or whether the information is imparted to them by stressing the offending structure during the process of palpation, thus reproducing the patient's symptoms. Intertherapist tester reliability for production of pain by localised movement or pressure from palpation itself has been found to be reliable.[123]

No controlled studies yet demonstrate intertester assessment of passive intervertebral motion to be reliable. On the contrary, intertherapist palpatory reliability has been shown to be extremely poor.[15, 23, 60, 108, 111, 173]

A recent study comparing intertester reliability in examination of sacroiliac dysfunction has also shown extremely poor correlation: in 11 of 13 tests, agreement was 50 percent or less. Palpatory skills were fundamental to 10 of the 13 cases. All the therapists involved were experienced and trained in orthopaedic manual therapy.[123]

I do not include passive intervertebral movement testing in the assessment of mechanical spinal disorders simply because the procedure is unreliable. Further, I could rarely detect a change in the passive range of motion following SMT even though the patient expressed delight from the relief of pain experienced.

Asymmetry:

Asymmetry of the spinal segments is not related to the incidence or occurence of mechanical spinal pain.[160] Diagnosis based on identification of palpable or radiological asymmetries is unreliable.

In a review of 20 studies on the topic of the natural history of adolescent ideopathic scoliosis, Weinstein,[160] and Dieck,[36] report that 40%-60%

of these patients complain of back pain. This incidence is comparable to the incidence of back pain in the general population. The location of pain in scoliotic patients was variable and generally unrelated to the location or magnitude of the curve. The pain was also unrelated to the severity of radiological osteoarthritic changes. Weinstein estimates that one percent of patients with scoliosis will require surgery specifically for backache. That incidence is similar to that for the general population.

Three Swedish long-term studies of scoliosis with greater than 90% patient follow-up at more than 30 years, demonstrated that low back pain was not a significant complaint.[160]

Dieck reported in a study with 25 year follow up, that postural asymmetry in teenagers did not indicate a predisposition to subsequent back or neck pain. No difference in the incidence of back pain was found between symmetrical and asymmetrical subjects.[36]

It is now well documented that asymmetries in the apophyseal joints and other developmental anomalies occur as regularly in the cervical region as in the other areas of the spine and are present in up to fifty-two percent of the population. Based on epidemiologic studies, it appears that many radiographic anomalies are not associated with pain, including spina bifida occulta, single disc narrowing and spondylosis, most facet joint abnormalities, sacralization of a lumbar vertebra, lumbarization of a sacral vertebra, hyperlordosis, and Schmorl's nodes.[116, 164]

Where palpable movement restrictions and other anomalies are identified, it is impossible to state that these are either the cause of the patient's present symptoms or are likely to cause symptoms in the future. The presence of palpable anomalies or restrictions of motion should not alone be the justification for the application of mobilisation or manipulation.

Hyper and hypomobility:

One of the main objects of palpation is to identify levels of hyper or hypomobility which are said to be related to painful spinal disorders. What is hyper or hypomobility? Variations occur in the range of motion in normal people to such a degree that it is almost impossible to claim that hyper or hypomobility is likely to be related to the presence of spinal pain. Furthermore, there is as yet no accepted definition or description of these clinical entities. It has been found that up to 8mm of translatory movement may occur on flexion and extension radiographs of asymptomatic people.[71] Recent expressed opinion suggests that in the absence of significant trauma, instability bears no relationship to the presence or absence of back pain.[58A] The identification of hyper and hypo mobility by palpation has yet to be demonstrated. Neither has there been corroboration of palpatory findings by radiological assessment.

It has been suggested that repetitive exercise will lead to hypermobility. It should be recognised that repetitive motion actually leads to strengthening of structures. Stress without damage is part of the remodelling process that equips us for progressively more difficult and heavier tasks.

A joint with a very free range of motion may be described by some as hypermobile. It will, however, become painful for the same reason that pain arises in any other joint. When it is placed on stretch at end range for a long enough period or if the stretch is severe enough, pain will be felt. In the hypermobile segment a greater range of movement must be accomplished before full stretch is achieved. Hypermobility in itself is not a painful state.

For the reasons described here, I do not use palpation as an assessment tool, nor do I believe that asymmetry, hyper and hypomobility alone are a cause of back pain.

The shoulder joint

Providing the dynamic mechanical evaluation of the cervical spine has established a causal relationship between the cervical structures and the patient's symptoms, I do not insist nor think it necessary on day one to conduct routine exploration of alternative possible sources of pain such as the shoulder joint. The widespread assessment by provocative testing of many structures on day one can lead to confusion of the patient and as a consequence may mislead the therapist attempting to identify the source of pain.

Only when we fail to influence symptoms by applying repetitive exercises to stress cervical structures over a twenty four hour period, should we suspect that the source of the patients pain may lie elsewhere. The investigation of this should take place the following day.

Should passive stretching or resisted movements at the shoulder as described by Cyriax,[30] reproduce the symptoms complained of, this joint must be considered a possible source of the pain.

Neurological examination

A more detailed neurological examination will be required, if there is any possibility of impairment of nerve root conductivity. Should the patient complain of symptoms radiating to the limb distally, reflexes, strength and sensation should all be assessed for impairment.

Patients complaining of cervical discomfort with associated weakness in the lower extremities or gait incoordination should be checked for signs of spinal cord compression. Patients suffering from spinal cord compression rarely experience pain in the lower extremities.

Musculature

Although the belief is widespread, rarely can pain in the back be attributed to torn or inflamed muscles three or four weeks after injury.[39] Should there be any doubts in this regard, the exclusion of muscle or tendonous structures as the source of pain should be established by a combination of resisted muscle testing as described by Cyriax,[30] and repetitive motion testing as described in this text. Of course local muscle tearing or contusion can occur in the region of the upper back and neck, but the natural history of muscle injury in other parts of the body would suggest that pains from this source would resolve spontaneously in two to three weeks.

CONCLUSIONS FOLLOWING THE EXAMINATION

We have now interviewed and examined the patient. From the history itself it is usually possible to determine the likely nature of the problem confronting us, and the examination should have allowed us to classify the patient according to the predominant syndrome. Some patients may have co-existing syndromes in which case it is desirable to identify the factor that forced consultation. Most patients seek consultation because of derangement, but have underlying dysfunction and postural faults. It is the derangement that must occupy our immediate attention. Any dysfunction present may be dealt with after the reduction of derangement.

Having classified the patient into either the Postural, Dysfunction or Derangement Syndrome, it is now necessary to apply an appropriate principle of treatment. We can choose to flex or extend the patient. If flexion is indicated we adopt the *Flexion Principle*. That is, we apply procedures of therapeutic motion utilising *flexion*. In the cervical spine this includes head protrusion, (lower cervical flexion only) neck flexion, flexion with overpressure, sustained flexion and flexion mobilisation.

On the other hand if extension is indicated, we adopt the *Extension Principle*. In this case we utilise all the procedures of *extension* including head retraction, (lower cervical extension only) retraction and extension, extension in lying (supine and prone), traction with extension, sustained extension and extension mobilisation.

Postural syndrome

In the postural syndrome the only treatment required is postural correction.

Dysfunction syndrome

In the dysfunction syndrome we have identified the movements in the examination that *produced* the patients pain. For example, if the patient has shortened structures causing painful limitation of *extension*, we identify *extension dysfunction*. Thus the patient requires the application of the *extension principle* in order to stretch and remodel the contractures.

Conversely, if we identify shortened structures causing painful limitation of *flexion* we identify *flexion dysfunction* in which case the patient will require the application of the *flexion principle* in order to stretch and remodel the contractures. Some patients may have both flexion and extension dysfunction in which case we can describe generalised dysfunction.

For treatment of dysfunction to be successful it is imperative that some pain be experienced, especially in the initial stages when adaptively shortened tissues must be stretched enough to initiate or enhance the process of remodelling. It is the remodelling process that allows the restoration of extensibility in the shortened structure.

Derangement syndrome

In the derangement syndrome we have identified the movements in the examination that *abolished, reduced or centralised* the patients symptoms. For example if the patient has *posterior derangement*, the pain would have *ceased, reduced or centralised* using *extension* movements. Thus the patient would require the application of the *extension principle*.

If the patient has *anterior derangement*, the pain would have *ceased, reduced or centralised* using *flexion* movements. Thus the patient would require the application of the *flexion principle*.

About seventy percent of all the patients with upper thoracic and cervical pain will respond to the application of repetitive motion and posture correction alone. These patients have a very good chance of becoming independent of therapists. They will be able to perform exercises to relieve themselves of pain without requiring techniques performed by specialist therapists. The remaining thirty percent of patients will require special techniques and manipulative procedures. The experienced practitioner will be able to identify these patients from the information supplied by the patient at the second or third treatment session when the effects of twenty four hours of repetitive motion will expose resistant derangements. (See Chapter 20)

The patient has been classified according to the Quebec Task Force recommendations 1,2,3 or 4, or under special circumstances 7,8, or 9.2. (See Chapter 8) We have identified factors from the patient's history which more specifically indicate the suitability or otherwise of our intended treatment strategy. We have mapped the pain patterns and have applied to our patient a dynamic mechanical assessment. The subgroup within the non specific spectrum has been identified, and the principle of treatment chosen. We are now in a position to confidently apply modern mechanical therapy to re-educate posture, remodel dysfunction, and reduce derangement. Whenever possible, the patient will be made to become responsible for his own treatment.

Warning

Atypicality: The experienced therapist or clinician develops a keen sense of what is typical for any given condition. This sense allows the immediate recognition of atypicality. Atypicality may appear during the course of taking the history. It may appear during the course of the examination. It may also appear as an atypical response to treatment. Irrespective of when it occurs, atypicality is a warning that something unusual is present in the patient's condition. It is possibly sinister in origin. Do you have enough information to enable you to justify the continued treatment of this patient using these methods?

If you cannot answer that question in the affirmative, you should suspend vigorous treatment until such time as all tests have been done to exclude serious pathology or major architectural faults.

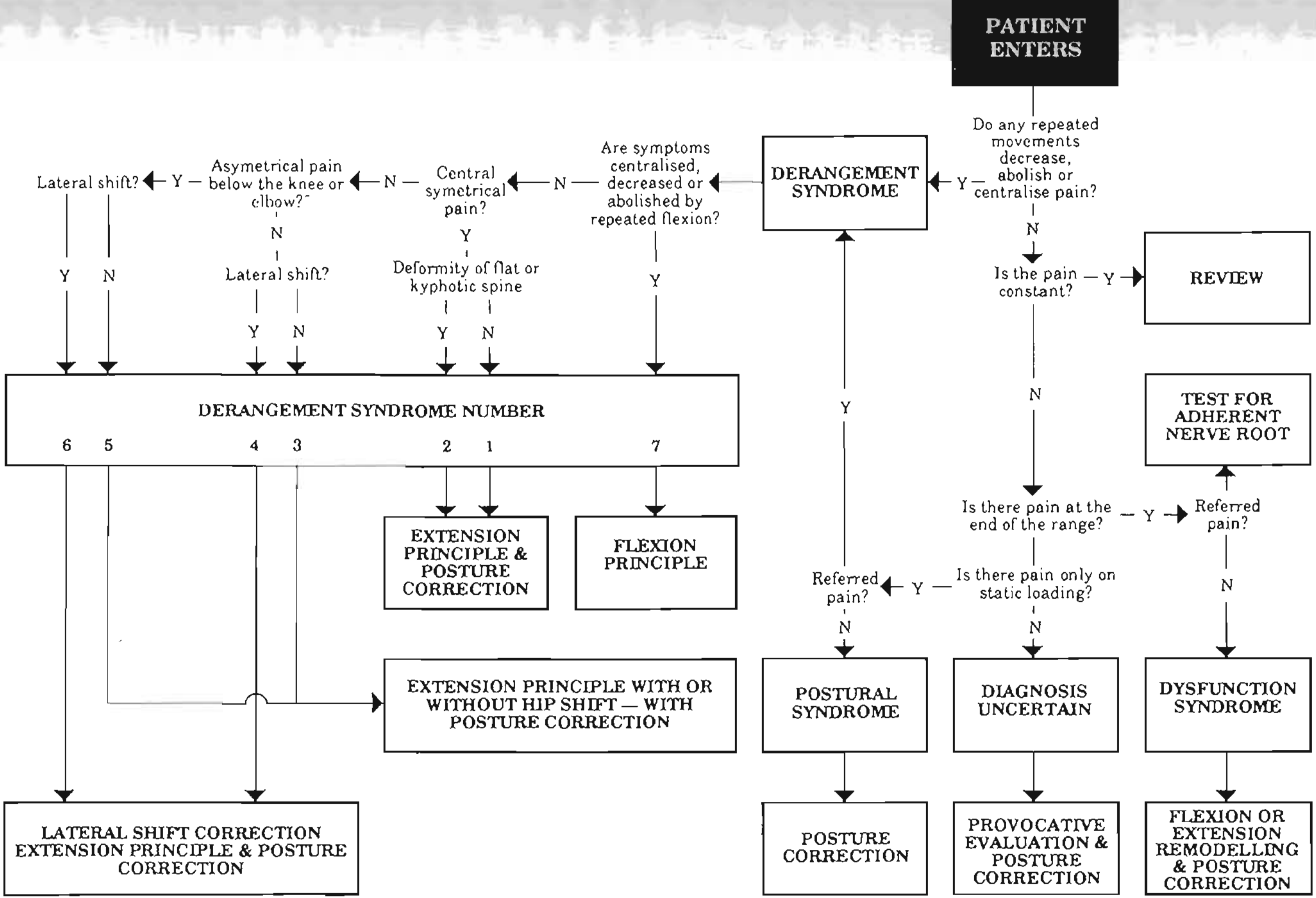


Fig 10.25. *A McKenzie Algorithm, after Kilby J, Stignant M, Roberts A: (Physiotherapy Sept. 1990)*

CHAPTER ELEVEN

Treatment

GENERAL PRINCIPLES

At present a great deal of research is taking place in attempts to scientifically validate SMT and explain its effects.[19, 37, 90] The most obvious and most important effect of mobilisation and manipulation is the increase of range of movement that can occur at any impaired joint to which the techniques are applied. This may be caused by an alteration in flow and displacement of an internal derangement, or by such an alteration in an adjacent structure that a more normal function is possible than existed prior to the application of the technique. The increase in range of movement as obtained by manipulation and mobilisation can also be achieved by exercises when performed in a certain way.

An exercise becomes a mobilisation when performed with a certain frequency and in such a way that a rhythmical passive stretch is created and in a similar manner a passive mobilisation can become a manipulation. Mobilisation and manipulation are extended exercises. In many situations it is possible to teach patients to apply mobilisation and manipulation to their own spine.

Provided there is adequate instruction and careful explanation regarding the aims of treatment, the self-treatment concept can be applied successfully to most patients with mechanical spinal pain. That is, to all the patients with the postural syndrome, nearly all with the dysfunction syndrome, and about seventy percent of the patients with the derangement syndrome. The emphasis in the "McKenzie" philosophy of patient care is self treatment. By teaching methods of self treatment it is possible for the patient to achieve independence from therapists and therapy.

Nevertheless the impression must not be created that SMT should be totally avoided in favour of a hands off approach. Of the seventy percent of patients who can self treat, the improvement in a significant number will be accelerated by the application of mobilising procedures applied in the initial stages of treatment and concurrently with the self treatment programme. The addition of mobilising procedures is also sometimes necessary to achieve complete reduction during the initial episode. Persisting pain, although much reduced in intensity from that present at onset, may only resolve with the use of SMT.[100] About thirty percent of patients with neck and upper back pain will only obtain complete recovery with techniques of either mobilisation or manipulation.

By reducing the use of therapist technique in the initial stages of treatment and maximising patient technique, the patient will recognise that his recovery is largely the result of his own efforts. Few patients fail to assume responsibility for active participation in their treatment, providing the instruction and education process is firmly and vigorously pursued.

Thus, we can choose to apply to common mechanical spinal problems either therapist generated force or patient generated force. The most widely used and popular mechanical therapy techniques are those in which the therapist applies external forces to the patient, that is, therapist generated forces. These procedures include massage, mobilisation, manipulation, and manual, sustained or intermittent traction, and will be described in more detail later in this chapter.

Various other mechanical systems of treatment such as myofascial release, cranio sacral therapy and muscle energy techniques involve the use of therapist generated forces but these procedures are conceptually vague, lack structure, and have no rational basis for their use. None have been studied scientifically. They will not be discussed here.

The second group of procedures are patient generated. Although less widely used, they are in my view the more important for they have the potential to provide the patient with that elusive long term benefit. The procedures in which patient generated forces are used to resolve the mechanical disorder can be static, as occurs when the patient is required to alter and maintain a new posture, or dynamic, such as occurs when the patient is required to exercise.

I have made it routine practice to emphasise the use of patient generated forces before applying therapist generated forces. Notable exceptions to this rule are explained in Chapter 20 under Derangement Four and Six.

The progressions for application of force in modern mechanical therapy are in order as follows:

Static patient generated force:

Positioning in mid range. (Fig 11:1)
Positioning at end range. (Fig 11:2)

Dynamic patient generated forces:

Patient motion in mid range. (Fig 11:3)
Patient motion to end range. (Fig 11:4)
Patient motion to end range with overpressure. (Fig 11:5)

Therapist generated forces:

Patient motion to end range with therapist overpressure. (Fig 11:6)
Therapist overpressure—mobilisation. (Fig 11:7)
Therapist overpressure—manipulation. (Fig 11:8)
Traction—manual, intermittent or sustained.(Fig 11:9)

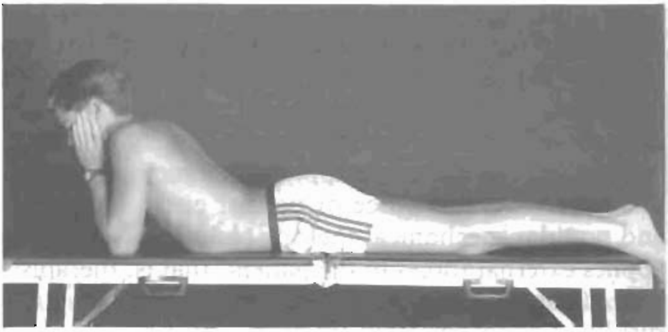


Fig 11:1

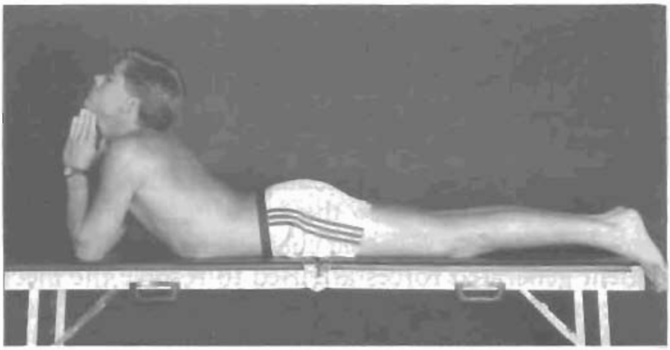


Fig 11:2

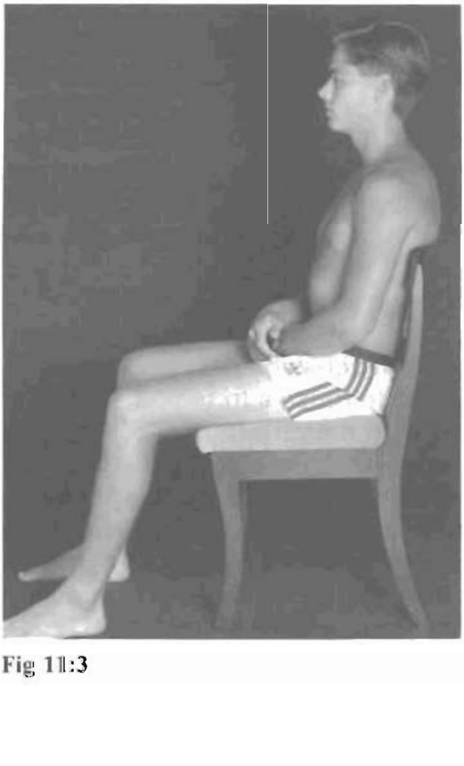


Fig 11:3

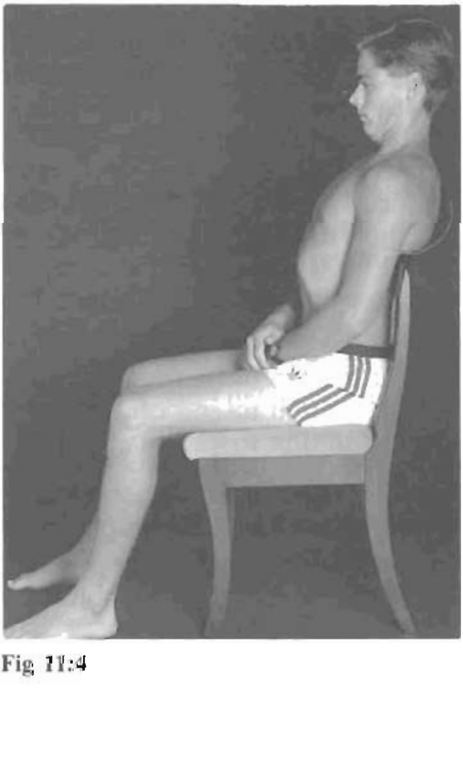


Fig 11:4

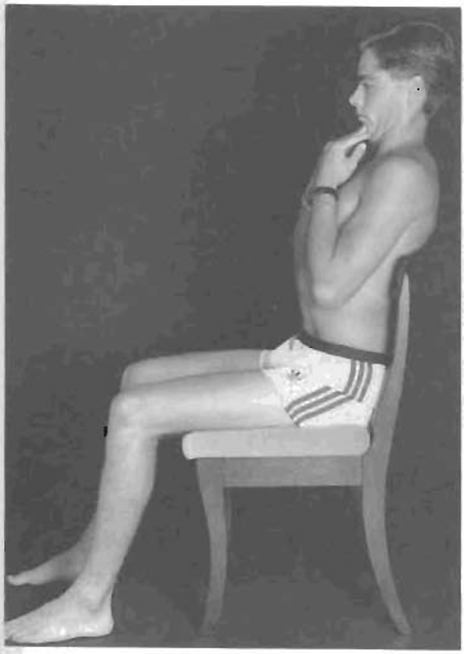


Fig 11:5

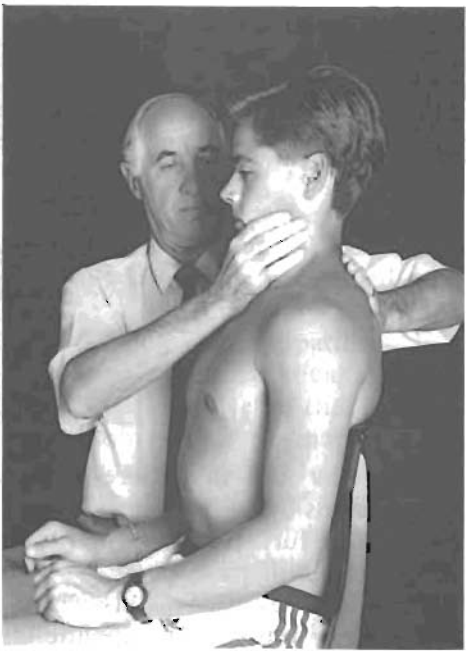


Fig 11:6

Fig 11:7

Fig 11:8

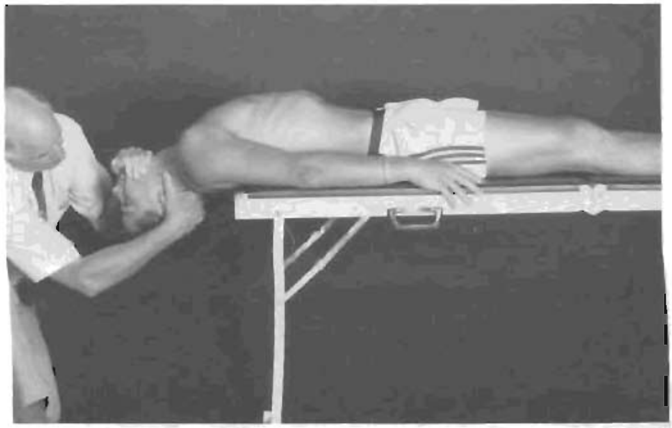


Fig 11:9

It can be seen that there is a gradual increase of force with the final progressions being made by the therapist. The increase is firstly in the force itself, but a further dimension is added by applying the force to the extreme of end range of motion.

There are several reasons why I think we should adopt this particular sequence in applying therapeutic mechanical force.

Firstly, can we justify the continued application of therapist generated forces in the form of mobilisation and manipulation, when it is likely that if given the opportunity, the patient can bring about the same result utilising his own movements and positions?

Secondly, patients, once taught methods of self treatment, can achieve on their own something that can never be provided by even the best intentioned therapist. The therapist providing mobilisation or manipulation therapy can apply those procedures at best once in every twenty-four hours if the patient is seen on a daily basis. The patient who has been taught self-applied reductive movements for derangement, can apply regularly throughout the day the pressures that will progressively reduce the derangement. Should he inadvertently move or position himself incorrectly and develop increasing symptoms, he merely exercises once more to reverse the process.

A further reason for teaching self-treatment methods is that therapy applied by therapists denies the patient the opportunity to gain independence from therapy, and almost certainly creates patient dependency. Our insistence on providing therapy by way of manual or various other procedures places the responsibility for the patient's progress fairly and squarely on the therapist. The patient has an excuse for his lack of progress should that situation prevail. On the other hand, once we can demonstrate to patients that they largely have control of their own pain, we can transfer the responsibility for the management of their problems back to the patients themselves.

By insisting whenever possible that our patients become responsible for their own care, we can assist to make them independent of therapy and provide for them what is potentially a long term benefit.

In applying patient generated force by way of natural movement which is repeated many times and, if necessary, in different planes, we test the integrity of the structures and thereby expose any likelihood of exacerbating fragile pathology. This built-in safeguard allows the therapist to confidently and safely apply therapist generated forces in the form of mobilisation or manipulation should those procedures be required.

Dynamic testing by repetitive motion should always precede the application of hands on procedures and is a vital part of any mechanical assessment programme. Dynamic testing utilising movements that are performed on a daily basis by most patients is safe and reliable. It is unwise to base one's decision to manipulate on findings obtained mainly from palpation.

Finally, therapists wishing to learn the unlocking sequence that can occur in patients with the derangement syndrome, deprive themselves of that learning experience when they rush in and apply mobilisation or manipulation prematurely before having given patients adequate opportunity to resolve the problem themselves. The movements that cause the "locked joint" to "unlock" are only discovered when the patient performs well defined repetitive movements in very specific sequences and the premature application of external forces can spoil that possibility by clouding the phenomenon of pain centralisation. It is this phenomenon that allows safe application of mechanical therapies in a reliable and predictable form.[41]

Clinical application of the centralisation phenomenon

The effects on the patient's symptoms that are produced by the application of loaded and unloaded repetitive sagittal flexion and extension provide, I believe, a more accurate indication of the nature of the underlying mechanical problem than any other testing system available to us today.

Centralisation of pain is most readily observed during the performance of repetitive sagittal flexion or extension. Either or both of these movements cause centralisation or peripheralisation of pain to occur more readily and in greater numbers of patients than do the movements of rotation and lateral flexion. For that reason I have used repetitive sagittal flexion and extension in the loaded and unloaded positions in both assessment and therapy. Those movements that cause the greatest change in the intensity or location of the patient's pain, are probably having the greatest effect on the causative pathology and are therefore most likely to bring about change.

The application of both patient generated and therapist generated forces should be governed by monitoring the effects that those forces have on the location and intensity of the patient's pain at the time of the delivery of those forces. *It will be taken for granted that therapists using the methods described in this book, will carry out the monitoring process precisely and regularly during both the assessment process and the entire period of treatment.*

Generally it will be found that about 67% of out-patients will respond to the application of repetitive sagittal motion and their symptoms will centralise, reduce or resolve completely without movement being required in other planes.[102] The remaining 33% will not sustain benefit from sagittal motion and its application may cause their symptoms to increase, peripheralise, or there will be no change. It is likely that in this group of patients resistant to sagittal extension, most will have unilateral symptoms.

Patients with asymmetrical or unilateral symptoms who have failed to respond to repetitive sagittal motion, usually require the application of unilateral forces in order to bring about reduction of the derangement and subsequent centralisation and resolution of their symptoms. The aim of treatment, whether obtained by the patient or the therapist, is to alter the location of pain and centralise it.

Movements that cause pain to increase in intensity or to move to a more distal location are undesirable and in some cases positively damaging and are thus contraindicated. With the exception of the treatment of nerve root adherence (a dysfunction) there is never an occasion to cause referred pain to increase or appear distally.

Movements that cause pain to reduce in intensity or move to a more proximal or central location are to be encouraged and are indications that the movement chosen is the appropriate movement or exercise for the patient. Sometimes the intensity of central pain can become quite significant and can dissuade the inexperienced therapist from persisting with the programme. An increase in central pain can be considered normal, provided radiating symptoms are at the same time reducing.

In treating radiating pain or pain referred from the cervical spine, centralisation may occur in a manner that can cause confusion when first observed. In such cases, referred symptoms may reduce and pain felt in the arm or shoulder may disappear. It would then be expected that as centralisation occurred, symptoms would appear in the central cervical region. However, although in these cases pain appears centrally, it does so initially in the vicinity of the seventh or eighth thoracic vertebra. With continued exercising the pain then tracks upwards and finally centralises about C5 to T1. This variation in the manner of centralisation is as reliable as the regular pattern and occurs particularly in those patients whose initial symptoms radiate or are referred. This pain behaviour may arise from dural involvement and requires further investigation. Pain referred from the cervical spine is commonly felt in the thoracic region[26] and this particular manner of centralising pain well demonstrates the fact. Patients complaining of pain only in the region of the neck itself are more likely to experience centralisation directly to the level affected.

To safely continue with an exercise that causes increasing central pain, the *peripheral symptoms must simultaneously move proximally or reduce in intensity. Do not persist with movements if the increasing centrally located pain is not at the same time accompanied by a reduction in the peripheral symptom.*

These guidelines or may I say "rules", will be followed throughout this book whenever assessment or treatment is described.

During the application of manual therapy techniques of mobilisation and manipulation, the monitoring of the location of pain is just as important, if not more so, as that which occurs during the performance of repeated movements carried out by the patient. Failure to follow the guidance provided by the centralisation and peripheralisation of pain that occurs during the process of mobilisation can lead to significant worsening of symptoms in patients with referred or radicular pain patterns.

The procedures of treatment described in this chapter will therefore consist of progressions of increasing force of motion applied in the sagittal plane firstly by the patient, and then by the therapist if that becomes necessary.

For those patients failing to respond to the application of sagittal forces, motion in another plane may be required to achieve centralisation. Even so the force initially must be applied by the patient himself and only when that force is inadequate should the therapist apply external therapeutic force.

Traction in flexion is one of the options I would recommend for the remaining resistant patients but, if that fails to provide relief, continuous passive end range motion in the direction of the restriction of motion may be of help. Patients with unresolved problems may eventually receive a wide variety of treatments before they respond, very often to some unorthodox form of therapy. A small number, perhaps two or three percent will never find relief from their problem. Patients with persisting pain may benefit from a pain modulation programme or pain relieving medication.

Nevertheless, the great majority of patients can be managed well providing the dominant syndrome is identified early and the appropriate treatment commenced as soon as possible. Just as the three R's, "Readin', Ritin' and Rithmetic", were the basics of primary education, so are the three R's in the treatment of musculo-skeletal conditions, "Re-education of posture, Remodelling of dysfunction and Reduction of derangement", the basics of therapy for mechanical spinal disorders.

CHAPTER TWELVE

Procedures and Techniques of Mechanical Therapy

A REVIEW

In the 1950's physiotherapists especially in British Commonwealth countries began incorporating manipulative procedures in their treatments. Prior to this mechanical therapy within physiotherapy consisted of techniques of massage and exercise in which the proponents were particularly adept. Then along came manipulative therapy, but there was no amalgamation between the exercise of physiotherapy and the manipulation of the osteopath and chiropractor. The conceptual model for the dispensing of exercise was completely different from the conceptual model for the use of manipulative therapy. There was no marriage between patient generated and therapist generated force. The two partners were incompatible.

Presently all over the world enthusiastic physiotherapists, frustrated and stifled by years of control by medicine or disillusioned by the use of ineffectual methods of physiotherapy, are "discovering" mobilisation and manipulation and are delivering SMT as the treatment of choice for most patients with spinal pain. This initial enthusiasm, although understandable, must be tempered and brought into perspective. Those of us well experienced in the use of manipulative therapy still derive that unique satisfaction whenever a spectacular improvement is obtained. There is no doubt that many patients benefit from SMT. Several studies demonstrate that there is a short-term benefit obtained from SMT,[18, 42, 51, 66, 75, 134] and a recent study,[109] has found that a long term benefit *may* be possible.

SMT has a particular and important part to play in the treatment of mechanical spinal pain. But those in the profession who, due to a long experience with SMT, are fully aware of the benefits and limitations of this form of treatment, must utilise this experience to moderate the enthusiasm of those entering the field. Until we have learned to distinguish between improvement that occurs directly as a result of treatment, and improvement that results from spontaneous healing or the natural history, our credibility is at risk. When our patients improve over a period of three to four months can we seriously attribute their recovery to our manipulative or mechanical prowess applied over this period? Failure to recognise and understand the natural history and the self-limiting characteristics of the non-specific spinal disorder, will perpetuate the inability of so many to critically review their treatment methods and results.

The time has come when we must rationalise the use of SMT. It is now possible to determine within the first 24 hours after assessment of the patient by repetitive end range motion, whether or not SMT will be a therapeutic requirement. The perpetuation of the mystique behind SMT itself is also of concern and its demystification is an urgent priority.

Once familiar with the various techniques of SMT, it becomes clear that the basic manoeuvres in common usage today, by whichever profession, are essentially the same. In essence, the manipulative treatments previously available only from osteopaths and chiropractors are now also dispensed by the physiotherapist well trained in modern mechanical concepts. The modern mechanical physiotherapist, however, has the added advantage of the use of the whole spectrum of mechanical concepts and tools. So in considering the form of mechanical therapy most appropriate for the patient, whether it be exercise, traction, mobilisation, or manipulation, the well trained modern mechanical therapist can provide this treatment.

It has now been demonstrated that several different patient populations can be taught to manage their own back problems using self-applied movement as described here and elsewhere. Several investigations have studied the value of the McKenzie approach in the treatment of the lower back. They are relevant nevertheless in this text as the methods are equally effective in the treatment of the cervical spine.

Of these studies, that by Roberts of Nottingham, England,[126] is of most significance, especially in regard to the long term benefit obtained by the patients treated by the McKenzie methods. Roberts compared McKenzie treatment with non-steroidal anti-inflammatory drug therapy. His patients were recruited prospectively and were treated within three weeks of onset of an attack of low back pain. Both groups of patients were encouraged to mobilise actively. Rest, after the first two days, was discouraged.

The major measure of outcome was a widely used disability questionnaire. At seven weeks after onset of the attack, the McKenzie treated patients were less disabled compared with the drug treatment patients. This difference became significant when those McKenzie patients who could not be diagnosed according to McKenzie's classification at the time of first assessment by the physiotherapist were excluded. This suggests that if a definite diagnosis cannot be made on initial assessment the result will be less certain, and that more experienced practitioners will have greater success when treating groups of patients as correct assessment seems to be a key part of treatment.

The patients in the McKenzie group who had not recovered after six treatments were found to represent a very difficult group to treat—at least by the physiotherapists involved in the study. This limit of six treatments matches the experience of Rath in America[124] and Stankovic in Scandinavia[142].

Patients who received McKenzie therapy were, however, away from work for longer than the drug patients and it is suggested that a directive to return to work from the physiotherapist is an important element to the regimen.

Careful psychological assessment was performed on all patients in connection with their personal responsibility for pain control. Patients undergoing McKenzie therapy were significantly more responsible for personal pain control than the drug treatment patients seven weeks after the onset of the low back pain. This responsibility alteration was still significantly different when measured six months later. McKenzie therapy alters the way patients think about pain.

The mechanism of centralisation was examined in detail and again, those patients who could be diagnosed on their first attendance with the physiotherapist showed better responses than the patients whose syndrome was unclear. Scores of pain intensity matched a score for peripheralisation with a very significant degree of correlation.

In 1986 Kopp[89] reported that of 67 patients with herniated nucleus pulposus (HNP) treated with the McKenzie extension protocol, 35 patients were able to achieve normal lumbar extension within three days of admission to the hospital. The remaining 32 patients all required surgery and of these only two were able to achieve extension before surgery. All 67 had failed six weeks of conservative treatment prior to being treated by the McKenzie protocol. Kopp concluded that the ability of patients with HNP and radiculopathy to achieve full passive lumbar extension is a useful predictor to select patients who can be expected to respond favourably to conservative management. He further reported that the inability to achieve extension (positive extension sign) is an early predictor of the need for surgical intervention, and recommended that extension exercises as a therapeutic modality.

In 1990 Alexander,[4] reported on a follow-up of the patients in the Kopp study. It was found that after an average of almost six years from onset, 33 of the 35 patients who did not require surgery were satisfied with the result and 82% had been able to resume their old jobs. At long-term follow-up, Alexander found that a negative extension sign was confirmed as a predictor of a favourable response to non-operative treatment of HNP in 91% of the non surgical group in Kopp's study.

Ponte,[122] and Nwuga,[118] both have compared the effects of the McKenzie programme with the Williams programme,[169] In both studies the McKenzie approach was found to be superior.

In 1990, Stankovic,[142] reported the results of a trial comparing the McKenzie protocol with a patient education programme in the form of mini back school. The patients, all of whom had acute low back pain, were randomly allocated to either one of the programmes. At one year, a follow-up assessed time taken to return to work, sick leave during initial episode, sick leave during recurrences, recurrences of pain during the year of observation, the patient's ability to self help, and pain and movement.

The patients in the McKenzie group achieved superior results for five out of seven variables. The only variables that did not show any significant differences were sick leave during recurring episodes of pain and patients' ability to self help. Although the study reports that there was no difference in the two groups with regard to the patients' ability to self help, it is significant that the patients in the McKenzie group had fewer recurrences during the year of observation. A possible explanation may be that the patients in the McKenzie group had fewer recurrences because they did have the ability to self help.

Only one study has assessed the long term value of this treatment approach for mechanical problems in the cervical spine.[103] In a single blind randomised prospective study McKinney found that advice to exercise and correct posture in the early phase after injury was superior to manipulative physiotherapy. At two year follow-up fewer patients in the exercise group had persisting symptoms. McKinney suggests that the reason for the superior results in the exercise group is that patients given responsibility for their own treatment may become self sufficient at managing episodes of a minor nature, and there may be psychological advantages in making patients responsible for their own treatment rather than victims of their own symptoms.

If there is the slightest chance that a patient can be educated in a method of treatment that enables him to reduce his own pain and disability using his own understanding and resources, he should receive that education. Every patient is entitled to this information, and every therapist should be obliged to provide it.

APPLICATION OF PROCEDURES AND TECHNIQUES

There are many mechanical options available to the therapist involved in the treatment of mechanical disorders of the spinal column. However, to simplify the process I have described here only those procedures which I have found to be consistently effective for the treatment of non-specific activity related spinal disorders which are most commonly seen in outpatient clinics.

After much experimentation, I have determined that the optimum number of movements necessary to effect stretching of shortened tissues and reduction of derangement, is somewhere between five to fifteen repetitions of each procedure. Therefore, exercises are performed in series of five to fifteen excursions each. The number of times in the day that each series of exercises must be done varies according to the syndrome to be treated, the effects to be obtained, and the capabilities of the patient involved but eight to ten times per day is usually adequate and not excessive. This means that a patient may need to repeat as many as 150 movements per day. Normally ten to fifteen excursions can be completed in one minute. Therefore no patient should use the excuse that there is insufficient time to exercise as instructed.

Unless stated otherwise, exercises will be performed with an almost continuous rhythm. On each contraction the maximum possible range must be maintained for a second. Each excursion must be followed by relaxation, and a brief pause of only a moment is required.

The procedures of self treatment for the cervical region are very simple and have the added advantage that they can be applied in sitting, standing or lying. This allows for the more frequent application of reductive pressures and a more rapid resolution of most of the problems; centralisation of pain occurs with less effort and in a greater proportion of patients than is the case when treating the lumbar spine.

If on the second visit the patient reports the pain has not changed, I always enquire about the pain in the following manner: "Is the pain in the same location as before? Do you feel the pain as often as before? If you had one hundred units of pain on your first visit, how many do you have today in terms of intensity?"

If no improvement has occured after two weeks of treatment by repetitive motion or SMT, a complete rest from all exercise should be prescribed for a minimum period of five days. Occasionally, exercise may be perpetuating rather than assisting in the resolution of the problem.

NOTE: During the application of mobilisation and manipulative therapy procedures it is possible to feel or hear a "click". It is advisable at this point to reassess the patient's range of motion, and the intensity and location of pain as frequently it will be found that a reduction in intensity or centralisation of the symptoms will have occurred.

TABLE OF PROCEDURES AND TECHNIQUES

PROCEDURE ONE

Retraction (with overpressure, sitting or standing)

In this text retraction means to move the head backwards as far as possible from a protruded position so that it is oriented more directly above the spinal column. During the movement the head must remain horizontal and facing forward and be inclined neither up nor down.

For instruction the patient is initially seated on an upright chair with a rather high back. From this position most patients can be taught to perform the exercise easily and can become proficient in a matter of five to ten minutes. Once the patient has mastered the exercise, it can be carried out in either sitting, standing or walking, whichever is convenient.

The intensity and location of any pain and other symptoms are recorded prior to the performance of the movement. In particular, always establish the location of the most distal symptom and constantly question the patient as to its behaviour.

If symptoms are already located centrally and there are no radiating pains, one must nevertheless be watchful for the development of radiating pain should the problem be acute and of recent onset.

The seated patient should be instructed to sit against the back of the chair allowing the head to adopt a natural relaxed position. (Fig 12:1)

From the relaxed position the patient is instructed to retract the head as far as possible, keeping the head facing forward and horizontal during the movement. (Fig 12:1a) The movement should be made to the maximum end range of retraction. Once the maximum end position has been reached and held momentarily, the patient may relax back to the start position. (Fig 12:1) The effect of this first single movement on pain intensity and location must be recorded. Any sign of peripheralisation of pain will sound a cautionary note, and any reduction or centralisation of pain will provide a clear indication of the suitability of the exercise.

The same movement should then be repeated rhythmically, always returning to the relaxed position after each retraction. With each excursion the patient should be encouraged to move even further than before, so that after five to fifteen movements the maximum possible range of motion has been achieved.

Changes in pain location and intensity, and the presence of either centralisation or peripheralisation are noted immediately after completion of each sequence of movements. We should also record whether symptoms remain better or worse as a result of the test movements. It may be necessary to allow some time before this can be established.

It is unwise to continue with the repetition of any exercise should it be clear after a few movements that distal symptoms are being exacerbated.

Once the safety of the manoeuvre is established, the first progression can be applied to ensure that maximum range of motion is produced by the patient. This is achieved by having the patient apply overpressure using one or both hands against the lower jaw. (Fig 12:1b)

Fig 12:1. *Neutral upright position.*

Fig 12:1a. *Head retraction.*

Fig 12:1b. *Retraction with overpressure.*

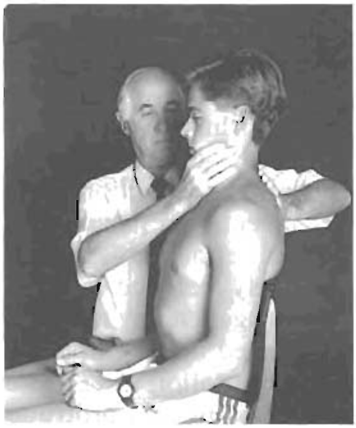


Fig 12:1c. *Retraction with therapist overpressure.*

Some incoordinated individuals will try the patience of the therapist and may take a day or so to master the movement. However, the correct application of this movement is vital for the success of the programme as a whole and the extra time involved in teaching the procedure will be well spent in the long run.

Under some circumstances such as may arise with apprehensive or nervous patients, the therapist may have to assist with the application of the overpressure. To do this, place one hand at the base of the patient's neck at about the level of the first or second thoracic vertebra to provide stability for the overpressure. Then, with the other hand, gently but firmly apply pressure against the patient's clenched jaw so that the head and neck is retracted as far as can be tolerated. (Fig 12:1c) Ensure that the patient's teeth are approximated so that movement occurs at the spine and not the jaw.

The patient should continue with the application of reductive pressures at home or at work as indicated in later chapters.

Effects

Retraction of the head produces flexion in the upper cervical segments and simultaneously causes extension in the lower segments. It has been demonstrated that more flexion occurs in the upper cervical spine when the head is retracted than occurs when the head and neck are simply flexed. (120)

Retraction of the head reverses any anterior shear or translation forces that may develop during prolonged end range positioning with head and neck flexed or in a protruded or forward head posture. Thus the restraining ligaments, the apophyseal joint capsules and the posterior annulus will relax and overstretching and creep will be avoided.

In the derangement syndrome any tendency for displacement or migration of fluid, nuclear gel or sequestrum towards the posterior compartment of the lower cervical intervertebral discs will be reduced by this movement.

In the dysfunction syndrome this exercise will stretch any structures adaptively shortened as a result of longstanding protruded head posture. The upper segments of the cervical spine and the atlanto occipital joints will be flexed during this exercise. This is clinically important in the treatment of cervical headache syndromes which respond well to upper cervical flexion obtained by retraction, but are in my experience almost totally unresponsive to conventional flexion exercises.

Head retraction is an essential precursor to other movements required to effectively treat the cervical spine. Some movements, apparently ineffectual or even aggravating to the patient, can become effective when their application is preceded by repetitive retraction of the head and neck. Limitation of the range of motion in extension and rotation which may be present while the head remains in a protruded position, can disappear when the movements are carried out with the head in the retracted position. Further, painful limitation of extension and rotation can become painless when the same movement is performed with the head in the retracted position.

Many patients suffer from painful restriction of extension in the cervical spine and avoid the painful movement. This is experienced so frequently that patients are regularly advised to avoid extension completely. However, if head retraction precedes the motion of extension, most patients, notably those in the derangement category, will recover painfree extension within a few days of commencing an appropriate exercise programme. The same experience can be had with patients who have painful and limited rotation of the head and neck.

Perhaps the most important reason for performing retraction of the head and neck prior to moving into the extended position is the effects these movements have on referred and radiating symptoms. A well established test to confirm the origin of radiating symptoms from the cervical spine is to extend and then rotate the neck towards the side of radiating pain or parasthaesia in order to provoke and thus confirm the origin of the problem. The commonly accepted theory is that this test reduces the diameter of the intervertebral foramen and will produce or increase peripheral symptoms should the existing nerve roots be compromised. If this test is applied repeatedly, the patient's condition will frequently worsen. However, should the head and neck be retracted immediately prior to extending and rotating the neck, a reduction of the referred symptoms frequently follows. This is most likely to occur if the referred symptoms are intermittent.

Patients with constant referred symptoms respond less frequently than those with intermittent pain but sufficient numbers improve to make the assessment process worthwhile.

Clinical application

Retraction is the first procedure and an essential preliminary technique for the reduction of posterior derangement in the lower cervical spine.

It is used for the treatment of flexion dysfunction in the upper and extension dysfunction in the lower cervical spine.

It is also the main treatment technique for headache of cervical origin.

PROCEDURE TWO

Retraction and extension (with overpressure, sitting or standing)

Head and neck retraction and extension is the movement of retraction (Procedure 1), followed immediately by movement of the head and neck into the fully extended position. Although there are two movements involved, they should appear to be one continuous motion until the neck is fully extended.

The intensity and location of any pain and other symptoms are recorded prior to the performance of the movement. In particular, always establish the location of the most distal symptom and constantly question the patient as to its behaviour.

The patient is seated as in Procedure One. (Fig 12:2) The patient then retracts the head as far as is possible or tolerable, depending on the intensity of the pain. (Fig 12:2a) Once the end range of retraction has been reached, the patient is instructed to continue the movement by slowly and cautiously extending the head backwards as far as is possible or can be tolerated. (Fig 12:2b) After a second the patient should carefully raise the head, using his hand to help if necessary, and return the head to the upright neutral position. (Fig 12:2) The effects of the performance of one movement on the pain should be recorded.

The patient then repeats the movement of retraction, with self-applied overpressure if necessary, and extension two or three times in a rhythmical fashion and the effects of repetition are recorded. Should there be no significant increase in the symptoms and providing pain has not moved distally, the patient can repeat the cycle of movement with an additional motion introduced at the end of the range of extension. This movement consists of a rotation of the head and neck which is introduced in the fully extended position. (Fig 12:2c) The patient should rotate the head to alternate sides about four or five times so that the nose moves about half an inch only to either side of the mid line. During the performance of this motion the patient should be encouraged to move further and further into the extended position. The patient should then return to the upright position and the effects recorded. (Fig 12:2)

If the performance of retraction is obstructed by severe increase or peripheralisation of pain, the sitting manoeuvre should be abandoned and the exercise performed in supine or prone lying.

Once the safety of the exercise has been established and the symptoms are centralising or reducing, the patient may perform the movement when sitting standing or walking. From now on the patient is able to apply reductive pressures frequently during the day and so counter any tendency for recurring posterior displacement. There is rarely a need to place rigid restriction on the number of cycles the patient may perform during the course of the day. The patient will soon learn to exercise whenever the need arises.

The patient should continue with the application of reductive pressures at home or at work as indicated in later chapters.

Fig 12:2. *Neutral upright posture.*

Fig 12:2a. *Head retraction.*

Fig 12:2b. *Extension.*

Fig 12:2c. *Rotation in extension.*

Effects

Retraction of the head preceding the movement of extension of the cervical spine causes a greater range of lower cervical extension than is obtained by performing extension alone.

The action of retracting the head immediately prior to moving into the extended position also has a significantly greater effect on the patients symptoms than is obtained by simply extending the neck from the neutral position.

Clinical application

This is the first progression and most widely applicable technique for the reduction of posterior derangement in the lower cervical spine.

The effects of retraction and extension on the intensity and location of pain arising from mechanical disorders of the cervical spine can be dramatic. This movement is probably even more effective in treating disorders of the cervical spine than prone sagittal extension is in the treatment of non specific low back and referred pain.

In posterior derangement this manoeuvre is the main method of treatment for reduction as it compresses the posterior compartment of the intervertebral disc in the extended position.

It is also the best prophylactic movement for long term care. It can be applied sitting standing or walking, whenever the need arises.

This is also the first progression of the Extension Principle for the treatment of extension dysfunction in the cervical spine.

PROCEDURE THREE

Retraction and extension (with overpressure, lying supine or prone)

This exercise produces the same movements of head retraction and neck extension that occur in Procedure 2, together with a fine rotary component added at the end. The movements are however carried out in the supine or prone position.

Lying Supine

The intensity and location of any pain and other symptoms are recorded prior to the performance of the movement. In particular, always establish the location of the most distal symptom and constantly question the patient as to its behaviour.

For ease of instruction, Procedure 3 may be divided into the two separate components of retraction and extension.

The patient should lie supine on the treatment table. (Fig 12:3) In acute cases and during the initial treatment session, one or two small pillows may be placed under the neck and head to allow for the deformity.

The patient should be instructed to retract the head by pulling the chin down as far as possible. (Fig 12:3a) It will not be possible for the whole head to move dorsally when the exercise is done in supine lying. The patient should then relax and allow the head to return to the starting position. The movement should be repeated several times to assess the effects of the exercise on the intensity and location of the pain. Presuming that no adverse reaction is experienced, the patient can now change position to perform the extension component of the Procedure.

The patient should be instructed to remain supine, place one hand behind the occiput, and move over the end of the treatment table so that the head, neck and shoulders are unsupported down to the level of the third or fourth thoracic vertebra. (Fig 12:3b) The patient then fully retracts the head, (Fig 12:3c) and lowers it until the neck is fully extended and hanging relaxed. (Fig 12:3d) After a second, or longer if possible, the patient should return to the starting position by lifting the head with the supporting hand while at the same time tucking in the chin. (Fig 12:3b) He should avoid actively raising the head by using the neck musculature or bringing head and neck too far forward into flexion. The effects of the procedure are recorded. The patient may repeat retraction and extension in a continuous rhythm for five or six excursions depending on individual tolerance.

Should there be no significant increase in the symptoms and providing pain has not moved distally, the patient can repeat the cycle of movement with an additional motion introduced at the end of the range of extension. This movement consists of a rotation of the head and neck which is initiated in the fully extended position. (Fig 12:3e) The patient rotates the head to alternate sides about four or five times so that the nose moves about half an inch to either side of the mid line. During the performance of this rotary motion he should be encouraged to move further and further into the extended position. On completion the head should be returned to the starting position. (Fig 12:3b)

The cycle of retraction, extension and rotation should be completed in sequences of five or six repetitions. The effects on the symptoms should be recorded and providing no adverse reactions are felt, the patient can be instructed to repeat the movements at home or at work according to the guidelines in later chapters.

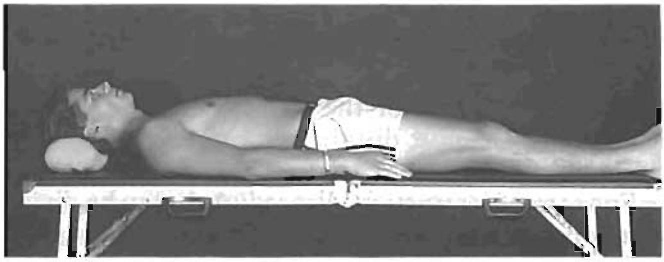


Fig 12:3. *Lying supine with small pillow.*

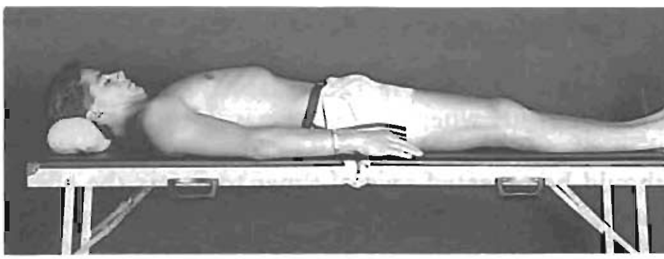


Fig 12:3a. *Head retraction in lying.*

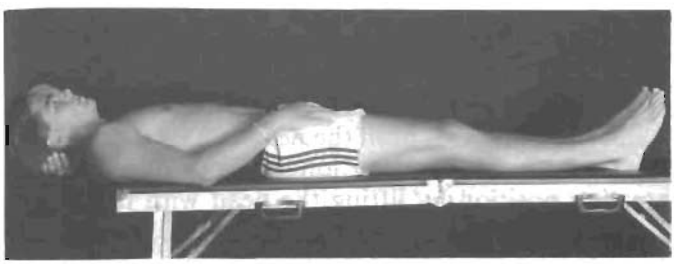


Fig 12:3b. *Supine over end of treatment table.*

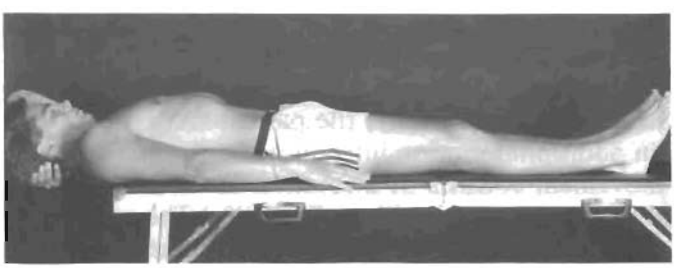


Fig 12:3c. *Retracts.*

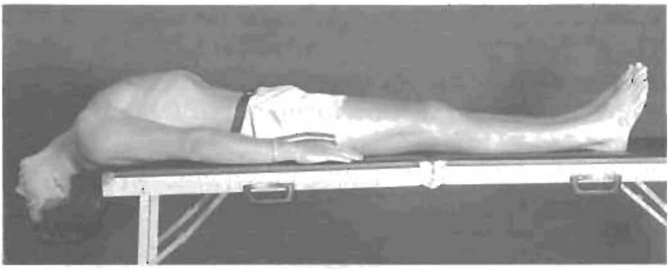


Fig 12:3d. *and Extends.*

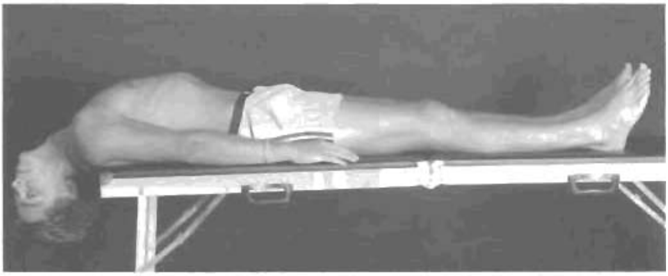


Fig 12:3e. *Rotation and extension in lying.*

Lying prone

The intensity and location of any pain and other symptoms present are recorded prior to the performance of the movement. In particular, always establish the location of the most distal symptom and constantly question the patient as to its behaviour.

The patient lies prone on the treatment table leaning on the elbows so as to raise the upper trunk. The patient then retracts and extends the head and neck in the same manner required when the exercise is performed in sitting. After repeating the movement five or six times, the patient then rests the chin on the outstretched finger tips with the head facing forwards and upwards in an extended position. (Fig 12:3f) It is important to have the patient as relaxed as possible in order that a passive overpressure can develop as the position is maintained for a few seconds.

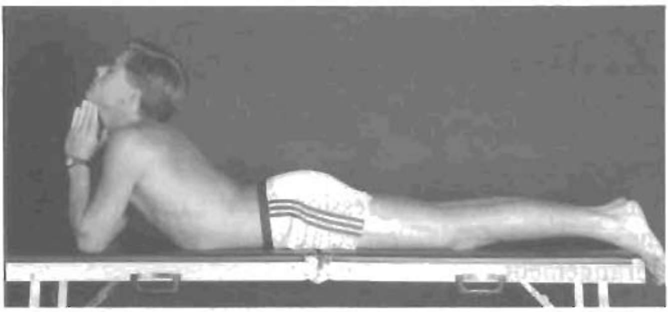


Fig 12:3f. *Extension prone.*

It is now necessary to add the rotary component whilst in the prone position. The patient should rotate the head to alternate sides about four or five times so that the nose moves only about half an inch to either side of the midline. (Fig 12:3g) During the performance of this rotary motion, the patient should be encouraged to move further and further into the extended position.

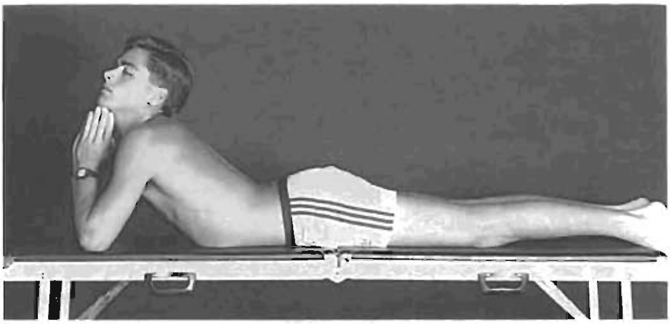


Fig 12:3g. *Rotation in extension prone.*

The cycle of retraction, extension and rotation should be applied in sequences of five or six repetitions. The effects on the patient should be recorded and providing no adverse effects are felt, the patient can be instructed to repeat the movements at home or at work as indicated in later chapters.

Effects

The unloaded lying position allows a better range of extension than can be obtained by performing this movement in either the sitting or standing position. The degree of pain experienced by doing the exercise in the unloaded supine lying position is significantly less in most patients. This is advantageous when treating patients with very acute symptoms who are unable, because of pain, to perform the exercise in the sitting or standing positions. If the patient is able to achieve total relaxation in the extended position, the weight of the head will provide a traction effect.

The adoption of the prone position enables a greater margin of patient control and many who are apprehensive of performing this exercise in the supine position are readily able to extend while prone.

It is often the case that patients who are initially unable to extend in the upright position, are able to do so following the performance of retraction and extension supine or prone.

Clinical application

This is the second progression for the reduction of posterior derangement in the cervical spine, especially of the very acute or resistant posterior derangement.

The procedure is also recommended for the treatment of extension dysfunction.

Some cervical headaches can be aggravated by both supine and prone extension exercise and require the application of the flexion principle of treatment for the upper cervical spine.

Some patients are unable to tolerate this exercise when performed supine because of dizziness or nausea. This may pass after repetition as the patient becomes accustomed to the exercise. Should this problem persist in the supine position, the prone lying version should be used. In patients who experience persistent dizziness or nausea, care should be taken to perform the variation of these tests outlined in Chapter 17 in Treatment for Cervical Headache.

PROCEDURE FOUR

Retraction and extension with traction and rotation (lying supine)

If trauma or external force was responsible for the present symptoms, the use of this manoeuvre should be delayed until such time as radiological investigations have ruled out the existence of fracture or ligamentous instability. This will be demonstrated radiographically by excessive translatory motion. The procedure may be applied only after adequate testing by repetitive motion and sustained positioning has ensured the safety of the technique.

Procedure Four calls for the application of therapist pressure which should not be applied until all patient self treatment procedures have been applied safely without causing either increasing or peripheralising symptoms.

The movement produced in this Procedure is retraction of the head and extension of the cervical spine whilst under traction.

The intensity and location of any pain and other symptoms are recorded prior to the performance of the movement. In particular, always establish the location of the most distal symptom and constantly question the patient as to its behaviour.

The patient lies supine with the head over the end of the treatment table. The patients head is supported by the therapist. The therapist holds the patient by placing one hand under the occiput with the thumb to one side and the fingers to the other side of the upper cervical segments. The therapist then places the other hand and fingers under the patient's chin and gently but steadily applies longitudinal traction. (Fig 12:4) While maintaining a firm traction the therapist fully retracts the patient's head and then extends the cervical spine by drawing the head down to the end of the available range of extension or as far as the patient can tolerate. (Fig 12:4a)

The patient remains completely relaxed throughout the movement. At the end range of extension the traction forces are slowly but not completely reduced, and the rotary component described in Procedures Two and Three is applied. While maintaining a little traction the therapist should, in the fully extended position, rotate the head to alternate sides four or five times so that the nose moves only about half an inch to either side of the mid line. (Fig 12:4b) During the performance of this motion the therapist aims at gaining even further extension.

The manoeuvre must be applied gently and slowly for the first two or three excursions. Throughout there should be continuous monitoring of the patient's symptoms and providing the patient's pain is reducing or centralising or the range is improving, the procedure can usually be repeated five or six times in the first session.

It is important that following the use of this procedure the patient is instructed to continue the reductive pressures by applying Procedure Three (Extension in lying supine or prone) at home or at work. The application of Procedure Four is usually not required for more than two or three successive days.

The patient should continue with the application of reductive pressures at home or at work as indicated in later chapters.

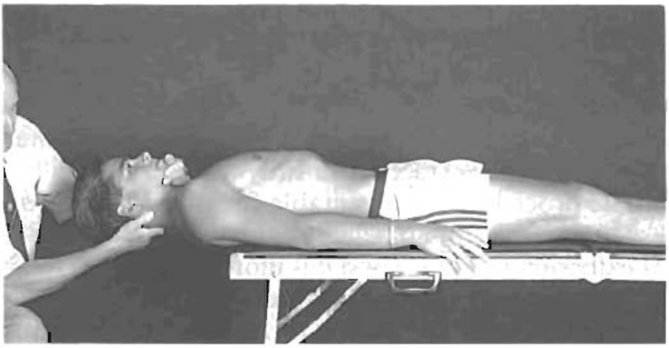


Fig 12:4. *Traction in lying.*

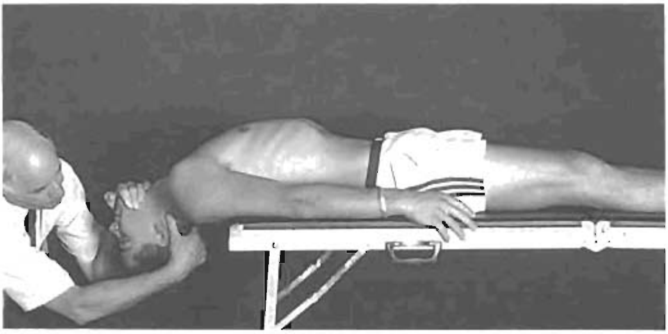


Fig 12:4a. *Traction and extension in lying.*

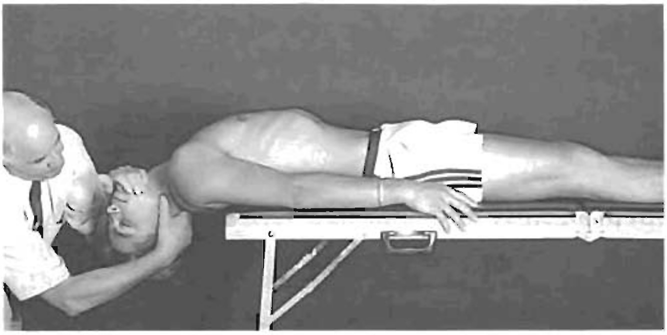


Fig 12:4b. *Rotation and traction in extension.*

Effects

Procedure Four is initiated with a component of traction which is maintained throughout the movement. The amount of retraction and extension obtained by this procedure is greater than can be achieved by any of the previous manoeuvres.

Clinical application

Procedure Four is the third progression for the reduction of posterior derangement in the cervical spine, especially of the very acute or resistant posterior derangement. It is particularly necessary for those patients whose symptoms improve with earlier progressions but who do not remain better as a result of their application. Sometimes it is the only way in which a posterior derangement may be reduced. Cervical extension may be impossible until the therapist applies traction in this way.

The procedure is not suitable for the treatment of extension dysfunction.

The intensity of some cervical headaches can be aggravated by this form of extension technique and it is more appropriate to apply the flexion principle of treatment for such symptoms.

*Some patients are unable to tolerate this exercise because of dizziness or nausea. Patients who experience these symptoms **must be** subjected to the tests outlined in **the treatment for cervical headache,** Chapter 17.*

PROCEDURE FIVE

Extension mobilisation (lying prone)

This procedure is required for patients whose symptoms are resistant to the previous manoeuvres. Although the symptoms may be reduced or centralised by previous procedures, they do not remain reduced and return shortly after the completion of the exercise. The direction of applied force and movement has been determined to be appropriate but patient generated force is inadequate to reduce the derangement.

The intensity and location of any pain and other symptoms are recorded prior to the performance of the procedure. In particular always establish the location of the most distal symptom and constantly question the patient as to its behaviour.

The patient lies prone on the treatment table with the arms by the side. A pillow is placed under the upper thorax and lower jaw. The placement of the pillow should be such that the application of pressure from posterior to anterior at the mid and lower cervical segments is likely to produce local segmental extension. To achieve this it may be necessary to place the pillow more cranially which will in turn place the cervical spine in a more extended position.

The therapist places the thumbs on either side of the spinous process at the appropriate level. (Fig 12:5) By exerting pressure evenly on both sides with the tips of the thumbs, the therapist accentuates extension movement in a rhythmical fashion by alternately applying and then releasing pressure. Pressure is applied towards the end of the range, (Fig 12:5a) held momentarily and then released but contact should not be lost. The effects on the symptoms should be recorded.

The movement may be repeated in a rhythmical fashion five to fifteen times and providing the pain is reducing or centralising the force applied may be progressively increased so that full end range motion is obtained.

Lying Supine

It is also possible to apply anterior to posterior translatory movements in the supine position. The patient lies supine on the treatment table which is elevated to a height that enables the therapist to perform the movement with good control. The patient's head and neck should lie over the end of the treatment table down to the level of T4. The patient must remain relaxed throughout the procedure. The therapist stands to one side and holds the patient's head under the occiput with one hand. The thumb and fingers of the other hand are placed over the patients upper lip. The head of the patient is held gently but firmly against the therapists waist. By bending and straightening the knees and at the same time keeping the patients head in the horizontal plane, the therapist alternatively applies retraction and protrusion of the head and neck. The emphasis should be on retraction.

Effects

The addition of therapist generated force enhances the effects obtained during the application of retraction and extension.

Clinical application

This procedure is most often required for patients with symmetrical symptoms arising from the mid and lower segments of the cervical spine, which radiate or are referred and which are not reducing or centralising with repetitive sagittal extension or which reduce or centralise but do not remain so.

In conjunction with retraction (Procedure One) and retraction and extension (Procedure Two), Procedure Five is suitable for the treatment of extension dysfunction of the mid and lower cervical spine.

Fig 12:5. *Thumb positioning for extension mobilisation.*

Fig 12:5a. *Pressure applied to end range.*

PROCEDURE SIX

Retraction and lateral flexion (with overpressure, sitting, standing or lying supine)

As with the other cervical procedures this manoeuvre retracts the head and cervical spine prior to performance of the prime movement of lateral flexion. The retracted position should be maintained throughout the lateral flexion component of the exercise.

The intensity and location of any pain and other symptoms are recorded prior to the performance of the movement. In particular, always establish the location of the most distal symptom and constantly question the patient as to its behaviour.

The seated patient firstly retracts the head, (Fig 12:6) and then laterally flexes towards the side of pain in derangement, and in dysfunction away from the side of pain. (Fig 12:6a) After a second in that position the patient returns to the upright position. (Fig 12:6) The effects of the procedure on the symptoms are recorded. The cycle of movement is repeated five to fifteen times so that the full available range is obtained. If the symptoms are responsive to this pressure the patient may continue the exercise at home or at work as recommended in later chapters.

Should the response be inadequate, it may be necessary to apply more pressure. To do this the patient stabilises the upper trunk by holding onto the seat base with the hand opposite to the side of pain. The patient then retracts, and places the other hand over the top of the head with the fingers reaching to the ear. With the head still retracted the patient pulls the head towards the side of pain as far as possible. (Fig 12:6b) After a second in this position, and while keeping the hand in place, the patient should return to the upright position. (Fig 12:6) The effects on pain are recorded.

Fig 12:6. *Retraction.*

Fig 12:6a. *Lateral flexion.*

Fig 12:6b. *Lateral flexion with overpressure.*

The movement should be repeated five to fifteen times and the effects of repetition should be noted. Providing the symptoms are reducing or centralising the patient can repeat the sequence whenever necessary. Care should be taken to avoid any rotation and if possible the movement should appear to be a lateral flexion only.

After establishing the safety of the procedure, the patient can be instructed to carry out the manoeuvres at home or at work as recommended in later chapters. Although the exercise is best done in the sitting position, patients should be shown how to perform the exercise in standing and supine lying as well.

The patient should continue with the application of reductive pressures at home or at work as indicated in later chapters.

Effects

The conceptual model for the treatment of patients with lateral or posterolateral derangement is that, if pain is felt unilaterally, any displacement present must be towards the side of pain. By laterally flexing towards the painful side, compressive loading in the lateral compartment of the disc will move displaced tissue towards the side of least loading. This causes any migratory tissue (fluid, nuclear gel or sequestrum) to relocate in a more central position. This will be indicated by the movement of pain to the midline. Should the motion of lateral flexion be excessive or prolonged, it is not uncommon to hear patients describe that their symptoms have appeared on the opposite side.

In dysfunction, it is necessary to remodel and stretch the adaptively shortened structures. In order to achieve this, side bending should take place away from the painful side.

Clinical application

This procedure is most often required for posterolateral derangement patients with unilateral symptoms arising from the lower segments of the cervical spine, which radiate or are referred and which are not reducing or centralising with repetitive sagittal extension.

Lateral flexion applied to the lateral compartment in postero lateral derangement, usually produces change in the patients symptoms within the first twenty four to forty eight hours. Do not persist with the exercise if the manoeuvre has ceased to cause change in the location or intensity of the patients symptoms. It is better to re-evaluate the effects of extension and, if found to be of no benefit, then to explore the effects of rotation.

The performance of lateral flexion may be discontinued once the pain has centralised or when improvement ceases. The patient should however continue with Procedure Two or if necessary Three in order to obtain complete reduction of the derangement.

PROCEDURE SEVEN

Lateral flexion mobilisation and manipulation (sitting and lying supine)

This procedure is required for patients whose symptoms are resistant to the previous manoeuvres and is a progression of Procedure Six. Although the symptoms may be reduced or centralised by previous procedures, they do not remain reduced and return shortly after the completion of the exercise. The direction of movement has been determined to be appropriate, but patient generated force is inadequate to reduce the derangement.

To determine the point at which the motion is to be accentuated, it will be necessary to test the effects of the application of pressure at different segmental levels. The mobilisation and, if found to be necessary, the manipulation will be applied at the level which causes the symptoms to reduce, centralise or abolish. *It is not appropriate to choose the level at which the manoeuvre is to be applied by relying on information obtained from palpation or radiography.*

The intensity and location of any pain and other symptoms are recorded prior to the performance of the movement. In particular, always establish the location of the most distal symptom and constantly question the patient as to its behaviour.

Sitting

The patient sits relaxed in a straight backed chair with the hands clasped together and resting on the top of the thighs. (Fig 12:7)

The therapist stands behind the patient and places one hand on the painful side so that the metacarpo phalangeal junction is against the lateral articular pillar of the cervical column at the appropriate level. The tip of the thumb rests against the side of the spinous process. (Fig 12:7a) The therapist's other hand is placed against the side of the patient's head on the non painful side. (Fig 12:7b)

The therapist laterally flexes the patient's head towards the side of pain and near end range. (Fig 12:7b) The therapist then applies pressure using the hand against the lateral pillar of the column, so that end range lateral flexion is obtained. Following this the therapist releases the pressure so that the head and neck return to an upright position. (Fig 12:7)

The effects on the symptoms should be recorded. The manoeuvre may be repeated in a rhythmical fashion five to fifteen times and providing the pain is reducing or centralising, the force applied may be progressively increased so that full end range motion occurs. The therapist should not allow rotation or protrusion of the head to occur as this manoeuvre is applied. The natural coupled movement of rotation that occurs with lateral flexion is of course unavoidable, but obvious rotation of the head and neck must be kept to a minimum.

After two or three sessions of mobilisation spread over a period of six or seven days, the patient's symptoms should be resolving. If no response is obtained by that time it may be necessary to apply the next progression of manipulation, but manipulation should not be applied routinely to all patients.

To progress the technique of mobilisation to that of manipulation, the positioning of both patient and therapist can remain the same. Premanipulative assessment obtained when applying mobilisation techniques will already have determined the available range of motion and confirmed the correct direction of movement.

The therapist laterally flexes the patients head towards the side of pain and with the hand against the lateral pillar of the column, the therapist then applies an additional short amplitude, high velocity movement at the end range of lateral flexion.

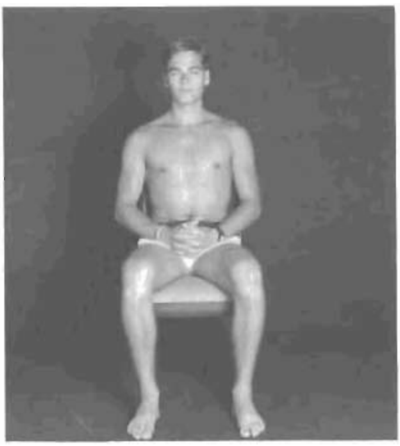


Fig 12:7. *Neutral upright posture.*

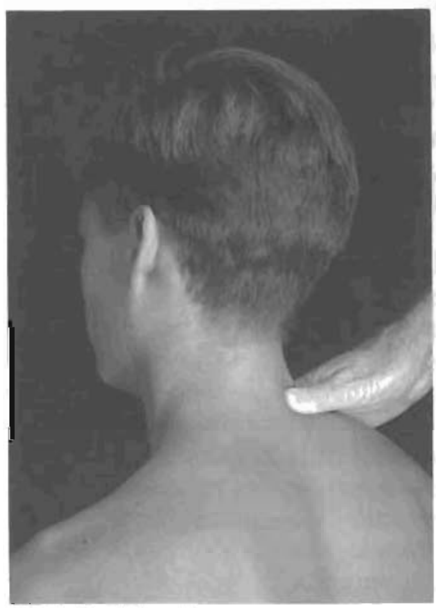


Fig 12:7a. *Thumb position for lateral flexion mobilisation.*

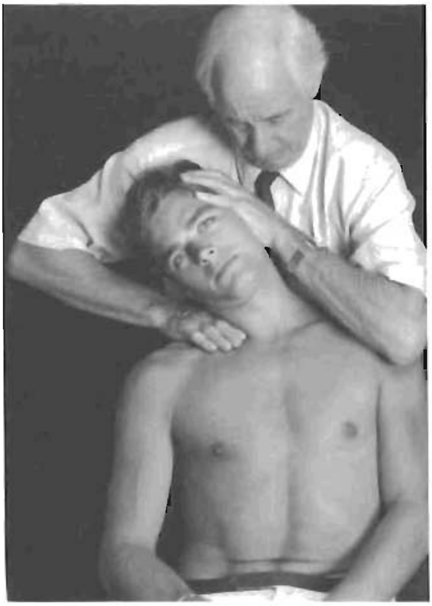


Fig 12:7b.
Pressure applied towards end range.

Lying supine

Should the therapist decide that these procedures would be better applied in the unloaded position, a modification is necessary.

The patient lies supine on the treatment table which is elevated to a height that enables the therapist to perform the manoeuvre with good control. The patients head and neck should lie over the end of the treatment table supported by the therapist. The patient must remain relaxed throughout the Procedure.

With one hand on the pain free side, the therapist holds the patient's jaw and cradles the head between forearm and chest wall. The therapist's other hand is placed so that the metacarpo-phalangeal junction of the index finger rests firmly against the lateral articular pillar of the cervical column. The therapist laterally flexes the patient's head towards the side of pain, accentuating the movement to the end of range with both hands. (Fig 12:7c) The therapist then releases the pressure so that the head and neck are returned to the neutral position.

The effects on the pain should be noted and the manoeuvre may be repeated in a rhythmical fashion five to fifteen times. Providing the pain is reducing or centralising, the force applied may be progressively increased so that full end range motion is obtained.

To progress the technique of mobilisation to that of manipulation, the positioning of both patient and therapist can remain the same.

The therapist now applies with the metacarpo phalangeal junction of the index finger against the lateral pillar, a short amplitude, high velocity movement to the end of the range of motion. During this process the hand on the other side stabilises the patient's head and neck.

Fig 12:7c. *Lateral flexion mobilisation in lying.*

Following manipulation the patient should continue with the application of reductive pressures at home or at work as indicated in later chapters.

It is also possible to apply lateral translatory movements in the supine position. The patient lies supine on the treatment table which is elevated to a height that enables the therapist to perform the movement with good control. The patient's head and neck should lie over the end of the treatment table down to the level of T4. The patient must remain relaxed throughout the procedure. The therapist holds the patient's head between both hands with the junction of the metacarpophalangeal joints adjacent to the articular pillar of the cervical segments. The patient's head is supported by the therapist's hands and abdomen. With the head remaining longitudinally, the therapist applies alternately, a left, and then a right side gliding movement. At the same time the therapist applies pressure with the metacarpophalangeal junction in a direction that accentuates the movement. By transferring weight alternately from the right foot to the left, the therapist can cause the patient's head and neck to move laterally at the same time.

Effects

The addition of therapist generated force enhances the effectiveness of the previous manoeuvre which applies patient generated lateral flexion and compressive forces. (See Proc 6)

Clinical application

The procedure is required for the reduction of mid and lower cervical postero lateral derangements which have proved resistant to all of the preceding manoeuvres.

In conjunction with retraction and lateral flexion (Procedure Six) and retraction and rotation (Procedure Eight), Procedure Seven is suitable for the treatment of lateral flexion and rotation dysfunction of the mid and lower cervical spine.

PROCEDURE EIGHT

Retraction and rotation (with overpressure, sitting or standing)

As with the other cervical procedures this manoeuvre starts from a position of retraction which must be retained during the movement of rotation.

The intensity and location of pain are recorded prior to the performance of the movement. In particular, always establish the location of the most distal symptom and constantly question the patient as to its behaviour.

The patient sits erect in a straight backed chair. (Fig 12:8) He firstly retracts, and then rotates the head *towards the side of pain*. (Fig 12:8a) After a second in that position the patient returns to the neutral position. (Fig 12:8) The effects on the symptoms are recorded. The cycle of movement is repeated ten to fifteen times so that the maximum available range is obtained. Provided no increase or peripheralisation of pain occurs, the patient is advised to continue the exercise at home or at work as recommended in later chapters.

Should the response be inadequate it may be necessary to add more pressure. To do this the patient retracts the head, and places the hand of the of the non painful side behind the head with the fingers over the ear on the painful side. The other hand is placed against the chin on the opposite side. With the head still retracted the patient turns the head *towards the side of pain* as far as possible and accentuates the movement by applying overpressure with the hands. (Fig 12:8b) After a second in this position, and while keeping the hands in place, the patient should return to the neutral position. The effects on pain are recorded.

The movement should be repeated five to fifteen times and the effects of repetition noted. Providing the symptoms are reducing or centralising no limit need be placed on the number of sequences to be performed and the patient can be instructed to carry out the manoeuvres at home or at work as recommended in later chapters.

Although the exercise is best done in the sitting position patients should be shown how to perform the exercise in the standing and lying positions.

Effects

Rotation causes asymmetrical compression of the lateral compartment and therefore may effect reduction of posterolateral displacement.

Throughout this procedure it has been recommended that the patient rotate the head and neck repetitively towards the side of pain in order to achieve reduction or centralisation of the pain. There are two reasons for this recommendation. Firstly, the conceptual model dictates that displacement obstructs motion and causes pain when the movement is attempted. In order to reduce the displacement it is necessary to repeat movements towards the obstruction.

Secondly, in my own experience, more patients will experience centralisation of their symptoms by rotating towards the pain than will occur by rotation away from the pain.

Fig 12:8.
Neutral upright posture.

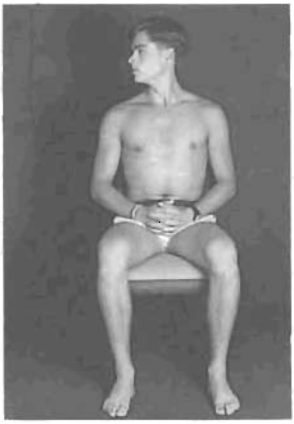


Fig 12:8a.
Retraction and rotation.

Fig 12:8b.
Retraction and rotation with overpressure.

In dysfunction, it is necessary to remodel and stretch the adaptively shortened structures. In order to achieve this, side bending should take place away from the painful side.

Clinical application

Procedure Eight is used for the treatment of posterolateral derangement in the mid cervical spine and for rotation and lateral flexion dysfunction.

This Procedure is most often required for patients with unilateral symptoms arising from the mid and upper segments of the cervical spine, which radiate or are referred and which are not reducing or centralising with repetitive sagittal movements. This includes patients with unilateral cervical headache who have not improved with the initial Procedures of flexion.

The performance of rotation may be discontinued once the patient's pain has centralised or when improvement ceases. The patient should however continue with retraction and extension sitting (Proc 2) or if necessary lying (Proc 3) in order to obtain complete reduction of the derangement.

Rotation applied to the mid and upper cervical segments usually produces change in the patient's symptoms within twenty four to forty eight hours of its introduction. If the manoeuvre fails to cause change in the location or intensity of the patient's symptoms within this period, it should be abandoned. Under these circumstances, providing the correct direction of movement has been identified it is better to introduce more pressure by applying rotation mobilisation (Proc 9).

PROCEDURE NINE

Rotation mobilisation and manipulation (sitting and lying supine)

This procedure is required for those patients whose symptoms are resistant to the previous manoeuvre. That is, although the symptoms may be reduced or centralised by previous procedures, they do not remain reduced and return shortly after exercise. The direction chosen for delivery of the movement has been determined to be appropriate, but the patient generated force is inadequate to reduce the derangement.

To determine the point at which the motion is to be accentuated, it will be necessary to test the effects of pressure application at different segmental levels. The mobilisation and, if found to be necessary, the manipulation will be applied at the level which causes the patient's symptoms to reduce, centralise, or abolish. It is not appropriate to choose the level at which the manoeuvre is to be applied by relying on information obtained from palpation or from radiography.

The intensity and location of pain are recorded prior to the performance of the movement. In particular, always establish the location of the most distal symptom and constantly question the patient as to its behaviour.

Sitting

The patient sits upright in a chair with the hands clasped together resting on the top of the thighs. (Fig 12:9)

The therapist stands behind the patient with one hand resting lightly on the patient's shoulder with the fingers anteriorly and the thumb firmly placed against the spinous process at the desired level on the side opposite to the pain. The patient rotates the head towards the side of pain. The therapist cradles the patient's head with the other hand and places the ulnar border of this hand below the occipital protuberances at the desired level. (Fig 12:9a)

The therapist applies gentle traction with the arm cradling the head and at the same time rotates the head to the end of the rotation range. (Fig 12:9b) With the other hand and thumb the therapist applies a gentle end range counterpressure to accentuate the rotation. Whilst maintaining the hand and arm positions, the therapist then releases the pressure so that the patient's head and neck return to the midline.

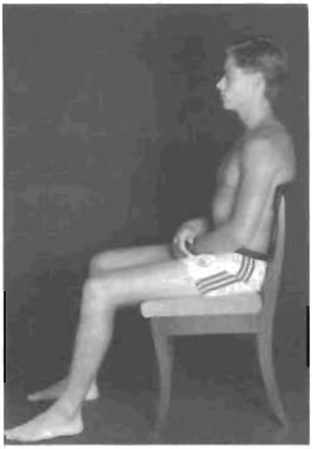


Fig 12:9.
Neutral upright posture.

Fig 12:9a.
Hand positions for rotation mobilisation.

Fig 12:9b.
Pressure applied to end range.

The effects on the pain should be noted and if no increase or peripheralisation of symptoms has occurred the manoeuvre may be repeated in a rhythmical fashion five to fifteen times. The force should be progressively increased to the maximum range, providing the pain is reducing or centralising.

After two or three sessions of mobilisations spread over a period of six or seven days, the patient's symptoms should resolve. If no response is obtained by that time it may be necessary to apply the progression of manipulation, but manipulation should not be applied routinely to all patients.

To progress the technique of mobilisation to that of manipulation, the positioning of both patient and therapist can remain the same.

With the hands positioned as for rotation mobilisation, the therapist moves the patient towards the side of pain so that the cervical spine is at the end range of rotation. The hand on one side stabilises the patient's head and neck. The therapist then applies *with the thumb against the spinous process* on the other side an additional short amplitude, high velocity movement. The degree of end range will already have been determined during the premanipulative experience of mobilisation.

Lying supine

Should the therapist decide that these procedures would be better applied in the unloaded position, a modification is necessary.

The intensity and location of pain are recorded prior to the performance of the movement. In particular, always establish the location of the most distal symptom and constantly question the patient as to its behaviour.

The patient lies supine on the treatment table which is elevated to a height that enables the therapist to perform the manoeuvre with good control. The patient's head and neck should lie over the end of the treatment table supported by the therapist. The patient must remain relaxed throughout the procedure.

The therapist stabilises the patient's head and neck by placing the forearm under the painful side of the patient's head so that the hand and fingers may firmly grasp the patient's lower jaw. The therapist's other hand is placed so that the metacarpal-phalangeal junction of the index finger rests firmly against the posterior aspect of the transverse processes at the lateral articular pillar of the cervical column, (Fig 12:9c) on the pain-free side.

Fig 12:9c. *Rotation mobilisation in lying.*

With the arm holding the patient's head the therapist rotates the cervical column to the maximum end range whilst the other hand accentuates pressure in rotation at the appropriate level. (Fig 12:9c) The motion should initially be carried *out towards the painful side.* After a second the therapist returns the patient to the neutral position.

The movement can be applied rhythmically as a mobilisation or with a single, more forceful pressure, as a manipulative technique. To apply the manipulation the therapist applies with the hand behind the lateral articular pillar a short amplitude, high velocity movement at the end of the range of motion.

The patient should continue to apply the reductive pressures at home or at work as indicated in later chapters.

Effects

The addition of therapist generated force enhances the effectiveness of the previous manoeuvre which utilises patient generated rotation forces. (See Procedure Eight)

Clinical application

This procedure is required for the treatment of postero- lateral derangements in the cervical spine that are proving resistant to all of the preceding manoeuvres and is a progression of Proc 8 (retraction and rotation).

Rotation mobilisation and manipulation are required for the treatment of upper cervical dysfunctions especially those related to cervical headache.

The Procedure is also suitable for the treatment of rotation and lateral flexion dysfunction of mid and lower cervical spine in conjunction with retraction and rotation (Proc 8) and retraction and lateral flexion (Proc 6).

PROCEDURE TEN

Flexion (with overpressure, sitting or standing)

Procedure One is an important preliminary to Procedure Ten and should be repeated eight or ten times immediately beforehand. Providing no adverse effects appear the progression to Procedure Ten can be made.

The intensity and location of any pain and other symptoms are recorded prior to the performance of the movement. In particular, always establish the location of the most distal symptom and constantly question the patient as to its behaviour.

The patient should be seated and relaxed. (Fig 12:10) The head should then be bent forwards so that the chin is as near to the sternum as possible. (Fig 12:10a) The patient is than asked to return the head to the upright position, (Fig 12:10) and the effects on the symptoms are noted. Should no adverse effects be felt the patient can repeat the movement in a rhythmical fashion five to fifteen times. The effects of repetition are recorded. Should the exercise reduce or centralise the patient's symptoms,it may repeated at home or at work as recommended in later chapters.

If the response to the exercise is inadequate, the following progression should be applied to ensure that maximum range of motion is achieved. The patient should be instructed to clasp the hands behind the neck, and repeat the movement. On reaching the end range position the patient should apply overpressure with the clasped hands, hold for a second, (Fig 12:10b) and then immediately return to the upright position.

The effects of applying overpressure should be recorded. If no adverse effects are felt the patient can repeat the movement in a rhythmical fashion five to fifteen times. The effects of repetition are recorded. If the exercise reduces or centralises the symptoms, it should be repeated at home or at work as recommended in later chapters.

Effects

This procedure causes a flexion stretch from the occiput to the second or third thoracic vertebra and when performed with overpressure may equal the degree of flexion that is generated in the upper cervical spine by performing pure head retraction.

In addition to stretching the posterior annulus,apophyseal joints and adjacent ligaments, the manoeuvre applies tension to the nerve roots, dura and posterior cervical muscles and their attachments.

Clinical application

The procedure causes flexion of the cervical spine and therefore is applied to patients with anterior derangement.

It is the main treatment for patients with flexion dysfunction appearing after the resolution of posterior derangements.

This procedure will also be required in the treatment of cervical headache.

Neck flexion is used in conjunction with certain movements of the shoulder and arm to stretch nerve root adherence. (See Derangement Six, Chapter 20, Treatment of Nerve Root Adherence)

Fig 12:10. *Relaxed sitting position.*

Fig 12:10a. *Flexion.*

Fig 12:10b. *Flexion with overpressure.*

PROCEDURE ELEVEN

Flexion mobilisation (lying supine)

This procedure is required for those patients whose symptoms are resistant to the previous manoeuvre. Although the patient's symptoms may be reduced or centralised by previous procedures, they do not remain reduced and return shortly after exercise. The direction chosen for application of the technique has been determined to be appropriate, but patient generated force is inadequate to reduce the derangement or, in long standing cases, to remodel the dysfunction.

The intensity and location of any pain and other symptoms are recorded prior to the performance of the movement. In particular, always establish the location of the most distal symptom and constantly question the patient as to its behaviour.

The supine patient lies with the head at the extreme end of the treatment table. The therapist stands at the end of the table and holds the occiput in the palm of one hand with the finger and thumb cradling the atlas and axis. The therapist's other hand is passed under the wrist or forearm and rests palm down on the patient's shoulder. By raising the therapist's forearms and the patient's occiput, and at the same time applying counterpressure with the hand on the patient's shoulder, the cervical spine is stretched to the end range of flexion, either sagittally (Fig 12:11) or to either side of the midline, (Fig 12:11a) depending on the nature of the existing problem. The patient is then returned to the neutral position and the effect of performing the movement once is recorded.

The movement is then repeated rhythmically five to fifteen times as necessary and the effects on the patients pain recorded. If the mobilisation reduces or centralises the symptoms, it should be repeated on successive days providing improvement continues. The patient should continue to apply flexion in sitting (Proc 10) at home or at work as recommended in later chapters.

Effects

The addition of therapist generated force enhances the effectiveness of the previous manoeuvre which utilises patient generated flexion forces. (Proc 10)

Clinical application

Procedure Eleven is most often required for the treatment of flexion dysfunction associated with symptoms of cervical headache.

The procedure is required for the treatment of those patients with mid and upper cervical flexion dysfunction resulting from poor postural habit or from flexion dysfunction in the lower cervical spine following posterior derangement. The procedure is also required for the treatment of nerve root adherence by remodelling.

The accentuated lordosis in the mid cervical spine which develops in the presence of Dowager's Hump, will benefit from this manoeuvre but must be followed by retraction to avoid exarcerbation of the cervico-thoracic kyphotic component of the deformity. In patients over fifty it is almost impossible to achieve changes in the deformity.

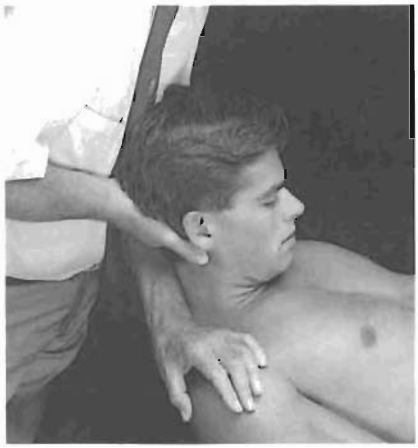


Fig 12:11.
Sagittal flexion mobilisation.

Fig 12:11a.
Unilateral flexion mobilisation.

PROCEDURE TWELVE

Cervical traction (lying supine)

Cervical traction is widely recommended and used for the conservative treatment of mechanical cervical disorders. Its value, however, has not been established.

Recent studies indicate that intermittent traction is of more benefit than either sustained or manual traction.[175] On the other hand it has been reported,[64] "that patients treated with traction recovered less well than those who were treated without it, and in general, greater therapy was associated with a worse result."

As with studies into the efficacy of SMT, most of the studies investigating the clinical efficacy of traction are flawed. However, some clinical evidence remains to suggest it is premature to discard the treatment as entirely ineffectual.

Patients with constant brachialgia (Derangement Six) treated with sustained traction in flexion, seem to obtain a better final outcome than do those left to await spontaneous recovery. I have found that benefit accrues only if the symptoms are reduced or centralised during the traction process itself. Where traction fails to provide relief during its application, it is unlikely that improvement will result from the treatment itself.

I would recommend that traction be given with the patient in the supine lying position. (Fig 12:12) The cervical spine should be flexed and the angle of flexion as well as the direction of the traction should be determined by the behaviour of the most peripheral symptoms. Naturally the main objective of traction therapy is to reduce, centralise or abolish symptoms, in particular those extending in the arm below the elbow. The duration of traction should always be determined by patient's tolerance and the effect of the traction on the patient's symptoms. Many sessions are usually required before relief is obtained.

OTHER CERVICAL TECHNIQUES

Certain other techniques of mobilisation and manipulation for various mechanical problems occurring in the cervical spine (especially the upper region) require a very high degree of expertise in both assessment testing and the final execution, and this cannot be obtained from a text. Applied by the unskilled these techniques can be hazardous and they should only be taught in a formal setting followed by an appropriate apprenticeship. Description of such techniques are not included in this volume.

Fig 12:12.
Cervical traction in flexion.

CHAPTER THIRTEEN

The Cervical Postural Syndrome

Worldwide, tens of thousands if not millions of people are seeking treatment for pain resulting only from poor posture.

Patients consult doctors who are generally unable to devote the time necessary to personally deal with the problem. They usually take the easy way out by prescribing pain relieving drugs instead of recommending postural correction. Disillusioned with drug therapy, patients then seek assistance from chiropractors, osteopaths, physiotherapists or fringe manipulators who, mainly out of ignorance, proceed to manipulate joints in which there is no pathology and certainly nothing 'out of place'.

It must be understood that patients with pain of postural origin will have no pathology. Postural correction is all that is required to abolish the symptoms, and treatment only consists of re-education and instruction in prophylaxis.

The clinical picture

The cervical postural syndrome is a painful disorder caused by prolonged static loading of soft tissues contained within or adjacent to the spinal column. The pain is produced by excessive mechanical deformation of soft tissues which takes place only when spinal segments are subjected to prolonged static loading with joints at end range. In the cervical spine this occurs most commonly when poor sitting or lying postures are adopted.

Patients with pain solely of postural origin are usually aged thirty or under. Frequently they have a sedentary occupation and in general they lack physical fitness. They develop pain which appears locally and symmetrically, usually adjacent to the mid line of the spinal column. In addition to upper back and neck pain they often describe similar pains which appear simultaneously or independently, in the lower thoracic and lumbar regions. They state that the pain is produced by positions and not by movement, and that the pain is intermittent and may sometimes disappear for two to three days at a time.

They may describe that when active at weekends, for instance when swimming, playing tennis and dancing, they have relatively little or no trouble. When constantly moving and changing position the structure under stress is varying continually and pain does not develop. The stresses arising from static postures, although less than those occurring during vigorous activity, are sustained and will, if maintained, eventually cause pain.

Pain from the postural syndrome alone is never induced by movement, is never extensively referred, and is never constant. There is no pathology, no loss of movement, and there are no signs to indicate the presence of joint abnormality. There is nothing to see other than the poor posture itself. Pain from the postural syndrome could arise from any of the soft tissues adjacent to the vertebral segments. It is probably ligamentous or capsular in origin.[5, 36]

Described simply, postural pain appears after prolonged static loading which in turn causes overstretching of normal tissue. The pain ceases immediately on removal of the loading.

Examination

On examination no deformity will be seen, movements will be normal and the test movements will not elicit discomfort or pain. Paraclinical tests will be negative. Some patients with this syndrome are described as being hypermobile, although in reality they have merely maintained their youthful range.

The only objective information will appear on examination of posture at the time the pain is present. The patient will be seen to adopt a poor posture and to "hang" at the end of range in both the sitting and standing positions.

Clinical example

Let us look at the clinical example of a typical patient with the postural syndrome (Fig 13:1). The patient has poor posture, and the pain cannot be reproduced by the test movements. To reproduce the appropriate postural stress the patient must assume and maintain the position that is stated to cause pain, in this case the sitting posture. Only after the passage of sufficient time will the symptoms appear in this position, and up to half an hour may be required before pain is felt.

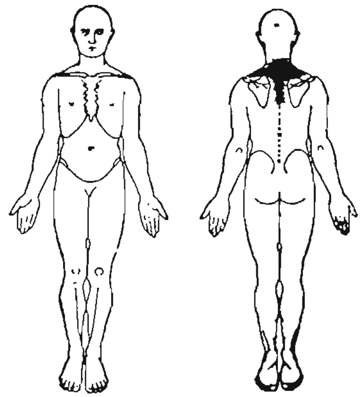
When pain has been produced by adoption of a certain posture, it will be abolished by correction of that posture. Any change in the position will relieve the pain providing the structures are unloaded. For the pain to remain better the patient must adopt positions in which no structures are loaded at end range.

Once the pain has stopped by moving from the end range position our suspicions are confirmed and a diagnosis can be made. In short, the patient with the postural syndrome has no clinical or laboratory findings indicating a particular pathology and all functions appear perfectly normal.

(POSTURE)

THE McKENZIE INSTITUTE
CERVICAL SPINE ASSESSMENT

Date 28 JULY 1990
Name MISS KAREN SMITH
Address 27 THE TERRACE, WELLINGTON
Telephone 543-876
Date of birth 30.9.66 (AGE 23)
Occupation TYPIST
Postures / stresses SITTING (7-8/HRS PER DAY)
Doctor McMILLAN



NECK PAIN

No Pain — Worst Possible Pain

ARM PAIN

HISTORY

Symptoms now CENTRAL LOWER CERVICAL, BILATERAL UPPER TRAPEZIUS AND CENTRAL MID AND UPPER THORACIC PAIN
Present for 4 MONTHS
At onset CENTRAL MID THORACIC PAIN
Improving / unchanged / worsening
Commenced as a result of
Commenced for no apparent reason ☑
Symptoms constant Intermittent
Worse
sitting prolonged bending turning lying / rising
am / as day progresses / pm stationary / on the move
other
Better
sitting prolonged bending turning lying / rising
am / as day progresses / pm stationary / on the move
other WHEN ACTIVE AND AT WEEKENDS
Disturbed sleep NO Pillows
Sleeping postures prone / supine / sidely
Cough / sneeze / swallow +ve / −ve Gait NORMAL
Dizziness / tinnitus / nausea −.VE. Motion sickness NIL
Previous history NIL
Previous treatment NIL
X-Rays NORMAL
General Health GOOD Weight loss NIL
Meds N.S.A.I.D.'s Steroids NIL
Recent surgery NIL
Accidents NIL

Fig 13:1. *Clinical example of a typical patient with the postural syndrome.*

EXAMINATION

POSTURE

Posture sitting	POOR	Posture standing	POOR
Protruded head posture	yes / no	Deformity	NIL

MOVEMENT LOSS	maj	mod	min	nil		maj	mod	min	nil
Protrusion				✓	Sidebending (R)				✓
Flexion				✓	Sidebending (L)				✓
Retraction				✓	Rotation (R)				✓
Extension				✓	Rotation (L)				✓

TEST MOVEMENTS

		Symptoms prior to testing	Symptoms after testing	Pain during motion	End range pain
	PRO	NIL	NIL	NIL	NIL
Rep	PRO		"		
	FLEX				
Rep	FLEX				
	RET				
Rep	RET				
	RET EXT				
Rep	RET EXT		SYMPTOMS NOT REPRODUCED WITH MOVEMENT		
	SB (R)				
Rep	SB (R)				
	SB (L)				
Rep	SB (L)				
	ROT (R)				
Rep	ROT (R)				
	ROT (L)				
Rep	ROT (L)				

STATIC TESTS SYMPTOMS PRODUCED AFTER 20 MINUTES SITTING

NEUROLOGICAL

Muscle strength	NORMAL	Reflexes	NORMAL
Dural signs	– VE	Sensation	NORMAL

OTHER

Shoulder girdle NORMAL

Special tests –

CONCLUSION

Posture Dysfunction Derangement no.

Other

PRINCIPLE OF TREATMENT

Posture Correction Extension Flexion

Other

Postures involved

Every patient with pain of postural origin has a different description of the circumstances leading to the production of pain. Sitting (Fig 13:2) is by no means the only cause of postural stress producing and prolonging neck and upper back pain. It is however the most frequent cause of postural pain. Some patients will name the sitting position alone as causative, and they complain that pain is produced as soon as they spend more than a certain amount of

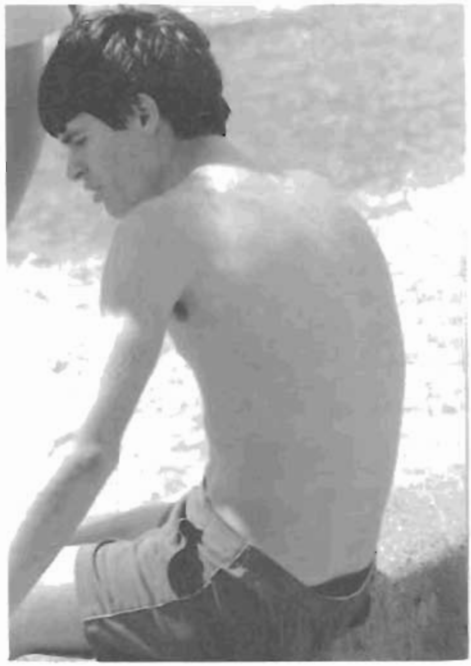


Fig 13:2. *Poor sitting postures.*

time, say ten minutes, in any sort of chair or car seat. Others will describe sitting at the typewriter or computer terminal as the only time that pain is felt. Bus, taxi, and car drivers all complain of being worse while seated for long periods in their vehicles; both pilots and passengers complain about the seating in airplanes.

Working in prolonged standing positions also may cause postural pain, but the opportunity to move and change position is greater in standing than in sitting and the avenues for relief are more numerous. Consequently, there are less complaints of pain arising from the standing position than from sitting. People who work in cramped positions, be it bending or sitting, are also likely to complain of upper back and neck pain. The incidence of cervical and upper thoracic symptoms is very high in people who work in continuously flexed postures. (Fig 13:3)

The lying position (Fig 13:4) may be an additional source of stress enhancing problems in the cervical spine and pain which predominantly occurs while lying requires thorough investigation.

Pain after activity

Particular notice must be taken of patients describing the regular appearance of pain in the neck and shoulders following activity and vigorous exercise such as tennis, football, or even plain hard work. If the patient states that pain was not experienced during the activity itself and only appeared subsequent to activity, it is likely that the pain developed not from the exercise as one might expect, but from the posture adopted after exercising.

The complaint of patients that their symptoms commenced after a particular activity is so common that we, as clinicians, tend to accept too readily the inference that exercise has been accurately identified as the causative factor. This then leads us to advise the patient to stop the particular activity suspected of causing the problem. Activity has been determined to be the precipitating factor when in truth the patient is predisposed to the problem because of poor postural habit. Intervertebral segments and their contents appear to deform and displace more readily, if they are held in end range for prolonged periods immediately following vigorous exercise.

To accurately establish the true cause of pain in these patients it is necessary to return them immediately to the activity considered to be the cause of their symptoms, but great care must be taken to ensure that their sitting posture following the activity is as correct as is possible. If symptoms appear even though the posture is corrected, then the activity and not the posture may be the cause of the problem. The importance of thoroughly exploring this cannot be over-emphasised. I have seen athletes of great promise diverted from activity as a result of incorrect assumptions made regarding the true cause of their particular problem.

Fig 13:3. *Poor working posture.*

Fig 13:4. *Poor lying posture.*

CHAPTER FOURTEEN

Treatment of the Cervical Postural Syndrome

Every patient must be examined and analysed individually, and educated for his own particular postural stress. Education is the most important part of the treatment for neck and upper back pain of postural origin. The patient must have a clear and unambiguous explanation of the mechanism that produces his pain. He must realise that, when he assumes the positions of stress causing pain, he is in fact pulling the ligaments apart. All that is required to stop his postural pain, is to stop stressing the ligaments for about ten to twenty days.

The more often structures are stressed to the point of being painful, the more sensitive they become to mechanical stimuli. As a result it requires less and less stress application to provoke pain.[159] Thus, poor sitting positions maintained regularly will cause pain after the passage of less and less time. Conversely, good sitting postures will enable the patient to remain pain free for longer and longer periods, and when slouching next occurs it will take much more time for the pain to arise. After two weeks of correct sitting patients will be able to slouch for short periods without having pain. However, no one should be permitted to slouch for extended periods. For example, a patient whose symptoms usually develop after ten minutes of slouched sitting, may after three weeks of sitting correctly be able to revert to the slouched position and experience little or no discomfort providing the position is not maintained for more than twenty to thirty minutes. This painfree slouched sitting period can be progressed up to a limit, so that at the end of ten weeks of correct sitting a patient may well be able to slouch for an hour or so.

It is necessary to explain to the patient that, once corrective procedures are implemented, new pains should and probably will appear. These new pains are commonly felt lower in the back and are merely the consequence of adjustment to a new postural habit. As the painful structures are relieved by removal of the constant tension, pain felt from those structures subsides, but new pains develop temporarily in other structures which now experience increased tension.

Correction of sitting posture

All patients who have upper back and neck pain produced or enhanced by prolonged sitting, should receive an adequate explanation regarding the cause of pain and the need for maintenance of the correct sitting posture.

We must explain that when a person sits, his spine will sooner or later take up a relaxed posture. Unless the chair is properly designed or a special support for the lower back is provided, or unless a conscious effort is made to maintain the lordosis, the lumbar spine will move into a fully flexed position placing various ligamentous structures on full stretch. As the lower back flexes the thoracic kyphosis increases and the head and neck must assume a protruded posture, the lower cervical and upper thoracic segments translating anteriorly and the spine falling into a fully flexed position. If these positions are sustained, fluid flow within the intervertebral disc is forced posteriorly, the intradiscal pressure rises, and the stresses on the posterior wall of the annulus and capsules of the apophyseal joints are increased. Meanwhile the mid and upper cervical segments take up an extended position. All of these structures are "hanging" at end range and at this time there are many reasons for both the lower and upper spine to feel uncomfortable.

If such positions are maintained for prolonged periods, the spine will become painful as well and in some cases derangement may occur. Few patients fail to comprehend our explanations, provided these are couched in terms understandable to the layman. For the postural syndrome patients, I always refer to the "bent finger" explanation which for even the slowest individuals is very graphic, particularly if their own finger is used for educational purposes!

To convince the patient that our suspicions regarding the sitting posture are correct, it is necessary to prove this. Pain of postural origin caused by sitting incorrectly will be abolished immediately by sitting correctly. During the first treatment session we must reproduce the pain by positioning the patient and allowing enough time for postural stresses to build up. Once pain is felt the patient is easily convinced that it is posture related when on adopting the correct sitting posture, the pain ceases.

It may not always be possible to reproduce the patients symptoms during the first examination, and in this case it will be necessary to instruct the patient to assess the relationship between posture and pain himself by correction of the sitting posture the next time pain is felt. I usually say, "The next time pain appears, can you stop it by correcting your position?" If so, "Will the pain remain better if you use an adequate support to hold the correct position?'

To achieve correction of the sitting posture irrespective of the area of the spine from which symptoms may arise it is necessary to correct first the position of the base of the patient's column, the buttocks on the chair, then the lumbar posture, and finally the cervical posture.

The following steps are necessary:

(1) firstly the patient must be able to attain the correct sitting posture;
(2) then the patient must know how to maintain it when sitting for prolonged periods.

To attain the correct sitting posture

The patient must have a good understanding of the correct sitting posture, and his control of the muscles and joints involved in obtaining it must be restored. Therefore, it is necessary that he be acquainted with the extreme of the good and bad sitting positions before he is instructed regarding the correct sitting posture.

In order to achieve this we have to introduce the "slouch overcorrect" procedure. The patient must sit slouched on a backless chair or stool, allow the lumbar spine to "hang" on the ligaments in the fully flexed position and permit the head and chin to protrude. (Fig 14:1) The patient must then smoothly move into the erect sitting posture with the lordosis at its maximum and the head held directly over the spine and fully retracted. (Fig 14:2) This sequence should be repeated in a flowing and rhythmical manner, so that the patient moves from the extreme of the good to the extreme of the bad position. After some practice at this most patients are able to find the extreme of the good sitting position. They should become so good at it, that at the snap of the fingers they can assume the overcorrected sitting posture and hold it for a few minutes. Once this can be achieved patients are advised to follow this procedure whenever pain is felt and to maintain the extreme of the good sitting position for a few minutes. Pain induced by poor sitting is nearly always quickly abolished by this method. On discovering the relationship between the adoption of poor sitting postures and the production of pain few patients fail to carry out our advice. Postural correction and exercises related to pain are easily understood and performed by most people.

Fig 14:1. *Extreme of the bad sitting posture.*

Fig 14:2 *Extreme of the good sitting posture.*

Once the patient has a good understanding of the good and bad postures he can assume while sitting, he must be taught which position is the correct sitting posture. The extreme of the good position is impossible to maintain for long periods as various structures are on full stretch and will become painful with time. Therefore, the patient is instructed to move into the extreme of lordosis in the lumbar spine and extreme retraction in the cervical spine and then release the last ten percent of the movement. (Fig 14:3) After this release from fully strained erect sitting the position can easily be maintained if necessary. This is the position that must be adopted habitually in the future.

It must be emphasised that in the correct sitting posture the lumbar lordosis should be retained to a similar degree as is present in the active alerted standing position. (Fig 14:4) The spine should not be held in excessive extension at end range. Maintaining a correct lumbar posture will more easily allow the patient to adopt a correct retracted cervical posture. Again, the retracted head posture should not be excessive and should allow the head to be held erect and high.

If postural pain arises in the sitting position, it is usually caused either by the elimination of the lordosis in the lumbar spine or the adoption of the protruded head posture in the cervical spine or a combinaton of both. Postural correction will abolish the pain in either case.

Thus, in order to learn how to assume the correct sitting posture with a lumbar lordosis and retracted head, patients must be instructed to carry out the 'slouch-overcorrect' procedure three times daily, five to fifteen times at each session. At the end of each session they must release the last ten percent

Fig 14:3
Correct sitting posture—strain released.

Fig 14:4
Active alerted standing posture.

' the extreme of the good sitting position. They have now found the correct :ting posture. This routine must be kept up for three to four days at least, nger if necessary, until the correct posture becomes automatic. In my perience it takes about a week to teach the patient properly and about three eeks before the patient adopts the postures automatically.

One treatment session will never be sufficient to educate the average patient the basics of postural correction. Unless the relationship between posture ıd the production of pain is made clear to the patient, he is seldom capable ' maintaining a pain free lifestyle.

) maintain the correct sitting posture

'hen sitting for prolonged periods it is essential that a the lumbar lordosis : maintained at all times. Without this correction of the position of the lower ıck it is extremely difficult to maintain correct head and neck posture. From e very first day the patient must be shown how this can be achieved. The mbar spine may be held in lordosis in two ways:

a) actively by conscious control of the lordosis, when sitting on a seat without backrest, as has just been described.
b) passively by the use of a lumbar support, when sitting on a seat with a backrest. The purpose of the lumbar supportive roll is to hold the lumbar spine in a good but not extreme lordosis in the sitting position while relaxing, working and driving the car. Without the support the lordosis will be lost as soon as a person leans back in a chair or concentrates on anything other than maintaining the lordosis.

The lumbar roll as sitting support:

A roll inserted in the small of the back provides adequate support for the lumbar spine in sitting, provided the apex of the support maintains the lordosis just short of its maximum. When placed at or just above the belt line, affecting approximately the area of the third and fourth lumbar vertebra, it produces the optimum lordosis provided one sits with the sacrum against the back of the chair (Fig 14:5). A cushion is not a suitable lumbar support because, when placed behind the low back, it merely pushes the whole spine a few centimeters away from the back of the chair without in any way influencing the angle of extension or degree of lordosis in the lumbar spine.

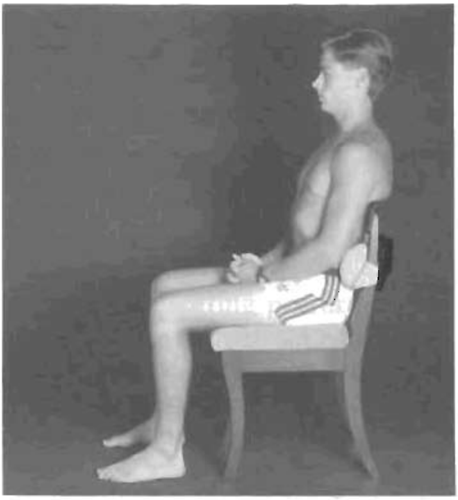


Fig 14:5.
Correction of posture using the lumbar roll.

Various rolls can be made for the different situations in which they may be required – for example, lounge chair, office chair and car seat. If a lounge chair or car seat is designed in such a way that the roll is absorbed by the upholstery, it may be necessary to place one or more cushions in the chair first and then add the lumbar roll. Ideally, the roll should be made of foam plastic or rubber. After compression by pressure of the patient's back against the back of the chair, the roll should still offer a minimum of one inch to one and a half inch support.

A New Zealand study completed in 1988,[168] demonstrated conclusively the benefits obtained by patients using portable lumbar rolls and sitting with the lumbar spine supported in lordosis compared with patients using seating pads and sitting in flexed postures. Both groups used the devices in all sitting environments over a forty-eight hour period.

The results showed that patients using a lumbar roll, whether they experienced back pain only or back and referred pain, reported significant pain centralisation and reduction in pain intensity. The benefits were most significant in patients with symptoms below the knee. No similar benefits were reported by the patients sitting in flexed postures.

Patients frequently complain about the effort they must expend to maintain the correct sitting posture. This is especially so when they are required to actively maintain the position. Many patients will describe a strain pain or say that the new position is a painful one. It is important that these pains are recognised as new postural stresses which should normally occur. If after a day or two of correct sitting a patient has not complained of 'new pains', it is likely that he has not maintained the corrected position often and long enough. Adjustment to a new posture results in shortlived transitional aching of a different quality and location than the pain which initially forced consultation. New pains, felt above the lumbar area when adjustments are made to the posture of the low back, and below the cervical area, when adjustments are made to posture of the upper back and neck are common. They should not last longer than five to six days.

Emphasis so far has been directed towards the need to correct the posture of the lumbar spine, as this is necessary in order to facilitate correction of the upper thoracic and cervical areas. Providing the posture of the lower back has been corrected, the patient can easily maintain the correct position by retraction of the head and cervical spine. If the lower back is permitted to fall into a flexed posture, the patient's upper thoracic and cervical spine also fall into a forward position which facilitates the protruded head posture and encumbers its correction. In correcting the posture by retraction of the upper spinal column it is fundamental to firstly correct the posture of the lower back.

In postural retraining, unless there is dysfunction, the problem does not lie in the inability to assume the correct posture, but in a loss of awareness of the correct posture. To restore this it is necessary to retrain postural habits and body awareness. Psychologists tell us it takes about three weeks to change a habit. During this time the patient must be motivated to alter his posture which is accomplished by influencing his symptoms, and become adept at finding the correct posture by himself which is achieved by teaching the slouch-overcorrect procedure.

A widespread misconception, held by many doctors and therapists, suggests that postural correction can be achieved solely by strengthening the muscles of the spine. Strengthening of muscles will have no effect on posture if the patient does not know the proper position. No strengthening exercises can teach the patient the correct posture. Once the correct posture can be found, stronger muscles may help the patient maintain it. Thus the patient must be taught how to find the correct posture and then encouraged to actively maintain it. Actively maintaining the correct posture is the best way to achieve postural correction and at the same time strengthen the postural muscles.

Correction of the standing posture

Prolonged standing does not appear to produce the exaccerbation of symptoms in the upper back and neck as does prolonged sitting and lying. The standing position allows the patient to be more erect and this may explain why the complaints regarding prolonged standing and increasing cervical pains are less numerous. However the principles are the same and the correction of the patients basic lumbar standing posture must precede instruction in the maintainance of retraction as outlined in the correction of the sitting posture.

The most common relaxed and "slouched" standing position causes the chest and thoracic spine to move posteriorly as the pelvis moves anteriorly. This places the lower lumbar and lumbo-sacral joints into full extension, the thoracic spine into flexion in the form of a long "C" curve and the cervical spine and head protrude. (Fig 14:6) The best way to determine if this posture is the cause of the patient's pain, is to talk with him for some time until he is standing relaxed. If pain is present due to this position, correction should reduce or abolish it.

Fig 14:6
Slouched standing posture.

To re-educate a patient with this stance, we must first place him in the relaxed standing position until pain is produced. (Fig 14:6) Once pain has developed the posture should be corrected. The correction is best achieved by lifting the chest and thoracic spine and retracting the head and neck. At the same time the pelvis is tilted slightly backwards. (Fig 14:4)

Alteration of the angle of pelvic inclination alters the posture of the lumbar and thoracic spine and allows correction of the protruded head posture. This will reduce the standing pain almost immediately. If pain in standing cannot be reproduced on the first examination, the patient must be instructed to evaluate the relationship between posture and pain himself by postural correction the next time pain is felt.

Correction of the lying posture

Pain in the lying position is common since end range positions of the head and neck are often assumed and maintained while sleeping.

If the patient's sleep is disturbed by pain during the night, either an unresolved derangement should be suspected, or the surface or pillow are unsuitable and require change. Disturbed sleep experienced over many days can severely test the patient's tolerance and can eventually disrupt the domestic harmony and lifestyle. It is therefore important to identify the causes in the first few days of treatment.

Patients who wake in the morning with symptoms that were not present the night before, or patients whose pain is worse in the morning than when they retired the night before, are probably using an unsuitable pillow or are adopting an inappropriate posture overnight.

There are two factors to be investigated:

(a) The lying posture itself may be inappropriate. This is different for each person and must be dealt with individually. The lying posture during sleep is difficult to influence.

(b) The surface on which the patient is lying may be inappropriate. For the majority of people with cervical problems the structure of the mattress is less important than the structure of the pillow. Although the mattress itself should not be too hard, the base should be firm and not sag. The content of the pillow should be constructed of kapok, feathers, rubber or foam chips. Under no circumstances should patients with neck pain use moulded foam or rubber pillows.

If attention to these two factors does not bring a solution, the possibility that an unresolved derangement is present should be considered.

The cervical night roll

The simplest method of providing support for the cervical spine is to use a cervical roll placed inside the patient's pillow. (Fig 14:7) No more than one pillow should be used. The roll fills the gap between the shoulders and the side of the head. This type of neck roll usually works quickly or not at all, and should be tried for three or four nights.

The position of the head when asleep is almost impossible to control. If a high pillow is used the head will be excessively flexed when lying supine, and excessively laterally flexed when lying on either side.

Patients who sleep prone, are forced to lie with the head in the extremes of rotation to one side or the other. (Fig 14:8) Positioning in rotation of the whole of the cervical spine is a most common cause of pain in those waking in the morning with stiff and painful necks. An extreme solution is to place a drawing pin or thumb tack with the sharp side against the abdomen and fix it with sticking plaster. It is drastic, but extremely effective.

Fig 14:7 *Cervical roll.*

Fig 14:8. *Prone sleeping position.*

CONCLUSION

We should now have equipped the patient with sufficient information enabling him to control mechanical postural stresses and deal with symptoms himself. The essence of treatment of the postural syndrome is that if it is possible for patients to stop their present pain, it is also possible for them to prevent the onset of future pain. I feel that it is negligent of the medical and physiotherapy profession to continue giving relief for episodic pain without familiarising patients with the manner in which their pain arises and providing them with the means to prevent the onset of such pain. It is my experience that patients with postural pain, when properly instructed and advised, treat themselves ably and adequately.

When treatment is completed successfully we must explain to the patient that although the present pain has been relieved, recurrence of similar symptoms is possible whenever he forgets postural care for extended periods. The consequences of postural neglect should be discussed when appropriate.

CONSEQUENCES OF POSTURAL NEGLECT

The effects of postural habits on the shape of man are obvious when we observe people around us. If a person's head and chin are habitually protruded, the ability to retract will be lost. Eventually, a permanently protruding head and a dowager's hump will result. As age advances this once reversible situation will become irreversible. People with this type of posture often have a flattened lumbar spine as well, and by the age of seventy the ability to stand erect is lost so that they walk with a slight stoop. Movement that was once easily obtained is lost forever. But this postural stoop is not the inevitable consequence of ageing. Loss of function can be prevented if movements in the desired direction are performed adequately and often enough.

Initially, poor postural habits will only produce pain without loss of function. If, as a result of continuous slouched sitting, flexion is regularly performed but extension rarely, the anterior structures of the joints involved will shorten and the posterior structures will lengthen. In this way flexion remains readily obtainable, but extension becomes more and more difficult and will therefore be avoided. Thus, the consequences of postural neglect are adaptive shortening leading to dysfunction.

Adaptive shortening implies loss of function and movement. In addition to the production of pain whenever the shortened structures are placed on stress, this loss of movement and function must inevitably lead to impairment of nutrition in an avascular structure like the disc. This will become one of the contributing factors of disc degeneration.

We should ensure that people engaged in sedentary occupations do not develop adaptive shortening and dysfunction. We must explain to them that shortening of soft tissue, caused by poor postural habit and inadequate exercise, can be prevented by regular postural correction and adequate performance of the appropriate exercises.

TYPICAL TREATMENT PROGRESSION FOR THE POSTURAL SYNDROME

The days referred to in the treatment progression are related to treatment sessions which in the first week of treatment should take place on consecutive days. This also applies for the treatment progressions of the dysfunction and derangement syndromes.

Day one

- Assessment and conclusion/provisional diagnosis.
- Postural discussion ensuring adequate explanation of the nature of the problem. The patient must understand the cause of pain. I usually give the simple example of pain arising from the passively bent forefinger.
- We must satisfy ourselves and the patient that the pain can be induced and abolished by positioning. If it is not possible to induce pain during the first treatment session, the patient must be instructed how to abolish pain by postural correction when next pain appears.
- Commence with postural correction exercises and give postural advice; do not try to teach too much the first visit.
- Discuss the importance of maintenance of the lordosis while sitting prolonged, and demonstrate the use of a lumbar roll in sitting and cervical roll in lying if necessary.

Day two

- Confirm diagnosis.
- Check results. If the patient was unsuccessful in controlling the postural pain on his own, it is possible that we have not taught postural correction well enough. It also may be that the patient has not corrected his posture adequately or maintained the corrected posture long enough. When confronted with such a suggestion in an accusing manner, patients often feel offended and deny having slouched. We must be tactful when discussing these points.
- If possible have the patient produce and abolish the pain; otherwise enquire as to his ability to abolish the pain during the preceding twenty-four hours by correcting the posture whenever pain appeared.
- Check the exercises. It is surprising how often patients alter the exercises without realising it.
- Repeat the postural advice in full.
- Inform the patient that "new pains' are to be expected as a result of adjustment to different postural habits.

Day three

- Treatment as for day two.
- Once the patient is adequately controlling his postural stesses, treatment may be altered from a daily basis to every second or third day.
- Once the pain occurs only occasionally and can be well controlled, the patient may stop the 'slouch-overcorrect' exercise.
- Reassure regarding the onset of 'new' postural pains.

Day four and five

- Check exercises and progress.
- Deal with any other postural pain that may have become apparent.
- Deal with other situations which may have previously been overlooked.

Further treatments

- A few check-ups at greater intervals may be necessary to ensure the patient has full control of his postural pain.
- We must ensure that the patient has adequately stressed the joints and is engaged in all normal activities.
- Discuss the consequences of postural neglect.
- Before discharge prophylaxis must be discussed in detail.

CHAPTER FIFTEEN

The Cervical Dysfunction Syndrome

THE CLINICAL PICTURE

Patients with this syndrome are usually over thirty years of age except where trauma can be identified as the original cause of their problem. They commonly exhibit poor posture and are frequently under exercised.

In dysfunction the pain experienced by the patient is always intermittent, occurring only when shortened periarticular structures are placed on full stretch. This happens much sooner in a patient with dysfunction than in a normal person, hence the much more frequent provocation of pain in dysfunction. The greater the loss of function, the more often will the pain occur.

Pain from dysfunction sometimes develops in an episodic manner and appears to resemble derangement. This episodic pain is triggered by excessive use, for example a vigorous game of tennis or even swimming where the head is required to repeatedly rotate to the extremes. Overstretching of contracted soft tissues causes minor trauma and produces or increases pain. If the patient rests for a few days the pain subsides, but further scarring and contractures will increasingly limit the available range of movement. This becomes a vicious circle which will only be broken by treatment procedures as described for dysfunction.

Although I am not aware of having seen it, it is conceivable that the loss of movement following injury could be so great that the patient has constant pain long after the inflammatory stage has passed. This could follow massive scarring and fibrosis after severe trauma. The scarring could contract so that a constant tension would exist, thus causing constant pain.

In the absence of trauma the patient with dysfunction will insidiously develop bilateral or unilateral pain which appears locally in the neck, adjacent to the mid line of the spinal column. The pain may radiate locally to the mid scapula region and the upper trapezius region especially after prolonged end range positioning. The pain is provoked on attempting full movement, by mechanically deforming shortened soft tissues in segments that have reduced elasticity and movement. The pain is always felt at end range and never felt during the movement itself. With the exception of a patient with an adherent nerve root, pain from dysfunction is never referred into the arm.

Patients with dysfunction often experience stiffness on turning the head and neck first thing in the morning, loosening as the day progresses. The same patients tend to feel better when active and moving than when they are at rest. During regular and not excessive activity, end range of movement is seldom required, and if so, only momentarily; on the other hand, during resting, end positions are readily assumed and as soon as they are maintained they may prove painful. The reasons for this are probably similar to those applying to the postural syndrome. Static loading can cause more pain than develops from motion because of the changing distribution of stresses that occurs with movement.

The pain in dysfunction is felt at the end range of certain movements which will now appear limited compared with the expected "normal" and this limitation may interfere with the performance of simple tasks. For example, loss of function in the neck is often first noticed when the motorist turns the head while reversing the car or when lying prone on the beach. In the cervical spine any rotation dysfunction will become apparent with prone lying, the patient waking frequently in the mornings with recurring pains from overstretching. This is usually caused by prolonged rotation maintained during the night in order to breath adequately.

The loss of movement evident in the dysfunction syndrome arises from two common causes. The first and most common cause of reduced spinal mobility is poor postural habits maintained during the first few decades of life. This is especially so when the individual is underexercised. The habitual adoption of slouched and flexed sitting postures especially in office and vehicular situations predisposes these occupational groups to a higher than usual incidence of back and neck pain. This assertion is supported in studies by Kelsey,[86] Magora,[104] and Shanahan.[132]

Whenever the patient's occupation is related to deskwork or driving vehicles, the predisposing postural component coupled with the length of time in years spent in the office or vehicle will indicate the likelihood of the presence of dysfunction. The reduced movements are often those sagittal movements essential for the maintenance of the very erect posture. The onset of dysfunction in these patients is insidious in nature and few patients are aware of their gradual loss of function until an acute episode draws their attention to generalised "stiffness". The patient will be unable to relate the cause of the pain to a particular incident and usually describes symptoms developing for no apparent reason.

When dysfunction develops following trauma or derangement, the patient will be aware of the cause of the problem and will attribute the present symptoms to some past injury. He will describe an acute episode of neck pain which occurred some time ago and state that "the acute pain subsided after two or three weeks but ever since, I have been unable to turn my head properly to the right". In such a case the symptoms can be attributed to shortening from contraction of the repair itself. The injury is over. The repair is complete.

But because tension on the repair is painful, the patient considers the injury to be still present and avoids the movement that produces pain. Subsequently the avoidance of the painful movement allows further shortening of collagen repair and without intervention a general deterioration in the range of movement is inevitable.

With time, contracture of the fibrous collagenous scar tissue may further limit mobility. Such inextensible repair will cause pain whenever the patient attempts full end range movement. Pain will not occur during the movement itself or before the structure is placed under tension. Surrounding healthy structures would be capable of further extensibility but are now restricted by the scar.

The real reason for the development of contractures is inactivity and the absence of motion occuring during the process of repair. Inactivity allows random crosslinking to develop between collagen fibres. The crosslinking is the mechanism of adhesion formation, thus prolonged inactivity is associated with structural limitations in range and apparent "shortening" of connective tissue in the absence of elastic fibres. "In every setting, where guided progressive activity is contrasted to inactivity, greater strength and range of connective tissue develops in the models which have had mechanical activity."[39]

The question can arise, "Which structure is involved in the production of this pain?" As was stated earlier, it is almost impossible to selectively stress and therefore identify specific structures causing pain in the spinal column. Let it suffice to say that following trauma the body institutes the processes of repair. Irrespective of where in the musculo-skeletal system the trauma may occur, healing by fibrous repair will eventually follow. The damage may have occurred in muscle, ligament, disc, apophyseal joint capsules, or aponeurosis. It no longer matters which structure was initially involved, the repair itself prevents normal function.

The pain may also result from adherence of nerve root or dura following severe intervertebral disc bulging or rupture but this is more readily identified.

Described simply, the pain of dysfunction appears immediately when shortened tissues are overstretched.

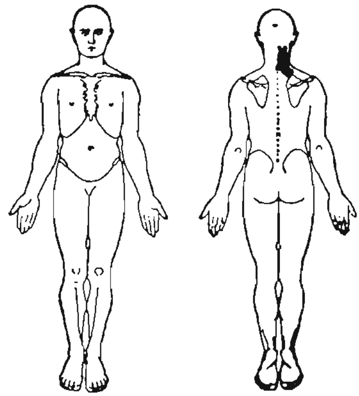
EXAMINATION

Generally, the posture of the patient with dysfunction will be poor. In the absence of trauma or previous episodes of neck pain, poor posture is often the only reason for the development of dysfunction. This is confirmed by merely correcting the posture thus removing tension from the shortened structures and immediately relieving the symptoms.

Except in the elderly with dysfunction and in the early stages of development of the "Dowager's Hump" which can be seen as early as the mid thirties, deformity from cervical dysfunction is not commonly seen. However, there is always a loss of movement.

(DYSFUNCTION FROM TRAUMA)

THE McKENZIE INSTITUTE
CERVICAL SPINE ASSESSMENT



Date 29 JULY 1990
Name MR KEITH JONES
Address 42 THE TERRACE, WELLINGTON
Telephone 676-282
Date of birth 30 SEPTEMBER 1954 (AGE 35)
Occupation SALESMAN
Postures / stresses STANDING
Doctor JOHNSTONE

HISTORY

NECK PAIN

No Pain — Worst Possible Pain

ARM PAIN

Symptoms now (R) C5,6,7,T PAIN
Present for 9 MONTHS
At onset SAME LOCATION
Improving / unchanged / worsening
Commenced as a result of MOTORCYCLE CRASH

Commenced for no apparent reason ☐
Symptoms constant ... intermittent

Worse
prolonged sitting | prolonged bending | turning (R) | lying / rising
am / as day progresses / pm | stationary / on the move
other

Better
sitting | prolonged bending | turning | lying / rising
am / as day progresses / pm | stationary / on the move
other

Disturbed sleep NO ... Pillows ONE FEATHER
Sleeping postures ... prone / supine / sidely
Cough / sneeze / swallow ... + ve / - ve ... Gait NORMAL
Dizziness / tinnitus / nausea - ve ... Motion sickness - ve
Previous history NIL

Previous treatment NIL
X-Rays NORMAL
General Health GOOD ... Weight loss NIL
Meds N.S.A.I.D.'s ... Steroids NIL
Recent surgery NIL
Accidents MOTORCYCLE CRASH 9 MONTHS AGO, SLOW SPEED SLIDE WITH FORCED (L) SIDEBENDING OF HEAD

Fig 15:1. *Clinical example of a typical patient with the dysfunction syndrome.*

EXAMINATION

POSTURE

Posture sitting POOR Posture standing GOOD

Protruded head posture yes / (no) Deformity

MOVEMENT LOSS

	maj	mod	min	nil		maj	mod	min	nil
Protrusion		✓			Sidebending (R)			✓	
Flexion		✓			Sidebending (L)		✓		
Retraction		✓			Rotation (R)			✓	
Extension	✓				Rotation (L)				✓

TEST MOVEMENTS

		Symptoms prior to testing	Symptoms after testing	Pain during motion	End range pain
	PRO	NO PAIN	PRODUCES (R) C5/T1. PAIN		✓
Rep	PRO		" DOES NOT WORSEN		✓
	FLEX	"	PRODUCES (R) C5/T1. PAIN		✓
Rep	FLEX		" DOES NOT WORSEN		✓
	RET	"	PRODUCES (R) C5/T1. PAIN		✓
Rep	RET		" DOES NOT WORSEN		✓
	RET EXT	"	PRODUCES (R) C5/T1. PAIN		✓
Rep	RET EXT		" DOES NOT WORSEN		✓
	SB (R)		NO PAIN		✓
Rep	SB (R)		NO PAIN		✓
	SB (L)	NO PAIN	PRODUCES (R) C5/T1. PAIN		
Rep	SB (L)		" DOES NOT WORSEN		
	ROT (R)	"	PRODUCES (R) C5/T1. PAIN		
Rep	ROT (R)		" DOES NOT WORSEN		
	ROT (L)	"	NO PAIN		
Rep	ROT (L)		NO PAIN		

STATIC TESTS ALL TESTS PRODUCTIVE OF PAIN

NEUROLOGICAL

Muscle strength NORMAL Reflexes NORMAL

Dural signs - VE Sensation NORMAL

OTHER

Shoulder girdle - VE

Special tests NEGATIVE V.B.I. TESTS

CONCLUSION

Posture (Dysfunction) Derangement no.

Other

PRINCIPLE OF TREATMENT

(Posture Correction) (Extension) Flexion

Other POSTURE CORRECTION SITTING PLUS EXTENSION 8 X 10 DAILY
ADD WHEN APPROPRIATE SIDEBENDING (L) 8 X 10 - ROTATION (R) 8 X 10

When dysfunction in the spine is the result of poor posture or spondylosis, there tends to be a symmetrical movement loss in all directions and many segments can be involved. However, when dysfunction is the result of trauma and derangement there is more often an asymmetrical movement loss, some movements remaining full range and others being partially or completely lost. Following trauma, depending on the extent of the damage sustained, assessment of the injury can be difficult. Following derangement, dysfunction tends to be limited to a localised area, the patient very often being able to point to the exact location with the fingertip.

If there is a significant loss of extension, the cervico- thoracic kyphosis may be accentuated. If there is a loss of flexion, the patient may have difficulty in placing the chin on the sternum when bending the head forward. In these cases the cervical spine may remain in slight lordosis when flexion is attempted.

Rotation and lateral flexion are frequently restricted in dysfunction of the cervical spine. Loss of rotation in particular may be for the patient the first indication that a problem exists.

THE TEST MOVEMENTS

In the dysfunction syndrome it will not be difficult to reproduce the patient's symptoms with the test movements. Due to the reduction in the available end range of motion pain will be elicited readily as soon as the shortened structures are stretched. Each time the stress is released the pain will subside quickly.

Following the test movements the patient should be allowed to move about and perhaps have a short walk. The object of this is to determine the effect of the test movements on the general pain pattern. A patient with dysfunction may be slightly more aware of his pain after the examination, but he will never remain significantly worse, provided tissue damage due to overstretching of shortened structures has not occured.

Following the test movements the movement pattern will not have altered—that is, if we were to repeat the whole sequence the same movements would produce the same pain as in the first session and the range of movement would not have changed, either for the better or the worse.

Clinical example

Let us look at the example of a typical patient with dysfunction (Fig 15:1). In particular we must assess the effects of the test movements on the pain. In this patient pain is produced at the point of full stretch in flexion and extension, which are both restricted in range of movement.

The test movements cause pain localised adjacent to the spine. Repetition of the test movements do not make the symptoms better or worse. On release of the stress the pain subsides leaving the patient no worse than before testing. Rapid changes of symptoms do not occur in dysfunction. The process of contraction of soft tissues takes weeks for shortening to develop. Conversely, it will take weeks of remodelling for extensibility to be restored.

CHAPTER SIXTEEN

Treatment of the Cervical Dysfunction Syndrome

The conservative treatment of contractures essentially requires the application of movements that will encourage the process of remodelling. By applying appropriate movement we can have a significant influence on the remodelling of tissue and ideally this should occur during the process of repair itself.[49, 69] The longer the time lapse between repair and the initiation of the recovery of full function the more consolidated the repair will be. This in turn will make the task of remodelling more difficult and will extend the recovery time.

In dysfunction, and also derangement, where there is a pathological cause for the pain, postural stresses may enhance pain arising from the pathological state. Irrespective of the nature of the underlying mechanical pathology, pains of postural origin mask and confuse the analysis of the mechanism of pain production. Until such time as the postural stresses are removed, it is impossible to comprehend the true behaviour of the pain resulting from the pathology itself. Patients with dysfunction therefore require postural instruction, for in almost all cases a postural component to their pain will be present.

When planning treatment we must include from the first day all the procedures laid down for the patient with postural pain. The patient with dysfunction can learn quickly to control those symptoms which are caused or enhanced by bad posture.

In many patients with suspected cervical dysfunction, the loss of movement, for example extension, is apparent only. If the patient's head and neck are firstly retracted, full extension may become possible. Patients in this category do not fall into the dysfunction syndrome since there is no loss of movement range, and should be treated as for the Postural Syndrome.

The symptoms of dysfunction are more related to movement and become apparent when the patient is unable to accomplish end range of movement, particularly when attempting the extremes of flexion and extension. These symptoms generally persist until remodelling of the shortened structures progresses sufficiently to permit a better or normal range of movement. This will be achieved in six to ten weeks providing all circumstances are favourable and the patient is strictly directed.

Self treatment procedures should always be applied in the initial stages of the treatment of dysfunction. These must be implemented in a precise and clearly defined manner, if remodelling is to be successful and the patient must persist with exercises even when little change is apparent. The very nature of adaptive shortening of soft tissues adjacent to articular structures prohibits the rapid recovery of function and progress must be measured in terms of weeks and months rather than days.

Stretching must also be performed frequently if remodelling is to occur. If the rest periods between the stretching procedures are too long, the length of time when no stretching takes place negates the effect of stretching. In all dysfunction situations exercises for the restoration of movement and function must be performed about five to fifteen times per session. Sessions should be repeated at two or three hourly intervals throughout the day.

The stretching must be firm enough to effect change but not sufficient to produce micro-trauma. If no strain pain is produced during the performance of exercises for the recovery of lost movement, the contracted soft tissues are not being stretched enough to stimulate remodelling. Pain produced by stretching should stop shortly after the stress is released. When pain persists long after the stretching exercises have been completed, it is likely that overstretching has occurred.

The following instructions must be given to the patient:

- Because posterior derangement is so common, patients with dysfunction in the cervical region *must maintain correct posture at all times and will at the end of each session of exercise perform retraction and extension*;
- If the exercises do not produce some minor pain, the movement has not been performed far enough into the end range;
- The type of discomfort aimed at is not unlike the pain felt when bending the finger backwards beyond the normal position;
- The pain should have subsided within ten to twenty minutes after completion of the exercises;
- When pain produced by the stretching procedures lasts continuously and is still evident the next day, overstretching—that is, too much stretching—has taken place; in this case the number of exercises in each sequence or the frequency of the sequences must be reduced.
- When stretching results in rapidly increasing and peripheralising pain, the procedure should be stopped immediately as derangement is likely to develop.

Some patients for various reasons may be unable to adhere strictly to the recommended exercise programme. Where it is not possible to perform stretching as often as instructed, recovery of full function is likely to take a little longer.

Manipulative therapy in dysfunction

Remodelling will not follow from the *daily application of spinal mobilisation or manipulation alone*. Manipulative thrust procedures applied *regularly* to patients with *dysfunction* in an attempt to lengthen contracted structures are likely to produce minor trauma (occasionally significant trauma results) and the dysfunction cycle will be perpetuated. In patients with the dysfunction syndrome, manipulative therapy is only occasionally required and then must be used in conjunction with a remodelling programme.

The purpose in regularly applying repetitive stretching movements in dysfunction is to initiate remodelling of the shortened structure. A widespread belief held particularly by osteopaths is that non specific stretching exercises should be avoided as they will cause segmental hypermobility to develop adjacent to hypomobile structures. This has not been proven and in fact appears to contradict scientific evidence that collagen formation and modelling occurs as a response to regularly applied stresses.[52, 69, 112] *Intermittent stress* applied regularly in this manner strengthens ligamentous structures rather than damages them, while scar tissue will remodel and become more extensible. On the other hand if a *sustained stress* is regularly applied, damage may occur to both ligamentous, capsular and scar tissue.[2, 73, 149, 167] It is therefore more likely that static end range loading will lead to hypermobility if indeed this is a factor in symptomatology.

Creep

This is the progressive deformation of a structure under constant load when the materials are stressed well below their fracture points.[149] The apparent improvement in the range of motion that immediately follows stretching exercises results from creep and will be temporary as the structure will return to its previous state within a short time. This is due to distortion of the cellular matrix and the expulsion or displacement of fluid.[149] Within a relatively short period of time the structure returns to its previous state as the fluid equilibrium is restored. Only by applying stretch over a period of many weeks can change in the length be obtained and this change comes from an alteration in the cellular structure. There are many occasions when attempts to remodel fail because of the dense nature and quality of the repair itself.

Hysteresis

This term describes a phenomenon whereby energy is absorbed or dissipated by a distorted structure. Less energy is released by a structure in recovering from the effects of an applied force than is required for its initial deformation. It frequently involves a "set" which can be permanent in the case of trauma, or which may recover with time as creep occurs to return the structure to its original size.[149]

TREATMENT OF EXTENSION DYSFUNCTION

The most common form of dysfunction in the cervical spine is that involving loss of lower cervical extension.

Having already explained and taught the postural requirements, we must now instruct the patient in the methods required to regain lost extension. We must explain the reasons for the need to recover the lost movement. The patient must realise that without an adequate range of extension it is not possible to sit upright and as a result there will be a constant tendency for the head to be forced forwards. For some patients it is impossible to adopt the correct sitting posture only because of the limitation in the available range of extension.

It is my experience that, following adequate explanation, patients will cooperate with the treatment and work hard at their recovery. They will perform exercises that cause discomfort or even pain, as long as they understand the reasons for doing so.

Exercises (see Fig 16:1)

The recovery of extension in the lower cervical spine can usually be achieved with patient generated force. In order to systematically stretch the lower cervical spine in extension, the procedures of retraction (sitting or standing, Proc 1), retraction and extension (sitting or standing, Proc 2) and retraction and extension (lying supine or prone, Proc 3) will be progressively indicated according to the effects obtained.

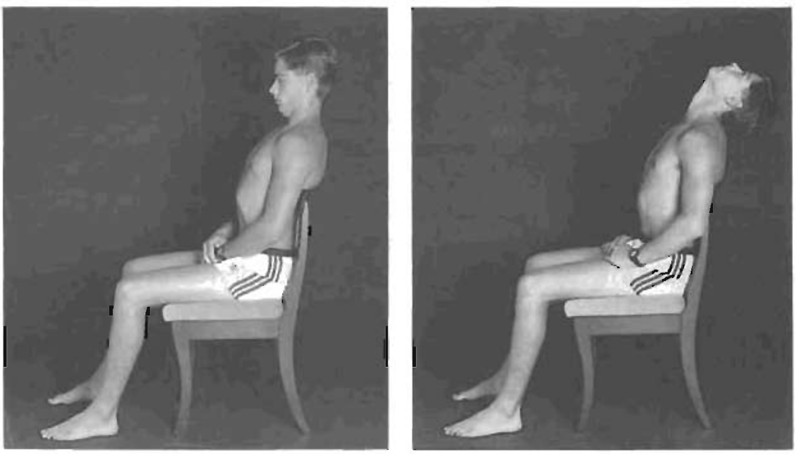
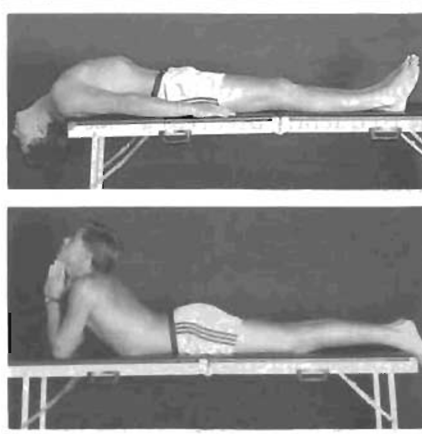


Fig 16:1
Retraction.
Extension.
Extension in lying supine.
Extension in lying prone.



The patient should be instructed to perform the exercises five to fifteen times on each occasion, and to repeat the series ten times a day at intervals of approximately two hours. It is most important to ensure that stretching occurs very regularly and the patient does not let more than two to three hours pass without doing so.

The exercise routine may result in an increase of localised central neck pain which should subside within ten to twenty minutes. The patient may also develop some new pains lower down in the spine between the shoulders and sometimes as low as the thoraco lumbar junction. These are normally the result of performing new exercises and holding a new posture. It is necessary to explain that the combination of the new posture and exercises will result in discomfort felt in other places; that this new aching is unavoidable and indeed necessary, but will pass after a week or so. Patients who do not complain of these transitional pains are probably not exercising adequately.

Irrespective of the category in which they may fall, all patients should be warned of the significance of producing peripheral pain. If exercises are found to produce peripheral pain, the patient should stop exercising and wait until the next treatment when further advice should be sought.

The loss of function in patients in this group is usually resolved gradually over a period of about six to ten weeks. After this period the patient may reduce the number of times the exercises are performed to four sessions per day, maintaining the number of repetitions at each session. I instruct my extension dysfunction patients that they should continue the programme and perform exercises twice daily for the rest of their life.

Often it is necessary to keep some record of actual progress and the therapist may choose to take photographs to evaluate the improvement in the extension curve. The improvement is usually most evident in the first week as the slack is taken up so to speak, and therefore the first photographs should be taken on the first day prior to the commencement of the self treatment programme.

Special techniques (See Fig 16:2)

Should patient generated forces alone fail to resolve the symptoms, it may be necessary to add retraction and extension with traction (Proc 4). If after

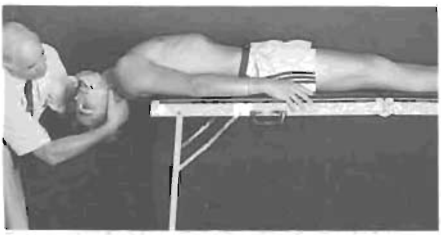


Fig 16:2
Retraction and extension with traction. Extension mmobilisation.

one week no change is evident, the patient may require extension mobilisation (Proc 5). Special techniques of mobilisation and less often manipulation, are indicated only when the patient alone is unable to fully restore cervical extension. These procedures will ensure full recovery of extension provided the extension exercises in lying (Proc.3) (see Fig 16:1) are continued as well.

TREATMENT OF ROTATION DYSFUNCTION

Loss of rotation is another common problem seen in the cervical spine. Any restriction of rotation becomes quickly evident, as the movement is continually required for many activities during the day. Limited rotation also affects the ability to adopt certain positions when lying, consequently disturbing the sleep of those affected.

To regain rotation we must, just as in the case of extension dysfunction, explain to the patient the purpose of performing exercises. Again, we must stress the necessity of causing a moderate degree of discomfort or pain with the exercises. Pain produced by stretching of contracted structures involved in the loss of rotation is usually felt to one side of the centre of the cervical spine itself. Often it may resemble the pain of which the patient originally complained and as in the recovery of extension it should be shortlived.

Exercises (See Fig 16:3)

Recovery of cervical rotation can usually be achieved using patient generated force. The patient must perform rotation (Proc 8). This exercise should be performed ten to fifteen times about every two hours. As said before, frequency and regularity of exercising are important factors in the treatment of dysfunction.

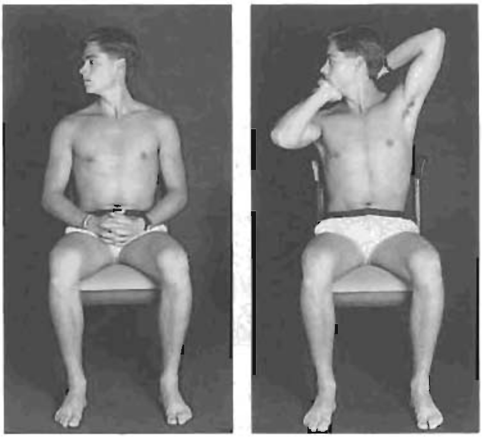


Fig 16:3
Rotation in sitting.
Rotation with overpressure in sitting.

When five to six days have passed the patient will describe that he can rotate the head further and the end range achieved actively is now painless. Of course, not enough time has passed to enable full recovery of function. If the present exercise is no longer painful it is unlikely to provide adequate stretching to restore full motion. In order to apply full passive stretch to regain the last few degrees of rotation it is necessary to apply the rotation with overpressure (Proc.8) (see Fig 16:3) so that some pain or discomfort is felt.

With the addition of overpressure the end range of rotation should again produce pain and the exercise should be initiated as recommended. Providing the range of movement gradually increases and the discomfort decreases, there will be no need to progress to therapist generated force.

Special techniques (See Fig 16:4)

Should patient generated forces fail to resolve the symptoms, it may be necessary to add rotation mobilisation (Proc.9) If after three to four mobilisation treatments no change is evident, the patient may require manipulation (Proc.9) Special techniques of mobilisation and less frequently manipulation are indicated only when the patient alone is unable to fully restore cervical rotation. These procedures may ensure full recovery of movement provided the rotation exercises (Proc.8) (see Fig 16:3) are continued as well.

Fig 16:4 *Rotation mobilisation – sitting.*

TREATMENT OF LATERAL FLEXION DYSFUNCTION

Loss of lateral flexion in the cervical spine does not so frequently cause the patient to seek assistance when it is the only limitation present. However limitation of the range of lateral flexion commonly coexists with restriction of rotation and may require specific exercises.

To regain lateral flexion we must explain to the patient the purpose of performing exercises. Again, we must stress the necessity of causing a moderate degree of discomfort or pain with the exercises. Pain produced by stretching of contracted structures causing loss of lateral flexion, will usually be felt laterally when the neck is flexed away from the painful side.

Exercises (See Fig 16:5)

Recovery of cervical lateral flexion can usually be achieved using patient generated force. The patient must perform lateral flexion (Proc.6) This exercise should be performed five to fifteen times about every two hours. As said before, frequency and regularity of exercising are important factors in the treatment of dysfunction.

When five to six days have passed the patient will describe that he can laterally flex the head further and the end range achieved actively is now painless. Of course, not enough time has passed to enable full recovery of function. If the present exercise is no longer painful it is unlikely to provide adequate stretching to restore full motion. In order to apply full passive stretch to regain the last few degrees of lateral flexion it is necessary to add overpressure (Proc.6) so that some pain or discomfort is felt.

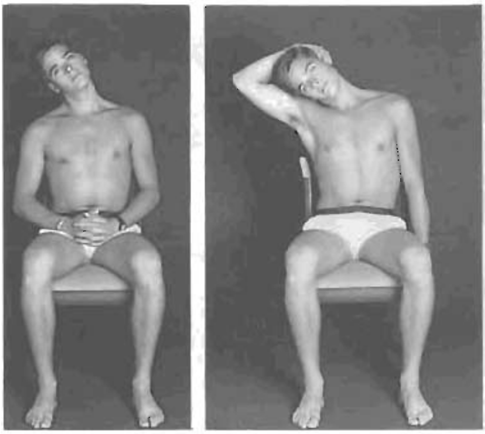


Fig 16:5
Lateral flexion in sitting.
Lateral flexion with overpressure in sitting.

With the addition of overpressure the end range of lateral flexion should again produce pain and the exercise should be initiated as recommended. Providing the range of movement gradually increases and the discomfort decreases, there will be no need to progress to therapist generated force.

Special techniques (See Fig 16:6)

Should patient generated forces fail to resolve the symptoms, it may be necessary to add mobilisation techniques (Proc.7). If after three to four mobilisation treatments no change is evident, the patient may require manipulation (Proc.7). Special techniques of mobilisation, and less frequently manipulation, are indicated only when the patient alone is unable to fully restore cervical lateral flexion. These procedures may ensure full recovery of movement provided the lateral flexion exercises (Proc.6) (see Fig 16:5) are continued as well.

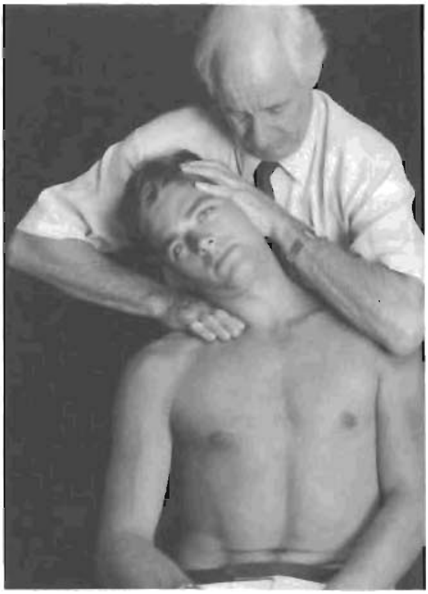


Fig 16:6
Lateral flexion mobilisation – lying
Lateral flexion mobilisation – sitting.

TREATMENT OF FLEXION DYSFUNCTION

Loss of flexion frequently occurs after resolution of acute posterior derangement. This is particularly so if the problem is complicated by referred or radicular symptoms. As in the lumbar spine, failure to recover flexion function after reduction of posterior derangement predisposes to further episodes.

The recovery of function following posterior derangement requires flexion forces and as these have the potential to cause further posterior derangement they must be applied with caution. Patients with flexion dysfunction following posterior derangement must be warned regarding the significance of the development of referred symptoms. At any sign of a return of radiating symptoms the exercises must be stopped and the patient reassessed. It may be necessary to delay further the introduction of flexion.

Exercises (See Fig 16:7)

Recovery of cervical flexion can usually be achieved using flexion in sitting (Proc 10). This should be applied without overpressure in the initial stages. For the first few days after commencing the exercise, it should be performed two or three times per day, five to ten times in each session. At the end of perhaps a week, the patient may increase the frequency and perform the exercise five to fifteen times every two hours. Immediately after each session of five to fifteen movements of flexion (Proc 10) the patient must retract and extend (Proc 2) in order to reduce any tendency for posterior flow or displacement.

Pain produced by stretching of contracted structures involved in the loss of flexion should be felt at or near the centre or just to one side of the cervical spine about the C5-7 area. This pain can also resemble the pain of which the patient originally complained, and as in the recovery of extension it should be shortlived.

When five to six days have passed the patient will describe that he can flex the head further and the end range achieved *actively* is now painless. Of course, not enough time has passed to enable full recovery of function. If the present exercise is not producing some pain it is unlikely to provide adequate stretching to restore full motion. In order to apply full passive stretch to regain the last few degrees of flexion it is necessary to perform flexion with overpressure added (Proc.10) so that some pain or discomfort is felt.

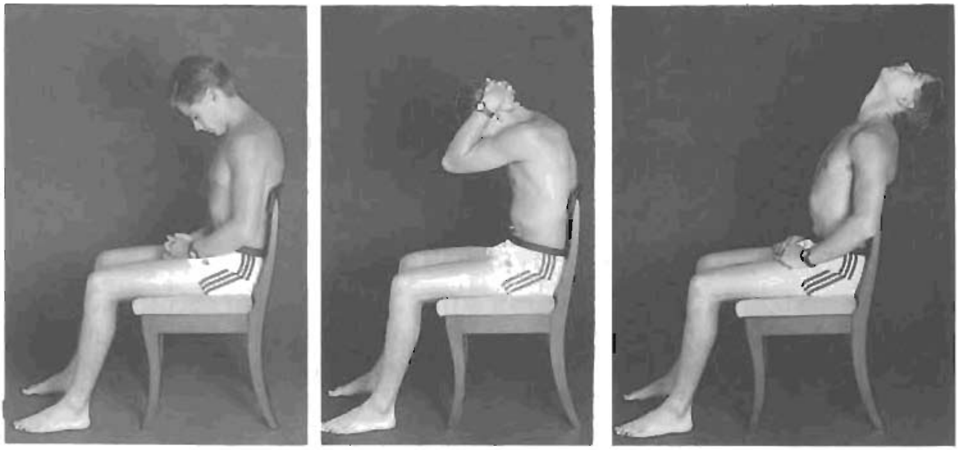


Fig 16:7 *Flexion in sitting. Flexion with overpressure in sitting. Extension in sitting.*

With overpressure the end range of flexion should again produce pain and the exercise should be initiated as recommended. Providing the range of movement gradually increases and the discomfort decreases, there will be no need to progress to therapist generated force.

Special techniques (See Fig 16:8)

Should patient generated forces fail to resolve the patient's symptoms it may be necessary to add flexion mobilisation. (Proc. 11) This should ensure full recovery of movement provided the flexion exercises (Proc. 10) (see Fig 16:7) are continued as well.

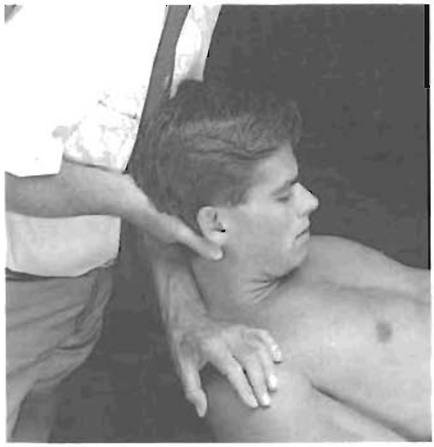


Fig 16:8
Flexion mobilisation.

TYPICAL TREATMENT PROGRESSION – THE DYSFUNCTION SYNDROME

The days referred to in the treatment progression are related to treatment sessions which in the first week of treatment should take place on consecutive days.

Day one

- Assessment and conclusion/provisional diagnosis.
- *In depth explanation of the cause* of dysfunction and the treatment approach.
- *Postural correction* and instructions, especially regarding sitting; demonstrate the use of a lumbar support by day for sitting, and a cervical support for night if required.
- Commence with appropriate exercises to recover the lost function as indicated.
- Emphasise the need to experience some discomfort during the exercises, and the importance of frequent exercising during the day.
- If flexion is recommended, we must warn to stop exercising if the symptoms quickly worsen or peripheralise. We may have overlooked derangement, or commenced the procedure too early following recent derangement.
- Always follow flexion exercises with some extension.

Day two

- Confirm diagnosis. Remember, in twenty-four hours little change can be expected in range of motion in dysfunction syndrome. Pain may be less as a result of postural correction, however.
- Check postural correction.
- Completely repeat postural correction and instructions.
- Check exercises. If improving nothing should be changed.
- Ensure that exercises are performed far enough into end range, maintained long enough during the last three repetitions, and performed often enough during the day.
- *Warn for 'new pains'.*

Day three

- If no improvement, or aggravation, add overpressures when exercising.

Day four and five

- Check exercises and progress.
- Consider the need for mobilising procedures.
- Ensure that patient has 'new pains'.

Further treatments

- If the patient ceases to improve and especially if the remaining pain is unilateral, then a rotation or lateral flexion mobilisation may occasionally be necessary. This may have to be repeated no more than two or three times and should be combined with mobilising and exercising procedures already being applied.
- I prefer to see patients in this category for five days in succession. If progress is adequate and the patient understands the self treatment programme, treatment may change to alternate days and late to twice per week if required.
- It usually takes five to six treatments to establish the needs of the patient with dysfunction. Remember, the remodelling process takes two to three months and longer. Having provided the patient with sufficient direction and movement it is necessary, by arranging follow-up, to ensure his continued compliance with exercise. You may not see the successful result unless you arrange sound follow-up procedures. The full recovery of function is imperative if the patient is to become pain free.
- Before discharge prophylaxis must be discussed in detail.

CHAPTER SEVENTEEN

Cervical Headache Syndrome

Headache is one of the most widely reported complaints of patients visiting family medicine clinics.[171, 56] There are many possible causes of headache, and of course it is important to exclude non mechanical pathologies before applying mechanical treatments. Only headache of mechanical origin will be discussed here.

The question of the origin of the mechanical cervical headache remains unanswered. Is the headache produced by postural stress, by contracture, or malpositioning? It is difficult to conceptualise internal derangement in anatomic terms at the occiput-atlas-axis junctions as there are no intervertebral discs at these levels. However, headaches could emanate from internal derangement of the intervertebral disc at the C2-3 level, and it has been proposed that they may arise from even lower segments. Postural factors certainly occur in many patients, for correction of the faulty posture abolishes the pain. The symptoms in some patients remain long after correction of posture and only resolve after the application of fairly vigorous flexion exercises. In these cases, it is also difficult to cause the headache to return. This is in contrast to the ease with which pain can be made to return in patients with the derangement syndrome. Many support the hypothesis that a neural component is responsible for such symptoms. The true mechanical cause remains a mystery.

FREQUENCY OF CERVICAL HEADACHE

Headache arising from mechanical disturbances within the cervical spine is a frequent complaint of the general patient population. Specific epidemiological data are sparse on the subject. Frykholm[56] reports that of all headaches encountered in practice, headache of cervical origin was the most frequent. Records from my own clinic indicate that in 1978 one patient in every five presenting with cervical syndrome reported associated headache.[102]

Cervical headaches occur regardless of age and sex, although a tendency towards a higher incidence in the female has been observed.[102] Cervical headache can resemble migraine and can produce symptoms of such severity that disruption of the normal lifestyle can result.

Although our understanding is incomplete it is widely reported that the articulations of occiput-atlas and atlas-axis together with C2-3 are in some way responsible for most but not all symptoms arising from this syndrome[11, 45, 46, 82, 95, 136, 147] Frykholm,[56] however, states that headache can arise from any of the segments of the cervical spine.

THE CLINICAL PICTURE

The ache from cervical headache is commonly felt at the base of the occiput and surrounding area, and it can affect the temporal and frontal regions. Cervical headache is frequently unilateral. Patients sometimes describe that the radiating ache can alternate from the right to the left side. Indeed, confirmation of the mechanical nature of the problem can be obtained when applying repetitive motion that induces this change. The headache is less often described as being only centrally located.

As in non specific neck pain in general, headaches arising from the cervical spine tend to be intermittent and episodic in nature. Headache originating from mechanical disturbance of the cervical spine behaves characteristically. It is nearly always affected by positioning but not always by movement. Cervical headaches seem to arise most commonly from static loading in end range positions which cause postural distortion. The great majority of headache sufferers describe that prolonged sitting, especially driving and office desk work, is the single most troublesome posture. The habitual adoption of a protruded head posture, so often seen in these situations, is a likely causative factor in the production of cervical headache. Patients, however, rarely recognise the relationship between their poor posture and the presence of headache. They more often attribute the problems to workload, stress and or fatigue.

Because of the possibility of serious injury if treatment methods are imprudently applied, it is important to recognise the fragile nature of the anatomy of the area, especially of the vertebral and basilar arterial circulation. Two major complications, if present, will contraindicate any application of mechanical therapy.

Unsuspected fracture or instability

If the patient states that his symptoms commenced following a traumatic event, it is essential to radiologically exclude the possibility of fracture and to identify instability by obtaining lateral views of the extremes of flexion and extension. The X-Rays should be taken before commencing the dynamic phase of the examination.

Vertebro-basilar artery insufficiency

Under normal circumstances any impairment of the circulation in one vertebral artery is compensated for by the other. However, should one of the vertebral arteries be impaired and the application of certain forces be sufficient to occlude the normal artery, the compensation mechanism fails and the patient is at risk from stroke and even death. Serious neurologic complications have occurred following neck manipulation[43, 115, 137] Such accidents have been reported usually following the performance of forced and vigorous rotary manipulation of the upper cervical spine. Rotation and rotation combined with extension are known to be the movements most likely to cause occlusion of the involved vessels.[131]

The large rotation that occurs at the C1-C2 articulation can cause clinical problems. Seleki,[131] studied the effects of this rotation on the vertebral arteries that ascend vertically in the foramina transversarium and then pass through both the C1-C2 and the occipito-atlantal articulation before entering the skull. He found that after 30 degrees of rotation to one side there is kinking of the contralateral vertebral artery. This kinking, which is also accompanied by stretching, first occurs as the vertebral artery exits from the transverse foramina. It becomes more marked as the angle of rotation is increased. At 45 degrees of rotation the ipsilateral artery also begins to kink. If the flow in both arteries is compromised, symptoms related to decreased flow in the posterior fossa may be elicited. Situations in which this phenomenon may occur include yoga, calisthenics, overhead work, and cervical traction. Similarly, cases of stroke have been reported following chiropractic manipulation of the neck and head. Most recently, Schellhas,[130] and co-workers angiographically confirmed vertebro-basilar injuries following chiropractic manipulation. Other authors have reported similar complications in patients without medical problems. Evidently, these accidents may occur in the absence of clinically apparent vascular or cervical spine disease.

According to Miller and Burton,[113] *there are usually premonitory symptoms including nausea, visual disturbance, vomiting, and vertigo during the preliminary treatments. If manipulative treatments are stopped at this stage, further irreversible damage can usually be avoided.* In all instances, patients with cervical spondylosis or symptoms of vertebral vascular insufficiency should be warned against undergoing manipulation of the cervical spine. Cervical spine fusion may alleviate this symptom complex; however, further clinical studies are needed to verify this supposition.

However, to keep things in perspective, Curtis,[29] reports that the total number of such accidents recorded so far ammount to less than 50, an incidence of less than 1 per 3 million treatments. Grant,[63] reports on 56 cases with an incidence of 1 per million treatments. Nevertheless caution must be exercised at all times. We must be careful to ensure that the application of external forces will not cause harm and that any exercises given can be performed with confidence. *Therefore, before providing any mechanical treatment for cervical headache it is essential to test rotation and rotation and extension movements to determine the effects on the symptomatology.*

Notwithstanding, Bolton[14] has reported a case in which the accepted tests for vertebro basilar artery function failed to predict cerebral ischaemia. "If the patient's head and cervical vertebral column have not been rotated at least 45-degrees, these tests must not be considered to have tested the patency of the vertebral arteries."

History

The history will be recorded and from this the nature and behaviour of the symptoms will be obtained. This will provide us with some indication of the likely response to be obtained from the testing procedures. For example, if the symptoms are intermittent on a daily basis, it should be comparatively easy to identify the causative factors and the movements involved.

If the patient is presently experiencing, or has experienced in the past, dizziness, tinnitus or nausea, especially related to certain movements or positions, it will be necessary to investigate the origin of these symptoms. Usually such symptoms arise from disturbance within the vestibular apparatus (semicircular canals), in which case there is no need to withold the treatment protocol. However, it is possible that such symptoms may arise from vertebro-basilar insufficiency. (VBI). Even though there may be no recollection of such symptoms, it is recommended that all patients should be assessed for VBI if it is possible that at some time during their treatment they may receive mobilisation or manipulation of the upper cervical spine.

If the patient is totally asymptomatic at the time of interview, it will be almost impossible to prove a mechanical cause and effect relationship. In this case, I usually advise the patient to return immediately when next the symptoms appear. This allows for a specific mechanical evaluation to be applied and the effects on symptoms can be recorded.

EXAMINATION

The nature of the patient's posture will be recorded but before any dynamic evaluation is undertaken testing for vascular impairment should be completed.

TEST PROCEDURES FOR CERVICAL HEADACHE

Test for vertebro-basilar insufficiency

The test is designed to detect any possible insufficiency in the vertebral and basilar arterial system. This must be done prior to the administration of any other tests. The test described here is the test that I most commonly use.

By placing the cervical spine in a position of extreme extension and adding a rotary component, any insufficiency of the arterial supply causing symptoms should be exposed. The test is performed so that minimal disturbance of the vestibular mechanism occurs at the point when the extreme of rotation and extension is reached.

Lying prone in extension

The intensity and location of the headache is recorded prior to the adoption of the extended position.

The patient lies prone on the treatment table leaning on the elbows and resting the chin on the outstretched finger tips with the head extended, facing forwards and upwards. (Fig 17:1) It is important to have the patient as relaxed as possible in order that a passive overpressure can develop as the position is maintained. It is necessary for the movement to be made to the maximum end range of extension. Record the nature of any symptoms present.

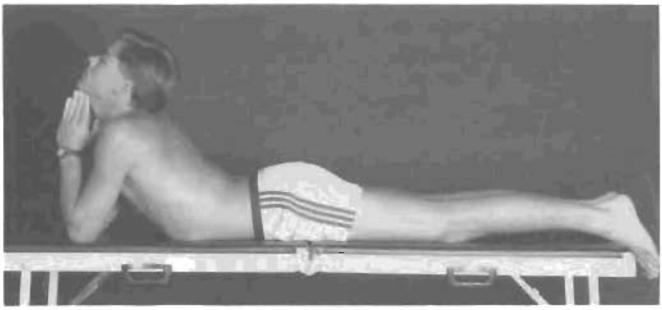


Fig 17:1. *Test for vertebro basilar insufficiency lying prone in extension.*

For up to two or three minutes if necessary, the patient should constantly report the effects on the symptoms whilst in this position. On return to the neutral position the patient is asked, "As a result of adopting that posture do you feel any nausea, or dizziness or do you feel unwell?" Should the patient be unaffected by the extended position, the procedure should be repeated but with the addition of a rotation component, first to one side and then the other. To this end the patient extends, and whilst in extension rotates *as far as possible* to one side and maintains this position again for about three minutes. (Fig 17:1a) If the patient is unaffected, the procedure should be repeated to the opposite side. A check should also be made on whether or not the symptom intensity or location has altered. The effects, if any, are recorded.

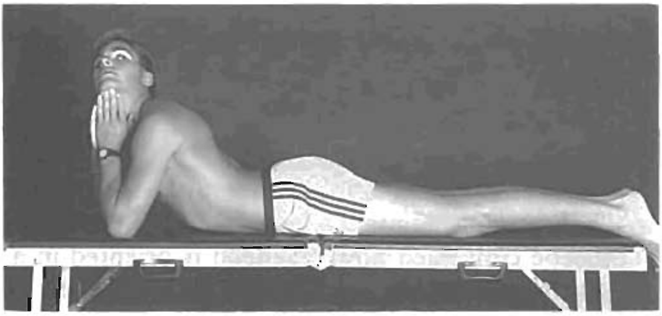


Fig 17:1a. *Test for vertebro basilar insufficiency—rotation in extension.*

In the event the patient becomes nauseous, dizzy or feels unwell whilst in extension, he should immediately allow the head to return to the neutral posture for a few minutes to recover. The process should then be repeated, but if the patient consistently reports distress from the procedure it should be abandoned and the patient referred for further investigation.

Mechanical assessment

The next step after establishing the relative safety of using cervical manoeuvres to treat the headache, is to confirm whether the symptoms are of cervical origin and whether there is a mechanical basis for their presence.

Headaches originating in the cervical spine behave characteristically. They are always affected by positioning but not always affected by movement. Cervical headaches arise most commonly from static loading in end range positions, which create postural distortion. Therefore in order to clarify the mechanical relationship, the simplest method is to place the cervical segments in positions of extreme end range for a few minutes at a time. These tests should cause the symptoms to reduce, increase or be abolished, thus confirming the mechanical nature of the problem.

To obtain maximum flexion and extension in the upper cervical spine it is important to remember that the degree of occipito-axial flexion and extension varies with the position of the head. The maximum flexion in this area is obtained when the head position is maintained in a horizontal plane with the head drawn back or retracted with the chin tucked in. Maximum extension is obtained in the upper cervical spine with the head protruded and extended. Maximum flexion and extension in the occipito axial region thus do not correspond to maximum flexion and extension of the neck.[120]

This observation is of significance especially in the causation and treatment of cervical headache. It provides a possible explanation for the rapid resolution of occipital and cervical headache that follows from the performance of the exercise described in this chapter. In my experience, active flexion of the neck performed by bending the head forward is not often therapeutic.

Sitting retraction

The intensity and location of the headache is recorded prior to the adoption of the retracted head posture.

The sitting patient is instructed to retract the head as far as possible and at the same time maintain a forward facing position. (Fig 17:2) The movement should be continued until the head is oriented in a more posterior position above the spinal column. It is important that the movement be made to the maximum end range of retraction. During the movement the head must remain horizontal and should be kept facing forward and inclined neither up or down. The patient, using the fingers of both hands applies graduated pressure against the chin so that the head and neck are retracted to an extreme position. (Fig 17:2a) On attaining the end position the pressure is held for a second and then released so that the head returns to the neutral position. The movement should be applied cyclically, and after five or six excursions the end position should be maintained as far as possible dictated by the patients tolerance for up to three minutes. *It may be necessary for the examiner to apply overpressure in order to produce change in pain intensity*. (Fig 17:2b) During the maintenance of this position the patient's headache will either reduce, increase, or disappear if the headache is mechanical in origin.

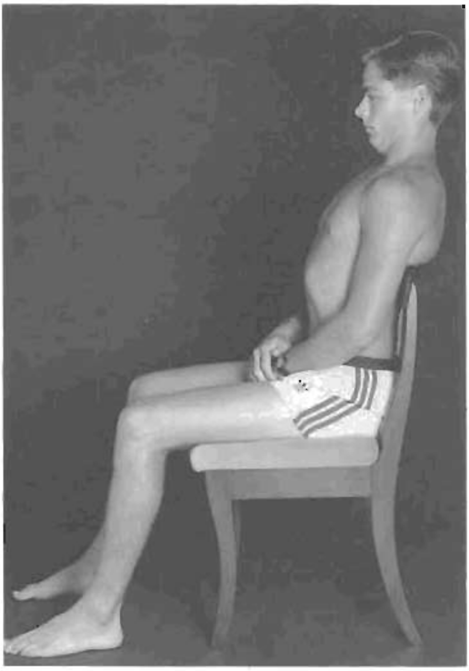


Fig 17:2. *Retraction in sitting.*

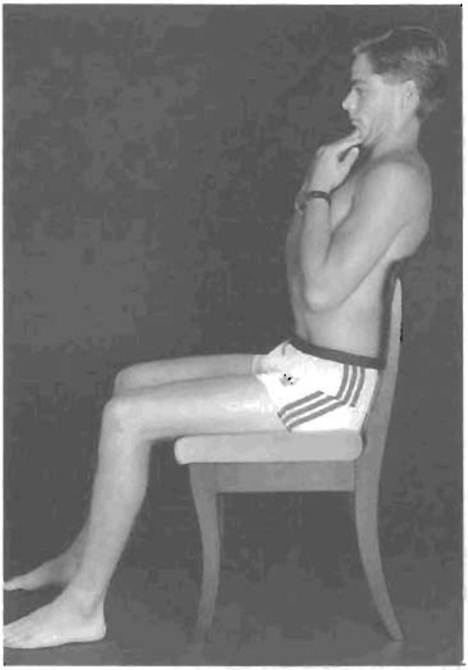


Fig 17:2a. *Retraction with overpressure in sitting.*

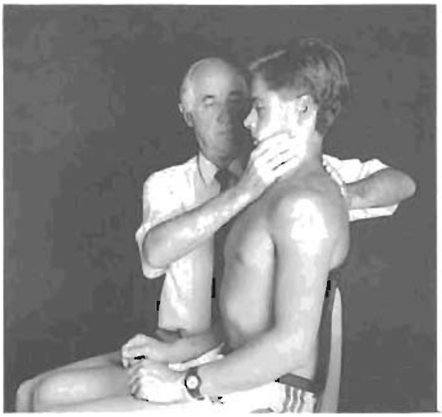


Fig 17:2b. *Retraction with therapist overpressure.*

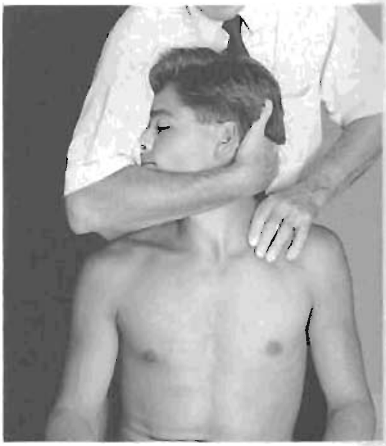
Other Tests

If the headache remains unaffected by maintaining the retracted position, the same test should be applied at the extremes of flexion (Fig 17:2c) and rotation (Fig 17:2d) with overpressure if necessary, in that order.

Occasionally a combination of flexion and rotation or extension and rotation will alter the symptoms. If on completion of these end range tests the symptoms remain unaffected, it is unlikely that the problem is of mechanical origin.

Fig 17:2c.
Flexion with overpressure in sitting.

Fig 17:2d.
Rotation with overpressure in sitting.



TREATMENT FOR CERVICAL HEADACHE

Once it has been established that the headache is mechanical and related to function of the cervical spine, the patient should commence all of the procedures to correct sitting and standing posture. (See Treatment of the Postural Syndrome Chapter 14) The degree of upper cervical flexion obtained by correcting posture alone is occasionally sufficient to abolish the headache.

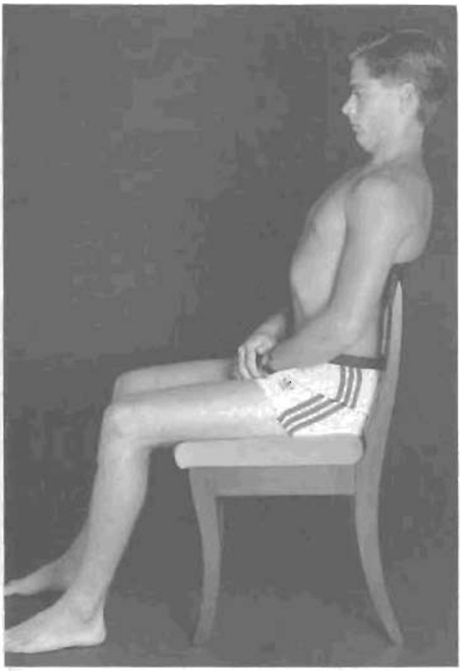
Exercises (See Fig 17:3)

If the patient does not find relief with posture correction alone, head retraction with overpressure if necessary, (Proc 1) should be commenced and repeated every two hours or more frequently if necessary. After two or three days using head retraction, (Proc 1) the patient should be improving steadily in which case no progression to the treatment should be made.

Should the patient improve for only a short period after exercise, neck flexion with overpressure, (Proc 10) and if inadequate, flexion mobilisation, (Proc 11) should be applied. If this fails to produce a satisfactory result, the patient should perform rotation with overpressure in sitting, (Proc 8) and then rotation mobilisation. (Proc 9).

Because regularly applied flexion forces may cause displacement in the lower cervical segments, it is advisable to perform three or four extension exercises (Proc 1) to reverse this tendency. The patient should apply these immediately on completion of the flexion exercises.

Although uncommon, in some patients extension exercises may abolish the headache when flexion has failed. It is possible that the headache in these cases is secondary to posterior derangement at a lower level of the cervical spine.



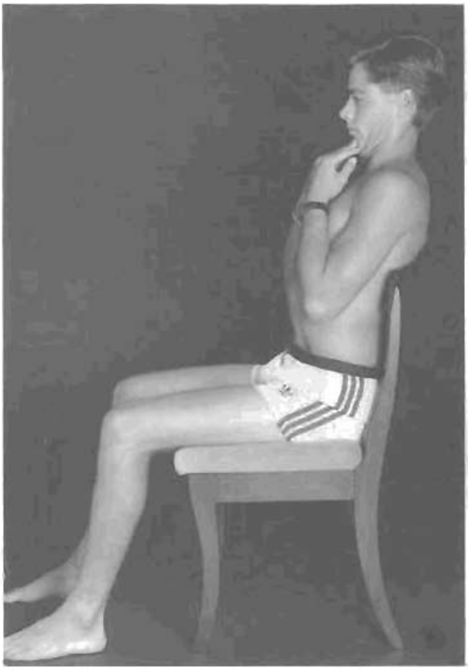
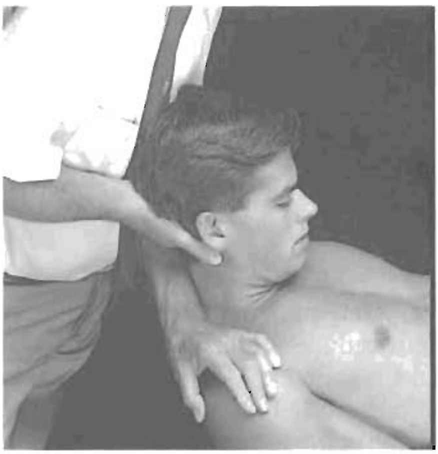


Fig 17:3.
Retraction in sitting.
Retraction with overpressure in sitting.
Flexion with overpressure in sitting.
Flexion mobilisation.



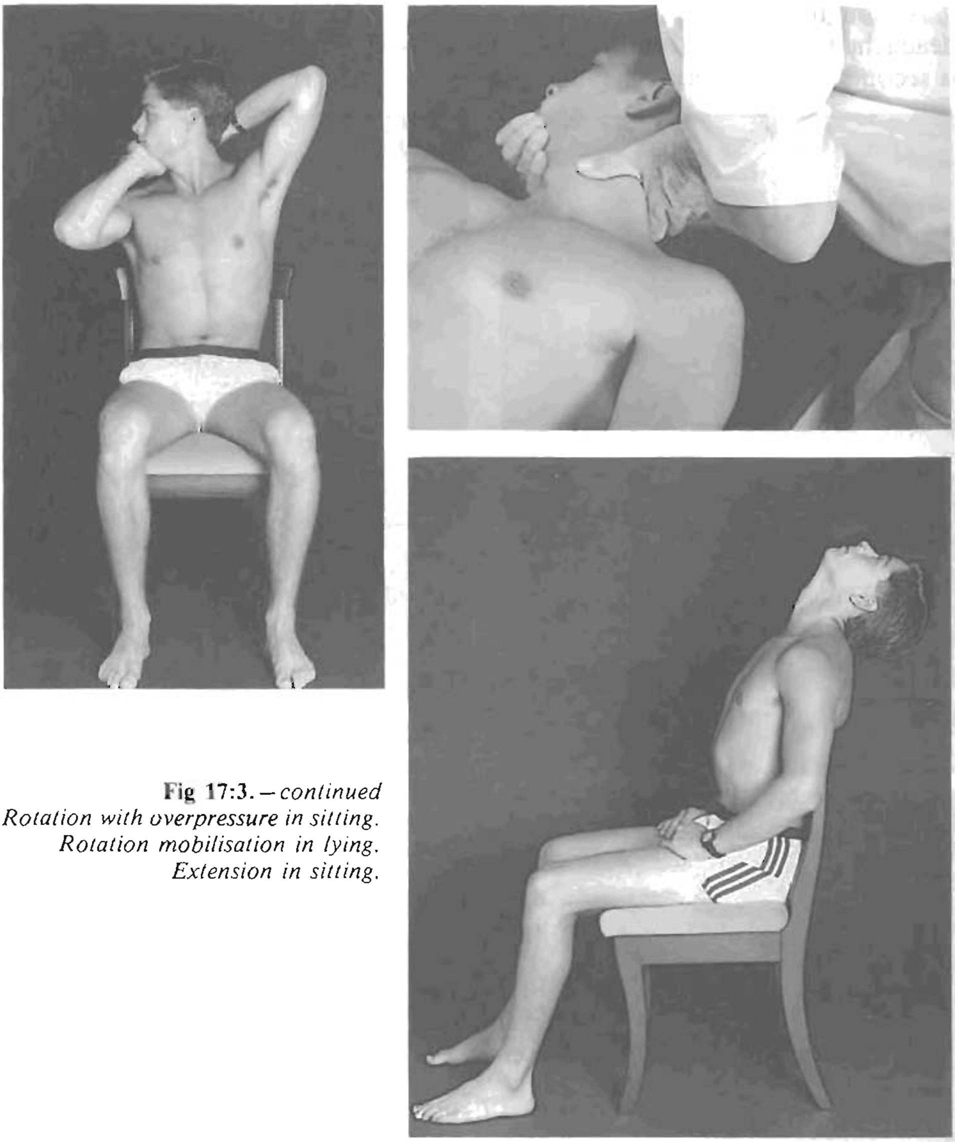


Fig 17:3.—*continued*
Rotation with overpressure in sitting.
Rotation mobilisation in lying.
Extension in sitting.

Very few patients with headache of cervical origin will fail to respond to the procedures described here. It may be, however, that resistant problems would respond to appropriate upper cervical techniques of mobilisation or manipulation. Patients requiring such techniques should be referred to a clinician with appropriate skills.

Correction of the lying posture

Some patients describe that their headache is consistently present on waking in the morning but did not exist the night before when retiring. This cannot always be attributed to over-indulgence! Any patient waking in the morning consistently with a headache that was not present on retiring the night before should be suspected of having a headache of mechanical origin.

The contents of all pillows should be loose and adjustable. For this reason moulded foam and rubber pillows should be avoided as they do not allow adjustment. However, patients who habitually sleep prone can have great difficulty in adapting to a new sleeping posture and it is these especially who seem to wake with unilateral headache responding only to specific manipulative therapy.

Symptoms which develop during the night from faulty pillow support can usually be dealt with simply by inserting a supportive roll. (For further detail see Correction of the Lying Posture, Chapter 14.)

SUMMARY

Cervical headache, if mechanical in nature will respond well to appropriate mechanical treatment. Sometimes, however, especially in the early stages of treatment, the headache initially increases for a few hours and then subsides. In spite of this, treatment should continue at least for four or five days after which time it may be abandoned should no sustained benefit accrue.

It is a mistake to correct posture, add exercise, and apply therapist technique on the first day. Should that sequence be applied there is no way of knowing which component of the overall treatment was responsible for any improvement that may follow.

CHAPTER EIGHTEEN

Cervical Trauma

Patients with cervical spine problems must be assessed with caution if the initial injury is the result of severe trauma. This is especially true in whiplash type injuries resulting from motor vehicle accidents. In these cases the likely response to the measures recommended in this text are unpredictable, progressions of treatment must be applied gradually and the effects on symptoms monitored closely. The use of excessive and vigorous motion in the early stages of recovery can be extremely detrimental and care must be taken to avoid disruption to the healing process.

Functional radiological assessment should be made in the case of any patient reporting symptoms arising from significant trauma. Lateral views of the extremes of both flexion and extension should be obtained. These will identify any instability resulting from the accident. The presence of any fracture or instability immediately contraindicates treatment by mechanical therapy.

Unless the injury is detected radiologically, it is often not possible to precisely identify the structures most affected in patients with significant cervical whiplash injury. Frequently, the pain prevents adequate assessment, so that in the early stages following injury the extent of soft tissue damage remains obscure. As soon as the condition permits, assessment by repetitive motion should be performed. The rate of recovery is unpredictable and disability from these injuries can be protracted.

TREATMENT

Immediately following injury, adequate rest to allow uninterupted healing is essential. However, rest must not be unduly prolonged. It has been demonstrated that patients suffering whiplash who were mobilised from an early stage responded better than those treated by an immobilising collar.[110] This calls into question the routine use of cervical collars to immobilise the spine following whiplash injury.

Correction of posture

The posture of patients recovering from cervical spine trauma must be controlled in order that they do not maintain a protruded head position during the repair process. Instruction and education in the management of postural care and exercise should take precedence over the use of a cervical collar.[103]

Most cervical collars force the patient's head towards a protruded posture and, if worn for months, perpetuate the problems. The recovery of full function in patients so treated is extremely unlikely, and in my experience they will be in significant discomfort for many months or years.

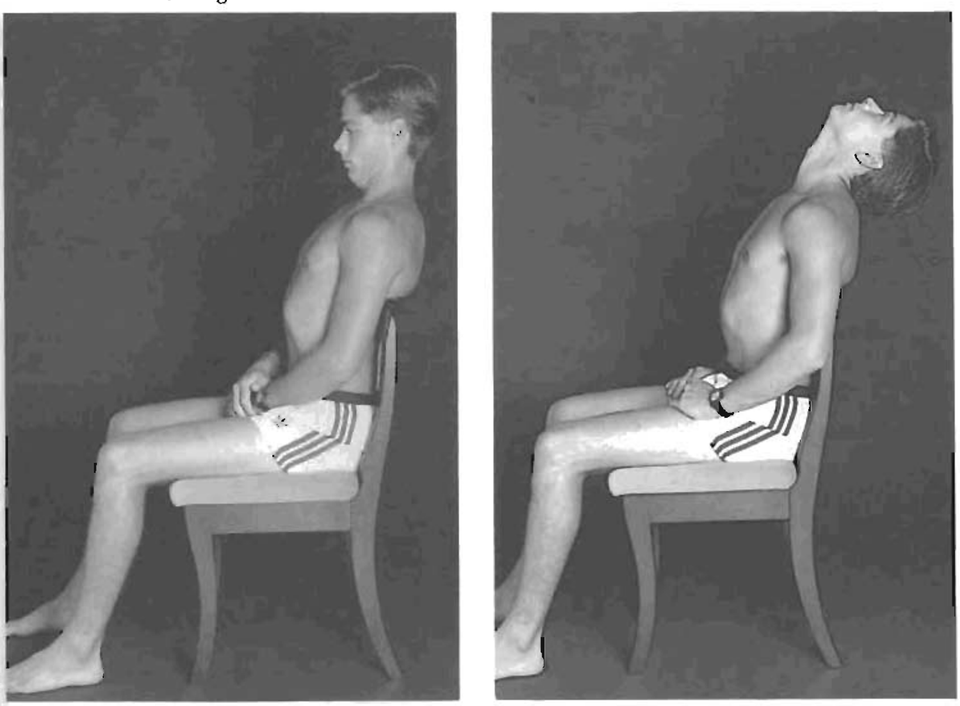
Exercises (See Fig 18:1)

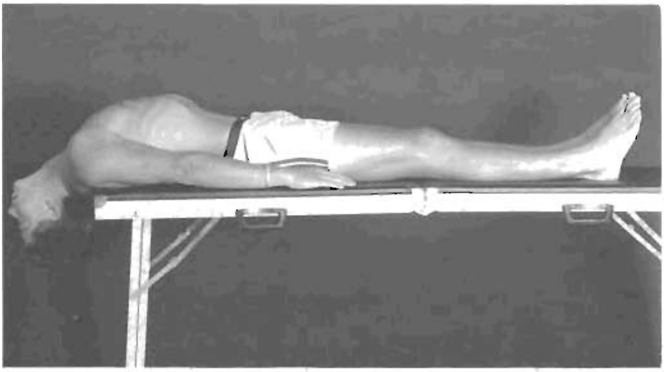
Should the patient report soon after injury, he or she should be encouraged to gently move through a full range of motion in all directions at least once every day. As the condition improves the patient must be encouraged to increase the frequency and vigour of the exercise programme. The daily attainment of full range of motion in all directions is vital.

Established loss of function in the cervical spine following trauma should be routinely treated as outlined in Chapter 16, Treatment of the Dysfunction Syndrome.

The exercises of greatest importance are retraction, (Proc 1) extension in sitting or lying prone or supine, (Proc 2 and 3) and rotation with overpressure if necessary. (Proc 8)

Fig 18:1. *Retraction in sitting. Extension in sitting.*





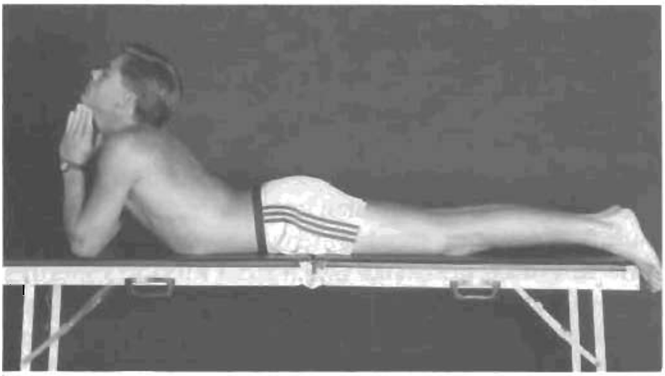


Fig 18:1.—*continued*
Extension in lying supine.
Extension in lying prone.
Rotation with overpressure.

Various mobilisation procedures may be required in addition to exercises, and these must be dispensed as required according to the direction of restricted motion.

In addition to generalised contusions and abrasions, many patients suffer derangement as a result of the initial injury. The derangement can cause persisting symptoms if not recognised early in the recovery stages. Once the patient's condition allows adequate assessment, it will be possible to determine if any derangement component is contributing to the problem. If this is the case, the patient should be classified by repeated movement testing into the appropriate category of either anterior or posterior derangement, and the routine treatments for the correct classification should be applied.

Pain from whiplash injuries to the upper back and cervical spine can *persist for many months* and it is common to find significant dysfunction in patients who have been immobile during the healing stages. These patients have persistent symptoms resulting from the repair itself and will require a vigorous programme of remodelling for generalised dysfunction. It is not uncommon to see restricted range of motion in all directions in these cases. Where patients are involved in litigation following motor vehicle accidents, prolonged recovery is likely.[78]

In summary, trauma involving the cervical spine must be permitted to heal. During this period the posture of the patient must be corrected and simple active movements performed at least once per day. Even with early movement dysfunction can easily develop. Should dysfunction develop it will require regular stretching exercises to encourage remodelling. As restriction of movement resulting from trauma to the cervical spine is so variable, it is not possible to predict which stretching procedures will most often be required. Should a derangement co-exist it must be reduced in the normal way, but extra care must be taken during the process of reduction.

CHAPTER NINETEEN

The Cervical Derangement Syndrome

The mechanism of internal derangement of the cervical intervertebral disc is not fully understood. That tissue originating from the innermost aspect of the intervertebral disc can be displaced towards, and extrude through the ruptured annulus, is unarguable.[26, 74, 92, 146] There must be an embryonic stage of displacement, when migration of tissue is minimal; when small displacements subjected to appropriate forces are reversible.

In patients under fifty-five years of age or thereabouts, internal derangement of the spinal segments may result from excessive flow or displacement of the fluid nucleus/annulus complex. In patients over fifty-five derangement may result from displacement of a sequestrum from the degenerated annulus or the now fibrosed nucleus, or both. Flow or displacement of the fluid nucleus/annulus complex will obstruct the performance of certain movements and disturb the normal resting position of adjacent vertebrae and, if excessive, will force deformity.

Described simply, the pain of derangement occurs as a result of anatomical disruption and flow or displacement within the intervertebral disc.

THE CLINICAL PICTURE

Patients with the cervical derangement syndrome are usually aged between twelve and fifty-five years. The incidence of cervical derangement in the young is common in comparison to similar problems encountered in the lumbar region where it is rather unusual to see young teenagers with the derangement syndrome.

The symptoms from the cervical derangement syndrome may be felt locally adjacent to the mid line of the spinal column, and may radiate and be referred distally in the form of pain, parasthaesiae or numbness.

Pain from the derangement syndrome may alter its location. It can move proximally or distally. It can change both in regard to the area affected, or the extent of the area affected which may increase or decrease. Pain from the derangement syndrome may cross the mid line, for example move from the right side of the neck to the left. Overnight, pain previously felt in the right scapula region may cease and appear on the left.

Discogenic pathology must always be suspected when the patient describes that his pain changes location and radiates when he changes position or performs different movements. When referred pain changes its location, displacement within the intervertebral disc is changing its shape and/or position and this occurs with movement or sustained positioning.

Patients presenting with derangement usually describe a sudden onset and in a matter of a few hours or over a day or two, they change from completely normal to significantly disabled beings. Very often there is no obvious reason for the onset of symptoms. Two of every three patients with low back pain have symptoms commencing for no apparent reason.[100] It is my observation that a similar or even greater number of patients develop symptoms for no apparent reason in the cervical region.

Pain from the derangement syndrome is frequently constant in nature. There may be no position in which the patient can find relief. The pain therefore will be present whether movement is performed or not and this pain is usually described as an ache. That ache is then made worse by movement in certain directions and reduced by movement in other directions.

Where there is no recognisable precipitating strain involved in the production of mechanical spinal pain, we must assume that the symptoms commenced as a result of the patient's normal daily pursuits. In other words, in the course of every day living the patient has performed a series of movements or adopted certain positions which have led to mechanical derangement within the spine. Under these circumstances it is possible to equip the patient with the necessary information and instruct him in the methods required to reverse the mechanical disturbances he unwittingly created and to prevent further episodes of back or neck pain. This can be achieved if instructions and explanations are given in a simple but adequate manner.

If the patient adopted a position or performed a movement that disturbed or displaced intradiscal tissue, utilisation of other movements or positions can reverse that displacement if we understand the mechanism involved.

Time can be a crucial factor in the production of derangement, but can also be utilised to advantage in the reduction process. For example, if the pain of derangement is stated to arise commonly after half an hour of knitting or writing at a desk, it is unlikely to appear clinically after only a few minutes in the damaging posture. Conversely, if it takes thirty minutes to produce pain clinically it is unlikely to disappear in two minutes. Throughout the treatment of derangement, ample time must be allowed for reversal of the flow of displaced fluid or gel within the disc. In the reduction of derangement, time is obtained by sustaining positions or repeating movements.

EXAMINATION

The patient with the cervical derangement syndrome frequently has a poor sitting posture. In the derangement syndrome, especially in severe cases, gross loss of movement may occur. Also in severe cases deformities such as kyphosis and torticollis are frequently seen. In the absence of injury, sudden loss of spinal mobility and the sudden appearance of deformity in acute neck pain may be likened to the sudden locking that may occur in the knee joint where internal derangement of the meniscus is common and obstructs movements mainly in one direction.

The symptoms are produced or abolished, and increased or decreased and they remain better or worse as a result of the testing procedures.

The test movements

In derangement the repetition of the test movements can have a rapid effect on the condition and the patient may improve or worsen in a matter of minutes depending on the direction in which the movements are performed. When the test movements are repeated in the direction which increases flow and displacement, pain will increase or move distally with each successive movement and after the treatment the patient may remain significantly worse as a result of increased derangement. The opposite applies when the test movements are repeated in the direction which reduces the derangement. In this case the patient improves with each successive movement and remains improved subsequently. In general, rapid and lasting changes in the condition as a result of completing the test movements indicates the presence of derangement.

If a patient with derangement describes changes in the pain pattern following the test movements, there should also be observable changes in range of movement and deformity. In other words, a patient who describes a significant increase in pain should exhibit an increase in the mechanical obstruction of movement and an increase in the degree of deformity. The patient who describes a reduction in pain should simultaneously exhibit an increase in range of movement and a reduction of deformity.

The vast majority of derangements – over 90% – are located either postero-centrally or postero-laterally and accordingly require extension forces to achieve reduction. The remainder occur anteriorly or antero laterally and require flexion forces to achieve reduction.

Many derangements commence postero-centrally and subsequently move postero-laterally. The findings of Cloward[26] and Fuchioka[59] supports the proposal made in the conceptual model. This may explain the change in location of pain that is frequently described by the patient. As these variations occur from time to time it is not possible to apply the extension principle to all patients. In order to identify the direction of motion appropriate for any given patient it is necessary to apply the test movements.

When the history suggests that a potentially disabling situation is present, it is not necessary to develop the protrusion or flexion testing procedures to completion. In these cases flexion may be too painful to be repeated and if forced each successive movement may increase or peripheralise the pain. In derangement, the increase or peripheralisation of pain with each repeated movement indicates a rapidly increasing derangement. When this occurs we should not insist on completing the recommended number of test movements.

When the test movements affect pain, it is important to state clearly whether pain is "produced" or "abolished"; "increased" or decreased"; and whether it "remains better or remains worse as a result of performing the exercises". These descriptions indicate increasing or decreasing mechanical deformation. It is imperative that we establish the existing pain state before commencing the test movements in order to be able to assess the effects of these test movements on pain.

If the annulus fibrosis is incompetent or is breached, we cannot influence the distribution of the fluid contents with normal movements of the spine. This situation appears clinically in the patient with brachialgia who has constant pain and cannot find relief by either positioning or movement. Most of the test movements will increase the distal symptoms and no movements will be found to reduce them. Thus, the performance of the test movements clarifies the severity of the derangement and its irreversible nature.

CLINICAL EXAMPLES

Let us now look at the example of a typical patient with derangement (Fig 19:1). He states that he has constant pain, but is better when moving and worse when still. The test movements show increase and peripheralisation of pain on the flexion or protrusion movements, and centralisation of symptoms occurs during retraction and extension. This patient will benefit from the extension principle, and his constant pain should become intermittent with the regular use of extension procedures.

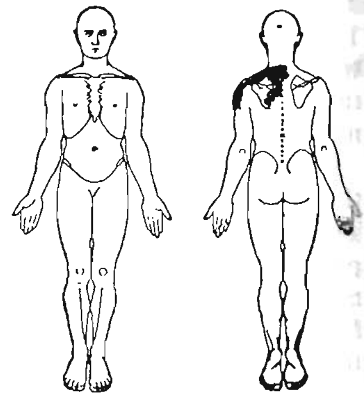
A few more examples will demonstrate the importance of centralisation of symptoms during test movements and treatment of the patient with derangement.

A patient complains of pain extending evenly across the neck and shoulders to about ten centimeters on either side of the midline. This pain has been present for some months and is usually worse when working in flexed positions or sitting prolonged. The test movements reveal that on repeated flexion the pain spreads further across the shoulders, and on repeated extension the pain increases but moves towards the midline. Further extension movements cause a reduction in intensity of that pain. Extension clearly is the movement that reduces the derangement and should be used in the treatment. If extension is continued and performed regularly over the next twenty-four hours, the pain should reduce and be under control within that time period.

A young woman complains of pain across the base of the neck and aching into both scapulae and upper arms. She states that the pain is only in the neck when she is upright and moving, but it moves into the scapulae, shoulders and upper arms when she is sitting watching television or reading and when driving. Sometimes in the night the arm pains become so severe she is forced to get out of bed and walk around. This history should immediately draw our attention to the probability that the protruded head posture (flexion) is

(DERANGEMENT 3)

THE McKENZIE INSTITUTE
CERVICAL SPINE ASSESSMENT



Date 29 JULY 1990
Name MISS ABIGAIL BROWN
Address 17 AURORA TERRACE, WELLINGTON
Telephone 357-246
Date of birth 16 JANUARY 1955 (AGE 35)
Occupation HAIRDRESSER
Postures / stresses STANDING
Doctor McDONALD

HISTORY

NECK PAIN

No Pain — Worst Possible Pain

ARM PAIN

Symptoms now (L) C6/7, MEDIAL SCAPULA, UPPER TRAPEZIUS AND LATERAL ARM PAIN
Present for 7 DAYS
At onset CENTRAL C6/7
Improving / unchanged / worsening
Commenced as a result of

Commenced for no apparent reason ☑
Symptoms constant Intermittent
Worse
sitting prolonged bending turning lying / rising
am / as day progresses / pm stationary / on the move
other
Better
sitting prolonged bending turning lying / rising
am / as day progresses / pm stationary / on the move
other
Disturbed sleep YES Pillows ONE SYNTHETIC
Sleeping postures prone / supine / sidely
Cough / sneeze / swallow +ve / −ve Gait NORMAL
Dizziness / tinnitus / nausea + VE Motion sickness NIL
Previous history RECURRENT EPISODIC (L) UPPER TRAPEZIUS PAIN PAST 5 YEARS. SIX PREVIOUS EPISODES INCREASING IN FREQUENCY AND SEVERITY.
Previous treatment MEDICATION
X-Rays NORMAL
General Health GOOD Weight loss NIL
Meds NIL Steroids NIL
Recent surgery NIL
Accidents NIL

Fig 19:1. *Clinical example of a typical patient with the derangement syndrome.*

EXAMINATION

POSTURE

Posture sitting POOR — Posture standing POOR

Protruded head posture (yes) no — Deformity NIL

MOVEMENT LOSS	maj	mod	min	nil		maj	mod	min	nil
Protrusion		✓			Sidebending (R)		✓		
Flexion		✓			Sidebending (L)	✓			
Retraction		✓			Rotation (R)			✓	
Extension	✓				Rotation (L)		✓		

TEST MOVEMENTS

		Symptoms prior to testing	Symptoms after testing	Pain during motion	End range pain
	PRO	(L) MED SCAP	↑ (L) MED SCAP	✓	
Rep	PRO		PRODUCES (L) TRAP	✓	
	FLEX	(L) MED SCAP + TRAP	↑ (L) TRAP	✓	
Rep	FLEX		PRODUCES (L) LAT ARM	✓	
	RET	(L) LAT ARM	↓ (L) LAT ARM	✓	
Rep	RET		ABOLISHES (L) LAT ARM ↑ TRAP	✓	
	RET EXT	(L) TRAP	↓ TRAP, PRODUCES CENTRAL C6/7	✓	
Rep	RET EXT		ABOLISHES (L) TRAP ↓ CENTRAL C6/7		
	SB (R)				
Rep	SB (R)				
	SB (L)		NOT TESTED		
Rep	SB (L)				
	ROT (R)				
Rep	ROT (R)				
	ROT (L)				
Rep	ROT (L)				

STATIC TESTS PROTRUSION PRODUCES (L) TRAP AND SHOULDER, EXTENSION SUPINE CENTRALISES

NEUROLOGICAL

Muscle strength NORMAL — Reflexes NORMAL

Dural signs - VE — Sensation NORMAL

OTHER

Shoulder girdle NORMAL

Special tests V.B.I. TESTS NEGATIVE

CONCLUSION

Posture — Dysfunction — (Derangement no. 3)

Other

PRINCIPLE OF TREATMENT

(Posture Correction) — (Extension) — Flexion

Other REP. RET. AND EXT 10 X 1 HR OR WHEN PAIN UNCENTRALISED
STOP PRONE SLEEPING

the cause of the pain. The peripheralisation of pain that occurs with sitting and lying indicates the likelihood that flexion is increasing the derangement. On the other hand, centralisation of pain present when she is upright suggests that extension movements are reducing the derangement and therefore extension is the correct principle of treatment for this patient. These possibilities will be confirmed after the application of the test movements.

CHAPTER TWENTY

The Cervical Derangements and their Treatment

In applying mechanical therapy to the spine in the derangement syndrome, there are two objectives. The first objective is to reverse the process of creep and hysteresis that must at some time have preceded the onset of derangement. The second objective is to reverse flow or displacement of fluid, nucleus, or sequestrum within the intervertebral disc and thus reduce the derangement. To achieve these objectives it is necessary to educate the patient and provide a means by which future mechanical deformation and derangement can be avoided. The model of derangement described earlier provides the rationale for adopting this approach. The model provides a logical explanation for the origin and behaviour of the signs and symptoms that occur in non specific disorders of the upper back and neck.

In general, the treatment of a derangement has four stages:

(1) reduction of derangement.
(2) maintenance of reduction.
(3) recovery of function.
(4) prevention of recurrence.

If possible, the first two stages will be achieved during the initial treatment session. The patient will immediately be taught a simple means of self-reduction to apply in the event of recurrence. Correction of sitting and standing posture will also be taught in the first session in order to achieve maintenance of the reduction.

REDUCTION OF DERANGEMENT

The method of treatment is to apply patient generated and then, if found inadequate, therapist generated forces in directions that reduce deformity and centralise pain in order to change all pain patterns to resemble the pattern of Derangement One. (Also QTF classification 1) By centralising referred pain patterns we are altering the QTF patient classification from a more complex to a less complex category. Take for example a patient with pain referred distally and experiencing numbness in the thumb and forefinger (QTF classification 4). If by using repeated movements the referred symptoms are abolished and the patient has pain only about the region of the neck, the QTF classification 1 now applies. The patient has a less complex pathology which is less disabling and threatening.

Successful reduction of derangement will not follow from the application of repeated movements if we fail to achieve the maximum available end range of motion with each applied movement. Reduction in resistant cases occurs only at the point of maximum end range. When reduction is achieved, the patient confirms this by describing that the pain has centralised or ceased as the maximum range is reached.

In attempts to reduce the derangement we should not use more than one new procedure at any one session. When several procedures are applied in one treatment session, it is presumably because the first manoeuvre failed to produce immediate change. When multiple treatment techniques are applied in the same treatment session, to which do we attribute any improvement reported on the following day? Is the improvement a result of something done the day before, or is it due to an exercise performed subsequently many times over a twenty-four hour period?

If a manipulative thrust technique is indicated, one and only one manoeuvre should be applied in any one treatment session. Following the application of a new procedure or a manipulation we must wait, if necessary twenty-four hours, to assess the response of the patient. It is common for repetitive movement to have a gradual but significant effect over a twenty-four hour period.

MAINTENANCE OF REDUCTION

The failure to obtain a lasting reduction in the treatment of derangement is almost always attributable to the therapists failure to educate and provide the patient with the necessary information regarding his position in space when sitting standing and lying.

The successful reduction of posterior derangement by the use of extension exercises is shortlived if the patient subsequently adopts a slouched and flexed posture. It is common for a patient to report shortlived relief from pain immediately following treatment. The reappearance of symptoms after an hour or two can usually be traced to the lack of instruction regarding postural correction. Patients are usually unaware that poor sitting postures can produce pain so readily. Once educated regarding the risks associated with slouched postures most patients comply with postural instruction without question.

It is essential in cervical derangement that from the very first treatment, correction of the sitting posture be achieved. In the early and acute stages of derangement, emphasis is placed on the maintenance of the retracted head posture and this is in turn dependent on obtaining the correct overall posture. Failure in this respect means failure of the overall treatment strategy.

RECOVERY OF FUNCTION

Recovery of function will only be commenced once reduction of derangement has proven to be stable. Stability of the reduction has been achieved when the patient can state that there has been little or no pain for twenty-four hours.

Commencement of the recovery of function can also be considered where it is clear that the patient is managing the problem satisfactorily. Once the patient can control his pain with postural correction and regular practice of the reductive movements it is time to recover function.

Following the successful and stable reduction of posterior derangement it is important to introduce flexion exercises as soon as possible. Poor results often follow when the introduction of flexion exercises is uneccesarily delayed.

One of the more common faults that occur in the use of this treatment protocol is to delay the introduction of the procedures to recover function for fear of exaccerbating the problem. This should not be of concern if the proper testing procedures have been applied and indications for recovery are positive.

PREVENTION OF RECURRENCE

Once the patient has recovered full and painfree movements in all directions, a full prophylactic programme must be offered and we must be sure that the patient fully understands his own potential to treat himself. Whenever engaged in activities that have previously led to the development of pain, the appropriate exercises must be applied. Self treatment is essential in prophylaxis. Prophylaxis is therefore impossible without understanding.

SUBGROUPS IN THE CERVICAL DERANGEMENT SYNDROME

Before commencing treatment proper, it is necessary to identify subgroups that occur in the Cervical Derangement Syndrome. The subgroups arise from the variations that occur in the direction of flow or displacement within the intervertebral disc which in turn causes differing pain patterns from one patient to another. These subgroups also exhibit different behavioural characteristics when subjected to identical mechanical forces. Before commencing treatment it is necessary to identify the subgroups, for this will allow the application of precise mechanical forces in appropriate directions. For instance, patients with anterior derangements require the flexion principle and must be separated from patients with posterior derangements who require the extension principle.

To simplify the classification I have retained the system of pain patterns and numbering used to classify derangements in the lumbar spine and described elsewhere.[100] This enables clinicians of various calling to enjoy at least one area of common ground. The pain patterns one to six are posterior derangements and number seven is the anterior derangement.

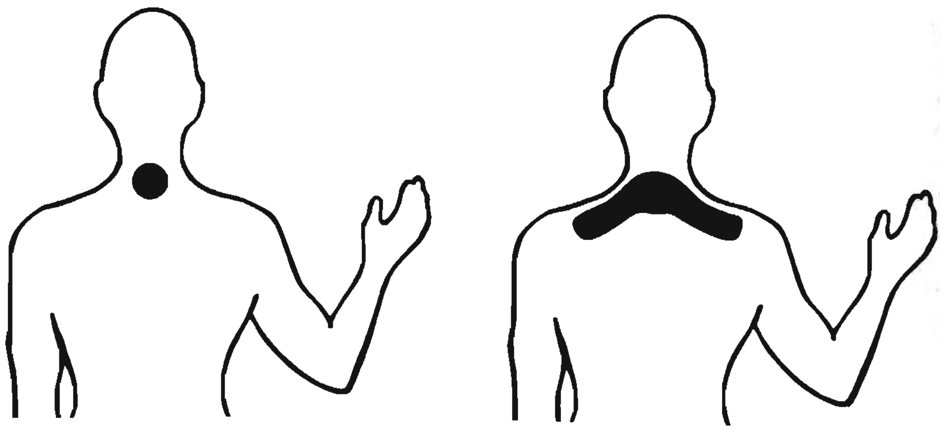
The use of pain patterns to classify non specific spinal disorders has the additional advantage of accord with the recommendations of the QTF.[139] The QTF does not provide a classification for asymmetry of pain patterns, especially those predominantly unilateral. This is important, for when asymmetry of pain exists a change in the direction of applied forces is often necessary before reduction of derangement is achieved.

The QTF does not provide a classification for non specific problems with a component of deformity. For those patients with deformity, it is common for therapist generated forces to be required on the first day of treatment. They must therefore be separately identified in order that appropriate treatment commences on day one.

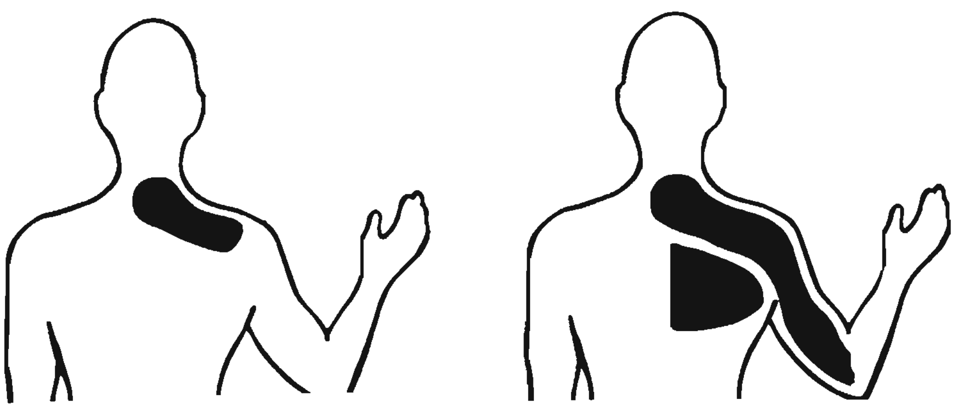
A separate classification for patients with deformity is also required to better understand the close relationship between similar pain patterns on one hand and patients with and without deformity on the other.

It must be appreciated that variations of the derangements are possible and overlap can occur.

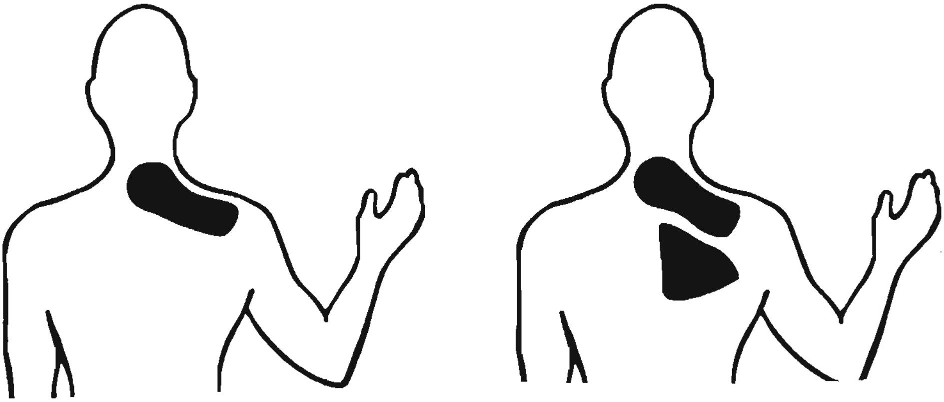
Fig 20:1. *Pain patterns and deformities in derangement subgroups.*



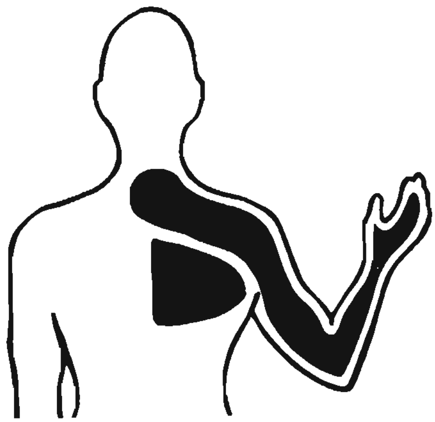
Derangement 1: Pain patterns, no deformity.
Derangement 2: Pain patterns, plus cervical kyphosis.



Derangement 3: Pain patterns, no deformity.



Derangement 4: Pain patterns, plus torticollis/list.



Derangement 5: Pain patterns, no deformity.
Derangement 6: Pain patterns, plus kyphosis/list.

It must be appreciated that variations of the derangements are possible and overlap can occur.

In the derangement model, Derangements One to Six are all progressions of the same disturbance within the intervertebral disc. Commencing with Derangement One, which is the embryonic stage of posterior flow or displacement exhibiting central pain, each successive derangement represents an increase in the degree of displacement or the direction of displacement which in turn causes a progressive peripheralisation of pain with or without the development of deformity. The Derangement Six patient has protrusion, herniation or extrusion of material from the disc. Derangement Seven applies to the less common anterior and antero-lateral flow or displacement, but here also the principal treatment aim is centralisation of pain.

DERANGEMENT ONE (QTF Classification 1)

Central or symmetrical pain about C5/7.
Rarely scapula or shoulder pain.
Extension obstructed.
No deformity.
Rapidly reversible.
Comprises approximately 35% of cervical spectrum.

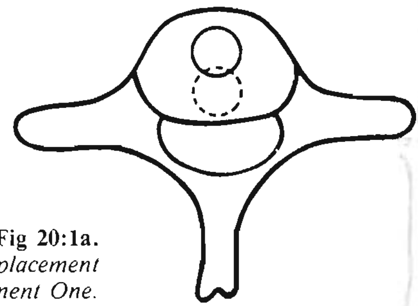


Fig 20:1a.
Diagram of displacement in Derangement One.

In Cervical Derangement One flow or displacement within the intervertebral disc is at a comparatively embryonic stage. (Fig 20:1a) Due to minor posterior flow of fluid or nucleus there is only minor distention of the annulus. This may in turn mechanicaly deform structures posteriorly such as the posterior longitudinal ligament which will give rise to central or symmetrical neck pain. The displacement acts as an obstruction to the performance of extension, the range of which will be limited. The degree of displacement, however, may not yet be sufficient to prevent curve reversal. The posterior flow is not sufficient to force the deformity of kyphosis and most patients are still able to extend the head and neck, but do not have full range.

In patients with Derangement One the history, symptoms and signs will be typical of the syndrome, and the test movements will confirm the diagnosis of derangement. Because displacement within the joint is relatively small it is easily influenced and responds well to the patients' own movements. The majority of patients are able to reduce the derangement themselves by applying self mobilising procedures. It is vitally important that all patients realise and experience the extent to which their own efforts of self treatment contribute to the reduction of Derangement One. *Therefore, it is undesirable to use therapist generated forces in the first twenty four hours of treatment.*

The procedures for reduction (Fig 20:1b)

Because in this derangement displacement is postero-central, symptoms are centrally located and only sagittal extension movements should be required for the reduction. The patient with Derangement One will therefore require the application of the extension principle. If the condition is not too acute, the whole treatment protocol can be administered with the patient in either the sitting or standing position. I prefer to treat the patient in the sitting position. If the patient is apprehensive or the pain too severe however, the procedures can on the first day be carried out in the lying position.

Head retraction, (Proc 1) (Fig 20:1b) should be the first procedure given. Providing the symptoms are reducing or centralising the patient must be instructed to perform the exercise at home or at work five to fifteen times per session. This may be repeated as often as the patient requires but not less frequently than every two hours. In some patients this may be all that is required to abolish the pain and restore full function.

Should head retraction not reduce the patients pain during the early stages of the first treatment session, *the first progression*, retraction and extension sitting (Proc 2) (Fig 20:1b) must be applied. Overpressure by the patient and therapist may be required.

In the event of acute pain or lack of improvement or if the patient is too apprehensive to perform the exercises in the sitting position, it will be necessary to unload the affected structures and carry out the exercises in lying. To achieve this the patient must be given the second progression, retraction and extension in lying (Proc 3), (Fig 20:1b) supine or prone.

If the patient is so acute that the exercises must be done in the lying position, it is unwise to apply additional procedures on the first day.

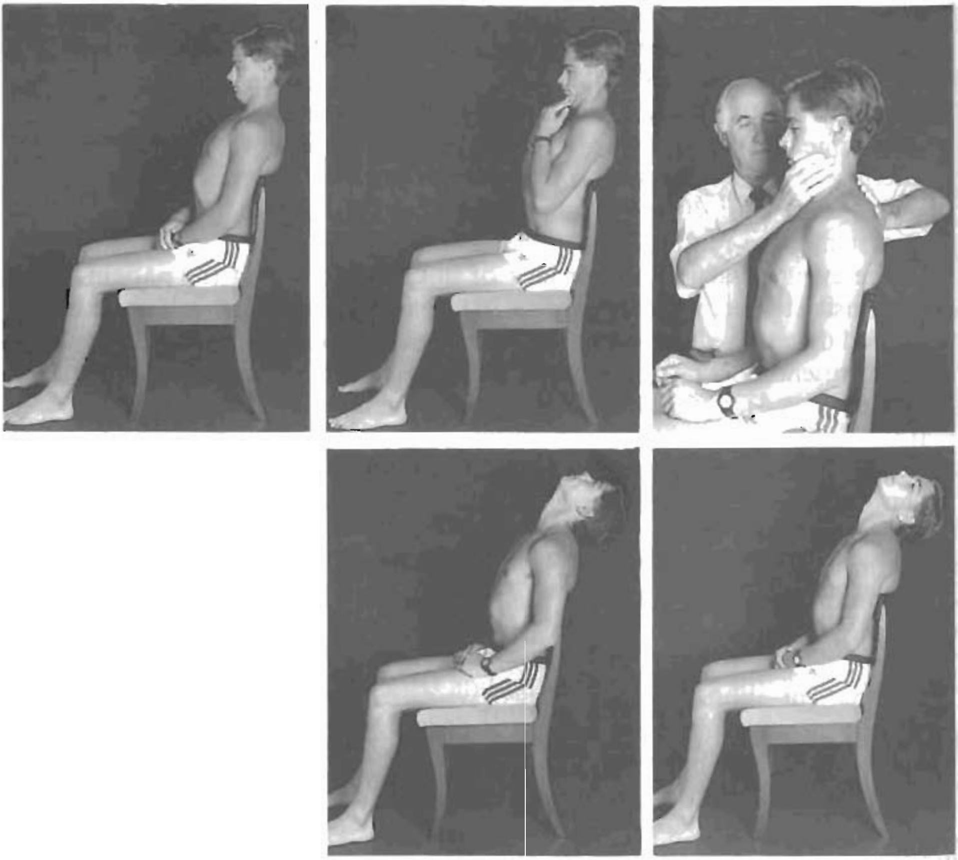
During the treatment session, each group of five to fifteen movements should be repeated as indicated by the response of the patient. Providing the patient's symptoms are progressively reducing or centralising, no limits should be placed on the number of sequences that are performed. It is usual, though, to repeat the groups three or four times with a rest period of about two minutes in between.

The patient should be questioned repeatedly during the application of repetitive movements to ensure that reduction of the derangement is taking place. Providing the intensity of the pain is reducing or the pain is centralising, progressive reduction of the derangement can be assumed.

In some resistant cases the first and second sequence of five to fifteen movements may actually increase the central symptoms significantly as the patient moves to the extreme of extension. The symptoms then return to their former level when the patient returns to the neutral position.

A resistant obstruction may require four or five sequences of repetitive movements before the disorder responds. On completion of four or five sequences the range of extension should have improved and the pain, if previously felt across the neck and shoulders, should be more localised centrally. If before exercising the pain was already felt centrally, it should now be reduced in intensity.

When reduction is almost complete patients often state that the original pain is gone but a strain pain or stiffness is felt instead. This can be achieved even during the first treatment session. No other procedures should be used if retraction and extension in sitting or lying (Proc.1,2 or 3) are sufficient to cause centralisation or reduction in the intensity of the presenting pain. If this occurs we can assume that there is a reduction in the magnitude of the derangement, and steps should now be taken to ensure that the reduction is maintained. Once extension is painless no obstruction can be present and the derangement is therefore reduced.



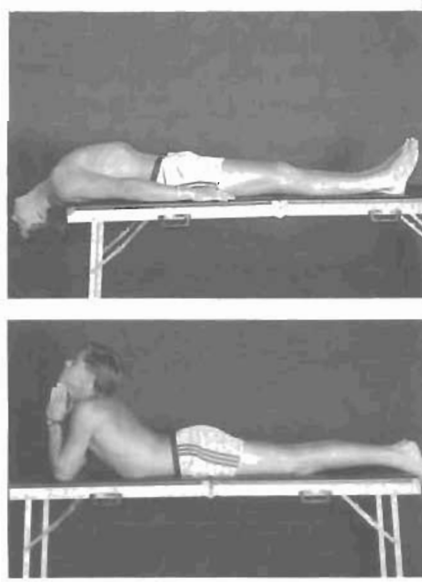


Fig 20:1b. *Showing Proc 1, 2, 3.*
Head retraction.
Retraction with overpressure in sitting.
Retraction with therapist overpressure
Extension in sitting.
Rotation in extension in sitting.
Extension in lying supine.
Extension in lying prone.

Once we have identified the appropriate procedures, the patient should be instructed to continue these at home or at work, five to fifteen times each session, hourly if possible and not less frequently than every two hours.

Maintenance of reduction

Sitting is usually the most troublesome position for all patients with derangement. In order to maintain reduction of posterior derangement in the cervical spine, the patient's lumbar lordosis must be maintained whenever the patient sits. The correction of the lower spinal posture by using a lumbar roll is a fundamental part of correcting the cervical posture when driving the car, or sitting in an office or easy chair. By maintaining the joints in a retracted position while sitting, the flexion and shear forces likely to produce creep and derangement are significantly reduced or eliminated. The patient should be instructed that the protruded head posture must be avoided at all times and any failure to heed this advice will lead to the risk of recurrence.

Although instruction in posture correction is important at this stage, the slouch-overcorrect procedure should not be introduced as yet for it allows the patient to protrude the head during the process. This procedure can be added once reduction of the derangement proves stable and the patient is ready for flexion procedures. In the early stages of treatment of Cervical Derangement the patient is instructed to maintain the lordosis with his own muscular effort or with the use of a lumbar support and at the same time maintain a retracted head posture.

It must be pointed out to all patients that if they are painfree with the head held in a retracted rather than a protruded position, there is no reason why pain should arise providing the retracted posture is maintained. Patients must acquire the simple skills of adjusting posture in all circumstances to prevent the onset of pain. Only the patient can control his own posture.

Besides maintaining the retracted head posture the patient must be instructed to repeat the exercises every waking hour for the next twenty four hours. Hourly repetition of retraction and extension in sitting or lying (Proc. 1,2 or 3) (Fig 20:1b) ensures that no significant flow or displacement develops in the posterior compartment of the intervertebral disc. One sequence of five to fifteen repetitions of these exercises is sufficient and it requires less than one minute to complete this. If circumstances prevent the performance of extension in lying (Proc.3) (Fig 20:1b) it must be replaced if possible by retraction and extension in sitting or standing (Proc.1 or 2). (Fig 20:1b)

If following successful reduction, pain returns or increases to its former level at some time later in the day, it is likely that the patient has permitted some protrusion or flexion of the head and neck to occur. The patient must learn that in this event he must immediately perform one or two sequences of five to fifteen repetitions of retraction and extension in sitting or lying. (Proc.1 and 2 or 3) (Fig 20:1b).

Especially in the first twenty-four hours following reduction of posterior derangement patients are at risk from recurrence. They are especially at risk in the first few hours of the days immediately following the onset of derangement. They must be told of the risks attached to protruded postures during this period of the day.

Patients with acute cervical derangement must be particularly careful when rising from either the lying or sitting position to standing. The cervical and upper thoracic spine momentarily flexes and the head protrudes when initiating either of these changes in position. An extremely protruded posture can be seen in any patient rising from the supine lying to the sitting position, especially at the initiation of the movement. This extreme position must be prevented and requires careful education. Patients must be shown how to maintain the retracted position when rising from lying and sitting, because without help they will not easily master this. From the lying position it is probably best if the patient turns onto the side and retracts as he levers himself upright. Some can learn to hold the retraction with one hand providing overpressure.

If the patient with cervical derangement reports that he is in pain while lying in bed or wakes in the morning with symptoms that were not present the day before, he should be provided with a cervical supportive roll to be placed inside the pillow. This helps to support the mid cervical segments when lying either supine or on the side. Providing the original symptoms reduce or centralise within a few days, the roll can be retained. If no improvement has occurred after four or five days the use of a night roll should be abandoned. New pains may appear with the use of a cervical support but these are usually transitional and pass within a few days. Occasionally patients will report that the use of a cervical roll has caused the symptoms to disappear on the side affected and they are now in the same location on the other side. The patient will almost certainly be one who sleeps on either side with the head protruded. The problem will disappear on complete reduction of the derangement.

The second treatment should be given twenty-four hours after the first session. Only after this time is it possible to confirm that the correct conclusions regarding diagnosis and principle of treatment have been made. If on returning the patient reports improvement, we must determine precisely the nature of the improvement. Improvement can be measured as follows:

The pain can cease.
The pain can centralise.
The pain can reduce in intensity.
Constant pain can become intermittent.
Intermittent pain can become less frequent.
The same pain may occur but the range of motion increases.

The nature of the change should be recorded and a new pain drawing and pain intensity scale completed.

Examination of the range of extension should show an increase and we can objectively confirm the patients improvement. Our diagnosis is confirmed and we should continue with extension principle procedures. It is a basic rule of treatment, applicable to all syndromes, that applied procedures presently resulting in improvement should not be added to, modified or replaced in any way until all improvement ceases. Thus, the same procedures can be continued safely over a number of days, provided the symptoms continue to improve.

If the patient no longer has constant pain, the frequency of the exercises may be reduced to every two hours and in addition exercises should be performed at the first signs of recurring symptoms. If pain arises intermittently when sitting or lying, it is almost certainly caused by loss of the correct posture and the importance of maintaining correction must be emphasised once more.

At this stage, in order to correct the patient's posture, the introduction of the slouch-overcorrect procedure may be appropriate. If applied carefully the patient will soon appreciate that the protruded head posture will produce the symptoms, whereas correct sitting abolishes them. (Fig 20:1c)

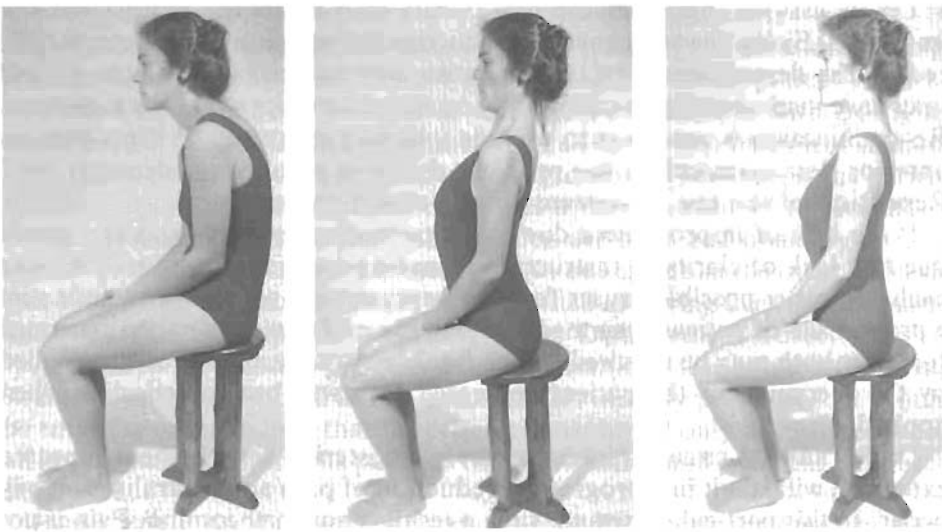


Fig 20:1c. *Slouch-overcorrect-correct procedure.*

As further improvement becomes apparent, routine retraction and extension (Proc 2) (Fig 20:1b) may be reduced to four or five sessions per day, but in addition should be performed at any time of the day should the need arise.

We must warn the patient that after having started the treatment programme he is likely to experience "new pains". These may be felt lower, between the shoulder blades, and possibly in the lower thoracic region. The new pains are different from the original pain for which treatment was sought, and are the result of adjustment by the body to new positions and movements. New pains should be expected and will wear off in a few days to a week, provided the exercises are continued.

All patients should be instructed that, if they have severe pain which worsens or peripheralises at the time of exercising, they should stop the exercises and report if necessary by telephone for further advice. We must make sure it is well understood that, to be guilty of aggravation of symptoms, the exercises must actually increase the pain *at the time of performance* and not two hours afterwards. Pain felt immediately after exercising can be a result of the exercise. Pain appearing two hours afterwards is commonly felt because of the position occupied at that time—for example, sitting slouched while watching television.

No response or benefit

I have outlined this far the routine that should apply in most Derangement One patients and which should result in the rapid and uneventful resolution of the symptoms. However symptoms and signs do not always respond as we would wish. Where reduction of posterior derangement proves difficult it will be necessary to apply additional forces in order to achieve reduction.

Let us assume that after the first twenty-four hours the patient has not improved. Either the self generated reductive forces are not adequate to fully reduce the derangement, or our diagnosis may be incorrect, or the patient may have inadvertently or unwittingly caused recurrence of the derangement. Re-examination is necessary to exclude incorrect diagnosis. Is it possibly an anterior derangement? Is the problem dysfunction and not derangement? Repetition of the test movement should clarify the situation.

Is the lack of improvement due to the patient's misunderstanding, or is it due to a lack of clarity in instruction regarding exercise or posture? Having excluded other possible causes for non improvement we must conclude that a progression of patient generated forces or the addition of therapist generated force, or both may be required. Often it takes but little extra pressure applied by the therapist for the patient generated forces to become effective when applied alone.

Under normal circumstances in cervical posterior derangement repeated extension will result in a progressive reduction of pain and centralisation will occur. In this particular instance such a result is not forthcoming. Pain is not continuing to reduce and is still present after repeated movements in extension.

If the patient has performed retraction and extension in either sitting or lying, (Proc 1,2 or 3) (Fig 20:1b) at home or at work over the previous twenty four hours with no improvement *the third progression*, extension with traction and rotation in lying (Proc 4) (Fig 20:1d) should be made. Providing the symptoms are reducing or centralising the number of times this procedure can be given is determined by the patient's tolerance to applied forces.

If no immediate improvement results from the application of extension with traction and rotation in lying (Proc 4), extension mobilisation (Proc 5) (Fig 20:1d) should be commenced.

Because these procedures involve the use of therapist generated force, their application must be delivered with caution and the therapist should be familiar with the precautions described in Chapter 17 Cervical Headache, Testing for Basilar Artery Insufficiency.

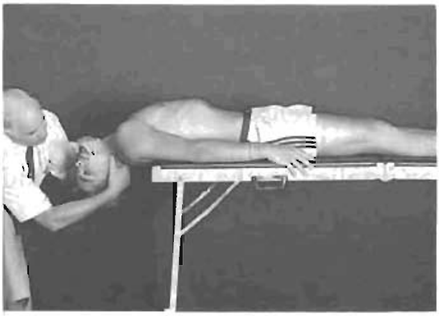


Fig 20:1d. *Showing Proc 4, 5.*
Extension with traction and rotation in lying.
Extension mobilisation.

Following the application of extension with traction and rotation in lying, and extension mobilisation (Proc 4 and 5) (Fig 20:1d) the patient must be instructed to continue at home or at work with extension in sitting or lying (Proc 2 and 3) (Fig 20:1b) as recommended during the first treatment session.

Very few patients will require further progressions. However, if the patient fails to respond to the first five Procedures a reassessment of the condition should be made to ensure that pain patterns are clear and unambiguous. Is there the possibility that there is more pain to one side than the other? Should that be the case the patient should be reclassified as having derangement three and the treatment adjusted accordingly (See Derangement Three).

After each progression the patient should continue through the following twenty-four hours with all advice and exercises initially prescribed. It should be emphasised again here that the progressions should only be initiated when all improvement utilising the patient's own movements and positions have been exhausted.

It can safely be assumed that reduction of Derangement One has been accomplished when full maximum extension in lying is painless even though the patient may describe a "strain pain" in this position. It is my experience that patients are well able to differentiate the "strain pain" from the pain that caused consultation. It is always necessary to ask them to make the differentiation, for when asked, "In maximum extension do you have pain?", the answer is invariably "yes" indicating to the unwary that the derangement is not reduced. However if you further ask, "Is it pain, or strain?" the answer is often "strain". A very subjective line of questioning, I know. But this is very important, as I have seen therapists abandon the extension principle of treatment merely because the patient described a pain at the extreme of extension that occurs commonly as end range strain in any normal joint.

Reduction of Derangement One can be assumed to be complete when the patient is experiencing no pain and extension is full range and painless. Once the obstruction is removed by reductive procedures, movement will no longer be impeded and the patient will experience no pain. However, should the patient still experience pain when the head is protruded or when the neck is flexed, the impression can be gained that the derangement may still exist. Posterior derangement and obstruction to movement cannot exist when extension is full and free and painless. The pain the patient is now describing appears only when the spine is flexed. In flexion, tension is applied to the recently injured structure and is productive of pain. Under these circumstances, the pain felt by the patient is from tension applied to the repair itself and is not a sign of recurring displacement.

If left untreated these pains can persist for years and cause end range pain whenever the patient moves to the extreme of flexion.

Recovery of function

The structures damaged during the process of posterior derangement all resist flexion. Once the repair has developed, the scar itself becomes involved in the resistance to flexion as the collagen fibres cross link and contract. Both flexion of the neck and head protrusion become progressively restricted as this process develops. In order to prevent contraction of the scar in those patients with recent injury it is necessary to apply flexion procedures as early in the course of recovery as the repair will permit. Function must always be restored following posterior derangement.

It is important that we recognise the signs that indicate when it is appropriate to apply the procedures that will enhance the quality of the developing collagen. By applying the appropriate stress, we can influence the direction in which the newly formed collagen fibres will lie, and at the same time reduce to a minimum the possibility of cross linkage of those fibres. This is the best method of enhancing the strength and quality of the new tissue. At the same time we ensure that the scar that forms is an extensible scar and will not interfere with the mobility of the adjacent healthy structures.

Some patients have no residual loss of movement following derangement. In this case the patient will have full range of motion and the motion itself will be painless. If so, it is unecessary to procede with flexion exercises.

To ensure that flexion may commence without the risk of creating further damage or derangement, reassessment of the test movement of flexion in sitting should be carried out. It is unlikely that in the early stages following reduction of derangement contracture of the repair has already occurred, but the possibility should be borne in mind.

Testing prior to recovery of function

1. If flexion becomes progressively more painful with repetition the manouvre should be abandoned as the continuation will either produce a recurrence of the derangement or disrupt the repair itself.
2. If on completion of the testing in flexion the patients pain remains worse as a result, the recovery of flexion should be delayed, and the test applied after six or seven days.

3. If flexion causes pain as the patient moves and well before the end of range is achieved, the derangement is not completely reduced. It is too soon to consider the application of flexion procedures.
4. If flexion becomes less painful with repetition it is likely that the collagen repair is not yet dense or contracted but is sufficiently plastic to adapt to the applied forces without damage. Flexion procedures may now be applied safely with the necessary precautions.
5. If flexion causes pain at the end range which does not progressively worsen with repetition, it is safe to commence the recovery of flexion.

Because there is a risk attached to the performance of flexion exercises following recent posterior derangement, care should be taken and some precautions exercised. The patient must be adequately informed regarding the process of repair, the need to restore elasticity to the damaged structures, and the methods by which he may safely assist in the restoration of that mobility.

If it is found that the recovery of function may be safely introduced the patient must commence with flexion in sitting. (Proc. 10) (Fig 20:1e). When starting flexion in sitting (Proc.10) (Fig 20:1e) the patient should reduce the usual number of exercises performed at each session, as well as the frequency of the sessions per day. For example, five or six repetitions of the exercise should be completed two or three times per day. Once the condition proves stable, the patient may gradually work towards a full programme of five to fifteen repetitions performed every two hours.

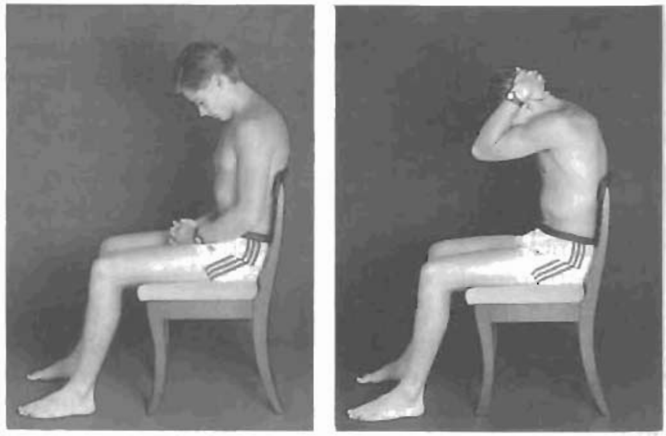
Flexion in sitting (Proc.10) (Fig 20:1e) must always be followed by retraction and extension in sitting. (Proc 2) (Fig 20:1e) to ensure that any flow or displacement that may have been initiated by the application of flexion forces is reversed, thereby removing the risk of recurrence of the derangement.

For the first four or five days after the introduction of flexion, no overpressure should be applied either by the patient or the therapist.

If after four or five days improvement in the flexion range ceases, and there still remains some limitation of movement with pain at end range, the patient should add overpressure to flexion in sitting. (Proc 10). (Fig 20:1e) If after a week or ten days the patient still has restricted and painful limitation of flexion, flexion mobilisation (Proc 11) (Fig 20:1e) should be applied. When full painfree flexion is recovered, the exercises may be reduced to one session of five or six movements per day.

Flexion procedures (Proc.10) (Fig 20:1e) with or without overpressure should not be done during the first few hours of the day. In this time period the risk of incurring derangement is increased due to the nocturnal increase in the fluid volume within the intervertebral disc.[3] This has been discussed previously. (Chapter 11).

Recovery of flexion is considered to be complete when, on performance of flexion in sitting, full range of movement is achieved without pain, athough a strain may be felt.



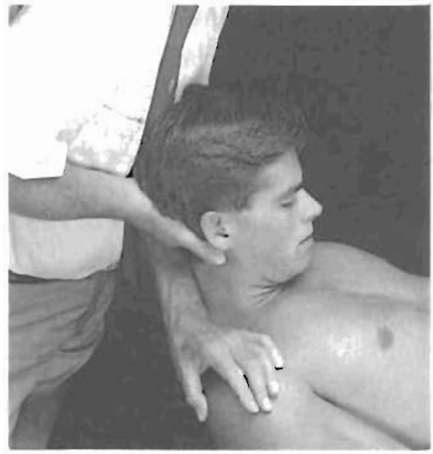
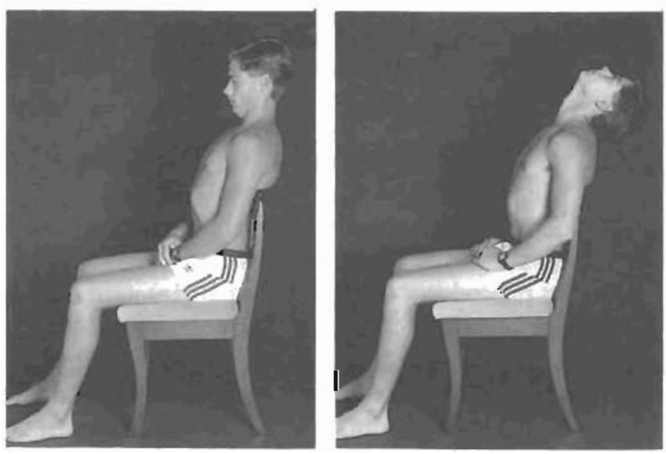


Fig 20:1e. *Showing Proc 10, 11, 2.*
Flexion in sitting.
Flexion with overpressure in sitting.
Flexion mobilisation.
Retraction and extension in sitting.



Prevention of recurrence

Once recovery of function is achieved, the patient is advised to continue for up to three months, possibly longer, with extension in sitting (Proc 2) (Fig 20:1e) twice per day—in the morning and evening. Flexion in sitting, (Proc 10) (Fig 20:1e) should be continued for a similar period to retain the flexibility, but only five or six movements need be repeated once per day. The most important preventative measure for the patient to remember is to apply reductive extension pressures (Proc 2) (Fig 20:1e) frequently during the day prior to the onset of pain to prevent displacement of fluid or gel. The correct sitting posture must of course be maintained when sitting for prolonged periods. (Fig 20:1c)

Very few patients require to reduce or discontinue activities following resolution of derangement of either the cervical or lumbar spine. We must explain that patients may resume all the usual activities such as sports, gardening, concreting, activities involving lifting, provided the advice and instructions given to prevent recurrence of derangement are carried out.

The failure to prevent recurrence is often the result of *our failure* to restore full function following derangement or trauma; *our failure* to ensure the patient has adequate knowledge and full understanding of the prophylactic measures; and, not less often, *the patient's failure* to adhere to the prophylactic measures and apply self treatment procedures when these are called for.

TYPICAL TREATMENT PROGRESSION—DERANGEMENT ONE

The days referred to in the treatment progression are related to treatment sessions which in the first week of treatment should take place on consecutive days.

Day one

- Assessment and conclusion/provisional diagnosis.
- Explanation of cause of derangement and treatment approach.
- Reduction of derangement: commence with retraction, extension in sitting, extension in lying.
- Instruct to maintain retracted head posture at all times.
- Must sit with lordosis and insert lumbar support.
- May benefit from supportive cervical roll in pillow.
- Repeat extension procedures each hour to maintain reduction and prevent recurrence.
- On first signs of recurrence of symptoms watch maintenance of retracted head posture. Immediately perform extension in sitting or lying.

Day two

- Confirm diagnosis.
- Check sitting posture and exercises.
- If improving, make no changes other than a gradual reduction in the number and the freqency of exercises — reduce extension in sitting or lying to once every two hours.
- Repeat postural correction and advice.
- Replace extension in lying with extension in sitting when possible.
- Warn for "new pains".
- If no improvement at all, check that exercises are performed far enough into extension, often enough during the day, and that the retracted head posture is well kept. Add the third progression, extension with traction and rotation in lying immediately.
- Continue with extension in lying every two hours.

Day three

- Check sitting posture and exercises.
- If improving, continue with procedures as directed.
- Once constant pain has changed to intermittent pain, stop extension in lying if possible and replace with extension in sitting or standing; start the slouch-overcorrect exercise.
- If no improvement, repeat extension with traction and rotation in lying.
- Reclassify to another category if error has been made or condition changed.

Day four

- Check exercises and progress.
- If progress is satisfactory, reduce treatment to three times per week.
- Continue with same programme until pain free for twenty four to forty eight hours.
- If progress is unsatisfactory, repeat extension with traction and rotation in lying, and add extension mobilisation.
- If no further improvement and predominantly unilateral symptoms, reclassify to Derangement Three and add recommended progressions if found necessary.

Day five to seven

- Check exercises and progress.
- Once pain free for twenty four to forty eight hours reduce extension in sitting or lying to three times per day and whenever necessary during the day.
- Commence flexion in sitting; take all necessary precautions.
- Flexion in sitting must be followed by extension in sitting.

Further treatments

- I prefer to see patients with derangement every day until the the reduction is stable and patients are well in control of the disorder. This may take up to five days. Then the treatment may be reduced to alternate days.
- Once reduction of derangement proves stable and the patient has good control, flexion exercises may be introduced to recover function.
- All flexion exercises must be followed by extension in sitting or lying; if this is not possible extension in standing is a suitable substitute.
- When no further flexion can be gained with flexion in sitting with overpressure, the therapist should add flexion mobilisation.
- When function is recovered flexion procedures can be reduced to one session of five or six movements per day.
- The patient is advised to continue with the exercises for up to ten weeks to prevent recurrence: he will do retraction/extension in the morning; flexion followed by retraction/extension in the evening; retraction/extension whenever necessary during the day; and the slouch-overcorrect exercise whenever becoming negligent regarding sitting.
- Before discharge prophylaxis and self treatment must be discussed in detail. We must emphasise that self treatment is infinitely preferable to dependence on therapy.

DERANGEMENT TWO (QTF Classification 2)

Central or symmetrical pain about C5/7.
With or without scapula, shoulder or upper arm pain.
Deformity of kyphosis.
Extension obstructed.
Rarely rapidly reversible.
Comprises approximately 3% of cervical spectrum.

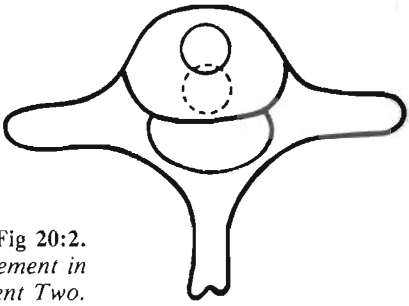


Fig 20:2.
Diagram of displacement in Derangement Two.

In Cervical Derangement Two posterior flow or displacement within the disc is significant. (Fig 20:2) The derangement is such that approximation of the posterior vertebral rims is prevented by the sheer bulk of the displaced material which forces flexion at the affected level. The patient is forced to hold the neck in a flexed position and it becomes impossible to move against the obstruction. Any attempt to extend the neck compresses the displaced material resulting in further distention of the adjacent soft tissues which in turn gives rise to severe pain. The patient often complains of twinges of severe pain and any movement performed in the direction of the obstruction is avoided.

The derangement may often be a progression of Derangement One, for the patient may describe the presence of pain long before the appearance of the deformity. Patients with Derangement Two are often aged in the forties and the obstruction to movement appears to be "hard" in contrast to the obstruction that occurs in younger patients. It may well be that the displaced material is, as Cyriax hypothesised, fibrous annulus. There is complete obstruction to curve reversal.

Due to the angle of flexion forced upon the patient, movements of extension which could assist in the reductive process are prevented. Hence without help the patients suffering can be prolonged. It is frequently the case that the posture is maintained for weeks and months after which time reversal is impossible. The symptoms are usually located symmetrically about the neck and shoulders and in some the pain can be felt into both upper arms.

The history, symptoms and signs will be typical of the syndrome. The very appearance of the patient on arrival for treatment is indicative of the underlying problem. It will be extremely difficult to perform a full range of test movements on a patient with derangement two and slow and gentle positioning must suffice to determine the postures that must be adopted and the movements that must be encouraged.

If the patient developed the symptoms as a result of trauma such as from a fall or a motor vehicle accident, no therapist generated forces should be applied and only preliminary patient generated forces given until the fragility of the disorder has been established. Injudicious handling of Derangement Two can cause exaccerbation of the complaint or worse, the development of peripheral symptoms of brachialgia. (Derangement Six)

Derangement Two is not easily influenced and does not always respond well to patient-generated forces. A few patients only are able to reduce the derangement using self mobilising procedures. Nevertheless, all of the procedures applicable to Derangement One should be given prior to the application of therapist generated force. It is desirable for the patient to continue with reductive pressures at home or at work after the initial treatment and these should be given where possible both before and after the reductive attempts by the therapist.

The therapist will gain considerable information about the nature of the obstruction, and whether it is plastic or rigid in nature if the patient can be pursuaded to attempt some repeated movements prior to the application of therapist techniques. It is sometimes possible to gain an impression regarding the reversability or otherwise of the derangement. This is important in the development of the overall treatment strategy for such a problem.

Unlike many of the other derangements, Derangement Two is rarely reversible in the first treatment session. It is more often the case that two or three weeks and longer are required to restore full extension. In some patients, recovery of movement is minimal even after three months. In these cases adaptive changes and regular exercise may reduce the pain and provide some improvement in mobility, but some degree of impairment is probably permanent. The patient will eventually develop significant dysfunction.

It is often necessary for the therapist to apply external forces for the treatment of Derangement Two in the latter stages of the first treatment session. This is to ensure that as much as possible is done to achieve even a partial although temporary reduction. Some patients will report the following day that they were significantly improved for some time following treatment.

The procedures for reduction

Because in this derangement displacement is postero-central, the symptoms will most often be centrally located. The patient with Derangement Two will therefore require the application of the extension principle. Only sagittal extension movements should be required for the reduction.

As the condition is always acute, the whole treatment protocol should initially be applied in the supine lying position.

Retraction in lying, (Proc 3) (Fig 20:2a) should be repeated five to fifteen times as tolerance permits. At first it may be necessary to provide the patient with two or even three small pillows under the head to maintain some degree of flexion. This is necessary for if the movement towards extension is too great, the patient will be unable to tolerate the position let alone the exercise. The number of pillows may be reduced slowly during the treatment session providing the range of motion towards extension increases and the pain is reducing or centralising. This allows the head and neck to move further towards a neutral position.

It is possible that continuation of the same approach at home or at work will produce further improvement over a twenty four hour period. The patient must be shown how to position the pillows and repeat the procedure every two hours, more frequently if possible. Providing the symptoms are reducing or centralising, retraction and extension in lying, (Proc 3) (Fig 20:2a) may be introduced carefully on the following day.

If the patient is having great difficulty with retraction in the supine position, even with the support of the pillows, it may be necessary for the therapist at this point to apply extension with traction and rotation in lying (Proc 4). (Fig 20:2a).

Initially the patient may not tolerate this procedure in anything other than a flexed or slightly flexed posture. The addition of traction can make the manoeuvre almost totally painless *as long as traction is maintained.* While traction is being maintained, the patient's head and neck are drawn repeatedly towards retraction and extension.

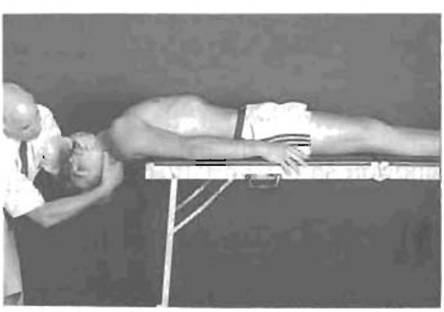


Fig 20:2a. *Showing Proc 3, 4, 1.*
Head retraction in lying.
Extension in lying supine.
Extension with traction and rotation in lying.
Retraction in sitting.

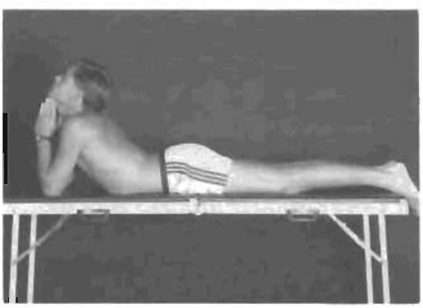
The cycle of traction may be repeated four or five times or as permitted by the patients tolerance. Four or five sequences are as much as can be expected in any one session.

At the end of the first treatment session the patient may have regained sufficient mobility to apply retraction in sitting. (Proc 1) (Fig 20:2a) This is important, for during the day the patient with Derangement Two has a constant battle to remain upright. Unless he has acquired some knowledge of the importance of posture correction and has received instruction in the means to maintain the desired posture, the problem becomes progressively worse towards the end of the day.

The patient should return the following day and providing no adverse effects have been experienced, the cycle should be repeated as for the previous day. In addition the patient must attempt extension in lying prone. (Proc 3) (Fig 20:2b) Performing the exercise in the prone position can make a difference to the patient's confidence. The patient has more control and feels less disoriented than when lying supine. If found to be tolerable, this procedure should replace extension in lying supine and must be practised during the day every two hours.

The treatment routine described above should be repeated on a daily basis providing the symptoms are reducing or centralising. As improvement continues the treatment should become more vigorous and follow that recommended for Derangement One.

For those patients who have not improved after two weeks of treatment using the protocol recommended so far, traction in flexion (Proc 12) (Fig 20:2b) must be applied. This must be followed immediately by extension with traction and rotation in lying (Proc 4). (Fig 20:2a) If this order in the application of traction is followed, some resistant derangements become responsive to the extension procedures.



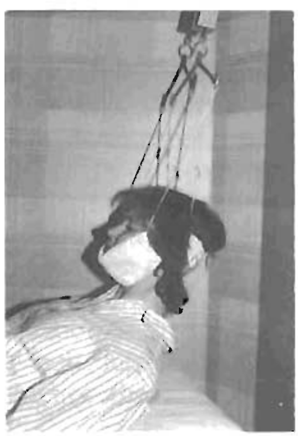


Fig 20:2b. *Showing Proc 3, 12. Extension in lying prone. Cervical traction in flexion.*

For those patients with Derangement Two who are totally unresponsive to mechanical therapy, it is difficult to estimate the time it may take to spontaneously recover.

The time for eventual recovery will certainly be measured in months and the disorder probably slowly develops into a dysfunction.

Measures and procedures used for the recovery of function and prevention of recurrence are the same as described under Derangement One.

DERANGEMENT THREE (QTF Classification 2)

Unilateral or asymmetrical pain about C3-7.
With or without scapula, shoulder or upper arm pain.
No deformity.
Extension, rotation and lateral flexion may be individually or collectively obstructed.
Rapidly reversible.
Comprises approximately 39% of cervical spectrum.

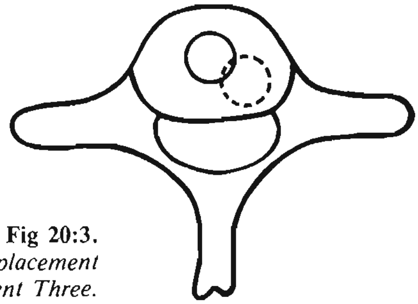


Fig 20:3.
Diagram of displacement in Derangement Three.

In Cervical Derangement Three the flow or displacement within the disc is located more postero-laterally rather than postero-centrally as is the case in Derangement One. The displacement may be a progression of Derangement One, but some patients report that the pain appeared off centre from the onset and that they have never experienced central pain. In those cases it may be that the primary site of the lesion lies postero-laterally. When the pain is stated to have commenced postero-laterally, full mid line centralisation is not always achieved during the reductive process.

The procedures for reduction

In this derangement the displacement is postero-lateral and the symptoms are unilateral or asymmetrically located. That is, sometimes the symptoms may be bilateral but are much more predominant on one side than the other. Very often the application of the extension principle for Derangement Three reduces the disturbance to Derangement One within twenty-four hours. Somewhere between 55% and 65% of Derangement Three patients will require only sagittal extension to achieve complete reduction of the problem.

Sagittal extension compresses the posterior compartment of the intervertebral disc. In the event that reduction is slow, incomplete or the patient ceases to improve with sagittal movements, it may be necessary to apply procedures in other planes in order to achieve reduction. The patient with Derangement Three will therefore require the application of the extension principle initially, and if this fails to produce improvement, lateral flexion or rotational forces should be added in order to influence the lateral compartment of the intervertebral disc.

Throughout the treatment protocol and the application of all the recommended progressions, education in postural correction and the maintenance of correct posture will be of paramount importance.

The initial treatment should be the same as for Derangement One and the protocol outlined can be followed precisely for the following twenty four hours. Every hour, or more often if required, the patient should apply retraction in sitting, (Proc 1) (Fig 20:3a), retraction with overpressure in sitting, (Proc 2) (Fig 20:3a), and rotation in extension in sitting, (Proc 3) (Fig 20:3a). The following day it should be apparent whether the sagittal procedures for reduction of Derangement One can successfully be applied to Derangement Three.

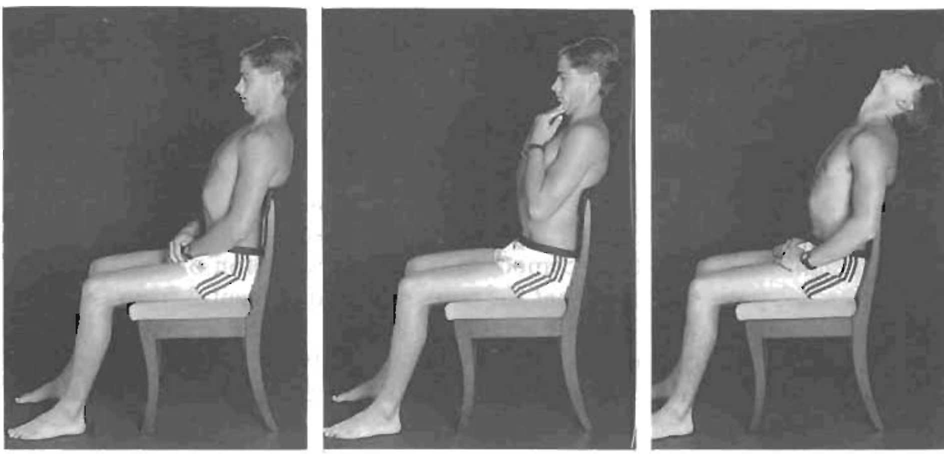


Fig 20:3a. *Showing Proc 1,2,3.*
Retraction in sitting.
Retraction with overpressure in sitting.
Extension in sitting.
Rotation in extension in sitting.

If on the second visit the patient is improving and the unilateral pain is reducing, centralising or has moved evenly across the neck, self reduction is progressing and the extension principle as laid out for Derangement One may be continued.

, Should the patient show no improvement on the second visit, re-examination and or re-instruction may be necessary; or, as was the case in the reduction of Derangement One it may be necessary to increase the applied forces. Should the reductive pressures prove inadequate, it will again be necessary to progressively increase these and additionally, alter the direction in which they are applied.

The first progression in Derangement Three should be retraction with therapist overpressure in sitting. (Proc 2) (Fig 20:3b). This is followed immediately with extension with traction and rotation in lying. (Proc 4) (Fig 20:3b)

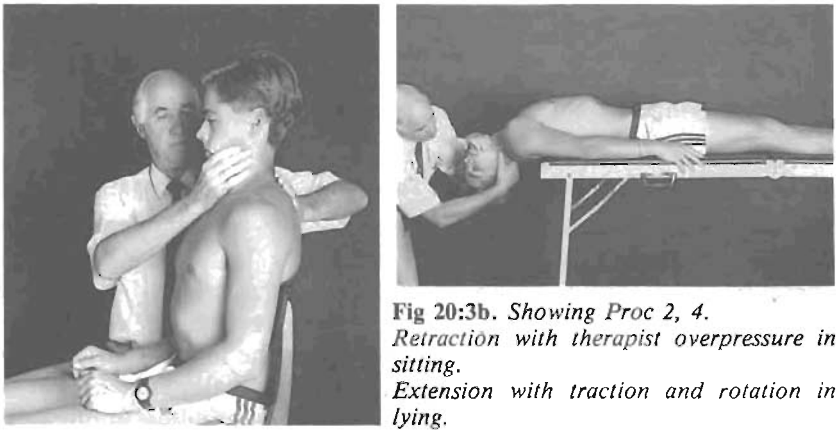


Fig 20:3b. *Showing Proc 2, 4.*
Retraction with therapist overpressure in sitting.
Extension with traction and rotation in lying.

After the application of extension with traction and rotation in lying (Proc 4), (Fig 20:3b) the reductive process, hitherto resistant to self treatment procedures, may now yield. Previously ineffectual patient generated forces may now become effective. If these procedures now reduce or centralise the pain, it is uneccesary to add further progressions and the patient must be instructed to continue with Procedures 1, 2, and 3, every two hours during the day, for a further twenty four hours. No other progressions should be made at the second treatment session until the patient has had a further twenty-four hours to apply self reductive forces.

In the event that no improvement results following the application of extension with traction and rotation in lying (Proc 4) (Fig 20:3b) it will be necessary to apply the second progression, extension mobilisation (Proc 5), (Fig 20:3c) in the same treatment session.

If this procedure reduces or centralises the pain, every two hours or more often if required, the patient should continue to apply retraction in sitting, (Proc 1) (Fig 20:3a), retraction with overpressure in sitting, (Proc 2) (Fig 20:3a), and retraction and extension in sitting, (Proc 3) (Fig 20:3a).

Fig 20:3c. *Showing Proc 5. Extension mobilisation.*

If no improvement or centralisation of pain occurs following extension mobilisation, (Proc 5), movements designed to apply compressive forces to the lateral compartment of the intervertebral disc may be applied in the same treatment session.

It will be understood that, once full centralisation is obtained, treatment should be continued and progressed exactly as described for Derangement One.

If the symptoms arise from the lower cervical segments:

The patient should apply the third progression, lateral flexion in sitting, (Proc 6) (Fig 20:3d) with overpressure if required. If no improvement results, the therapist should immediately apply lateral flexion mobilisation (Proc 7) (Fig 20:3d). The direction in which these manoeuvres shall be applied is of course guided by the centralisation or reduction in the intensity of the pain. In the case of symptoms arising from the lower cervical spine, lateral flexion will usually cause centralisation or reduction of pain when applied towards the side of pain.

If these procedures reduce or centralise the pain, the patient should continue to apply lateral flexion sitting, (Proc 6) (Fig 20:3d) with overpressure, every two hours or more often if required.

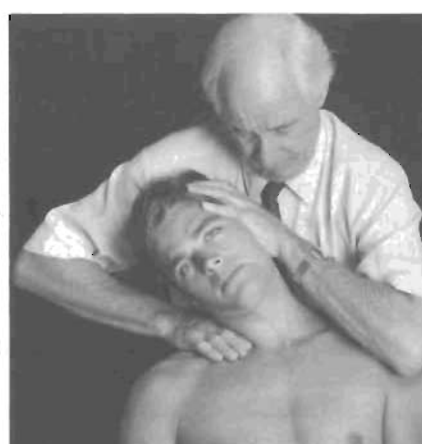


Fig 20:3d. *Showing Proc 6,7.*
Lateral flexion with overpressure in sitting.
Lateral flexion mobilisation in sitting.

If the symptoms originate in the mid or upper cervical segments:

The patient should apply the third progression, rotation in sitting, (Proc 8) (Fig 20:3e) with overpressure if required. If no improvement results, the therapist should immediately apply rotation mobilisation (Proc 9) (Fig 20:3e). The direction in which these manoevres shall be applied is of course guided by the centralisation or reduction in the intensity of the pain.

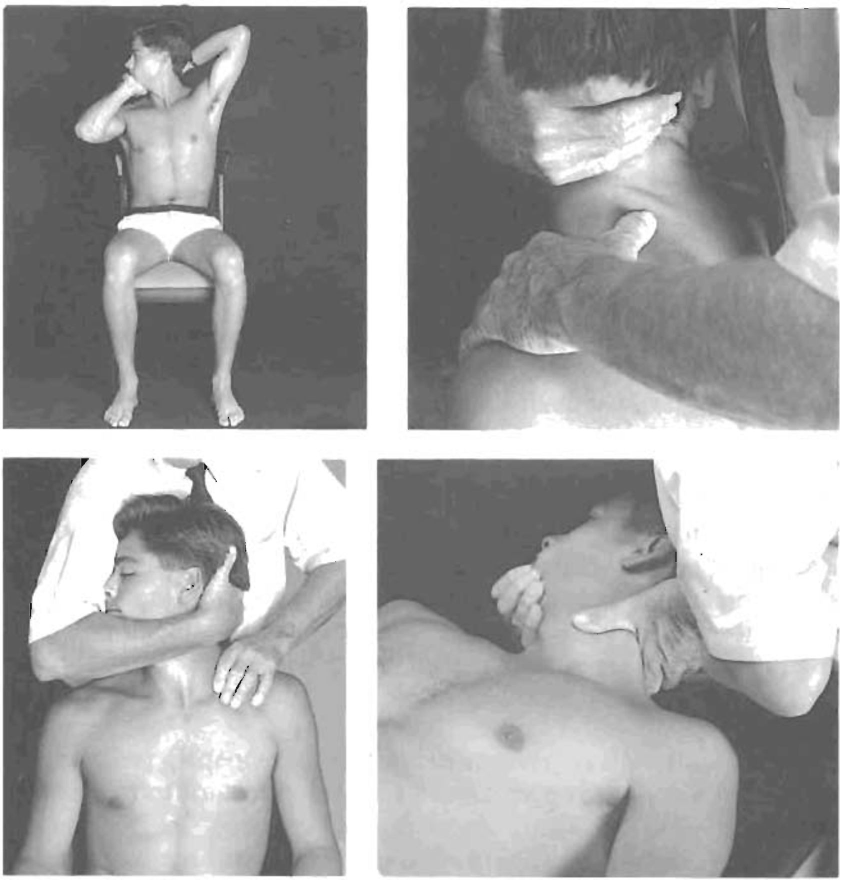


Fig 20:3e. *Showing Proc 8,9.*
Rotation with overpressure in sitting.
Rotation mobilisation in sitting or lying.

If these procedures reduce or centralise the pain, the patient should continue to apply rotation in sitting with overpressure, (Proc 8) (Fig 20:3e) every two hours or more often if required.

It is my practice to repeat mobilisation on two to four occasions and if after that time no improvement is obtained it will be necessary to apply the fourth progression, lateral flexion manipulation (Proc 7) for the lower cervical segments or rotation manipulation, (Proc 9) for the segments C3/4, 4/5.

Measures and procedures used for the recovery of function and prevention of recurrence are the same as described under Derangement One.

DERANGEMENT FOUR (QTF Classification 1)

Unilateral or asymmetrical pain about C5-6-7.
With or without scapula, shoulder or upper arm pain.
With deformity of acute wry neck or torticollis.
With obstruction of lateral flexion, rotation and extension.
Rapidly reversible.
Comprises approximately 2% of cervical spectrum.

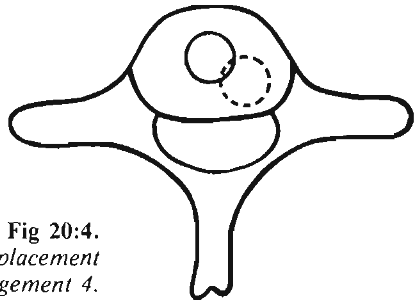


Fig 20:4.
Diagram of displacement in derangement 4.

This acute disorder, most often affecting the younger age groups from ten to twenty years, is analagous to the acute list or lateral shift occurring in the lumbar spine. The patient with this derangement is fixed in lateral flexion and flexion and cannot laterally flex, rotate, or extend normally. There is usually significant obstruction to curve reversal.

The derangement normally recovers spontaneously in three to four days in about ninety percent of cases. Providing the pain and range of movement steadily improve over that time period, the condition requires no treatment. However, some patients and often parents are concerned about the prognosis and insist that some treatment routine is provided. Furthermore, this derangement tends to be recurrent and instruction in prevention and the correction of posture, especially the sleeping position, should be given routinely.

Where there is clear evidence that the rate of recovery is slow and significant disability remains after four or five days a more active approach is indicated.

Attempts to correct posture should be commenced only after the derangement has reduced substantially as it is virtually impossible for patients with acute wry neck to attempt correction without incurring an unacceptable increase in the level of pain.

Exercises are best applied with the patient lying supine. In the unloaded position the level of pain produced by the movements is usually within the patients tolerance.

As is the case in the treatment of acute list in the lumbar spine, it may be necessary to correct the lateral component of the derangement before attempting correction of the posterior component. Lateral flexion is most likely to reduce or centralise the symptoms, but rotation may in some cases be as successful.

The procedures for reduction

This derangement causes acute pain and all procedures must be applied carefully.

Retraction in lying (Proc 3) (at least one pillow may be required), (Fig 20:4a) should be attempted initially followed by retraction and extension in lying (Proc 3) (Fig 20:4a).

Should these procedures reduce or centralise the pain, the patient should be instructed to repeat them every hour at home or at work.

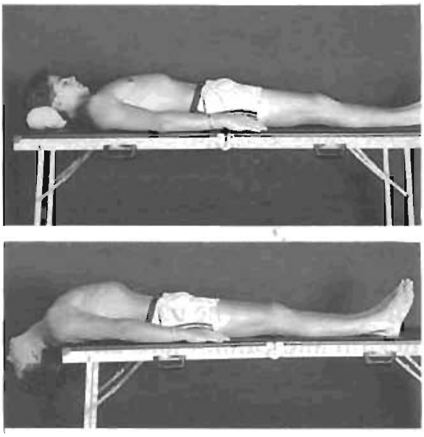


Fig 20:4a *showing Proc 3,4. Retraction in lying. Extension in lying.*

Should no benefit ensue (which is often the case), procedures that affect the lateral compartment should be commenced immediately. Lateral flexion, (Proc 6) (Fig 20:4b) (but modified for the supine lying position) should be applied. The patient must actively laterally flex the head towards the side of pain. On reaching the maximum range possible the position should be held for a second and then the patient returns the head to the neutral position. The therapist may need to gently assist the patient in the attainment of lateral flexion. This is achieved by applying localised overpressure at the level of the affected segments. The movement should be repeated five or six times or according to the patient's tolerance.

The exercise may be more beneficial if overpressure is added as described for lateral flexion (Proc 6). On completion of four or five movements with overpressure, the patient must hold the head laterally flexed towards the side of pain and maintain this position for three to four minutes if possible. In that time the patient must try to obtain as much relaxation of the neck muscles as possible in order to facilitate the reduction process. Again, the therapist may need to gently assist the patient in the attainment of lateral flexion by applying localised pressure.

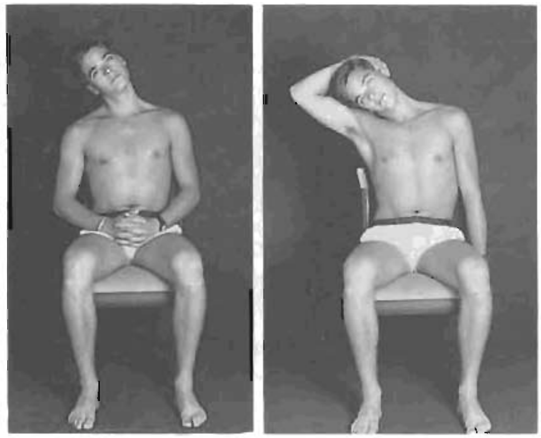


Fig 20:4b
Lateral flexion.
Lateral flexion with overpressure.

If the application of lateral flexion (Proc 6) in lying has definitely reduced or centralised the pain, the manoeuvre as described above must be performed frequently during the following twenty-four hours. If possible, providing there is no production or increase in distal pain, lateral flexion (Proc 6) should be followed by extension in lying (Proc 3) (Fig 20:4a).

If no improvement results from the application of lateral flexion (Proc 6), in lying, then rotation (Proc 8) (Fig 20:4c) must be modified for application in the lying position. The sequence of movements and end positioning and the number of movements to be performed is just the same as described for the application of lateral flexion.

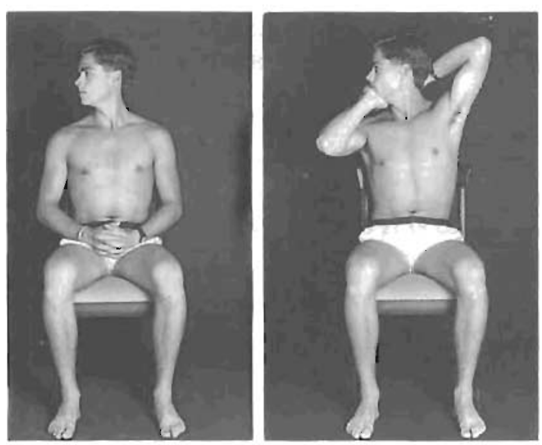


Fig 20:4c
Rotation
Rotation with overpressure

If no improvement follows the application of patient applied lateral flexion or rotation, lateral flexion mobilisation in lying (Proc 7) (Fig 20:4d) and/or rotation mobilisation in lying (Proc 9) (Fig 20:4d) should be commenced. Following this the patient must continue to apply the appropriate procedures at home or at work.

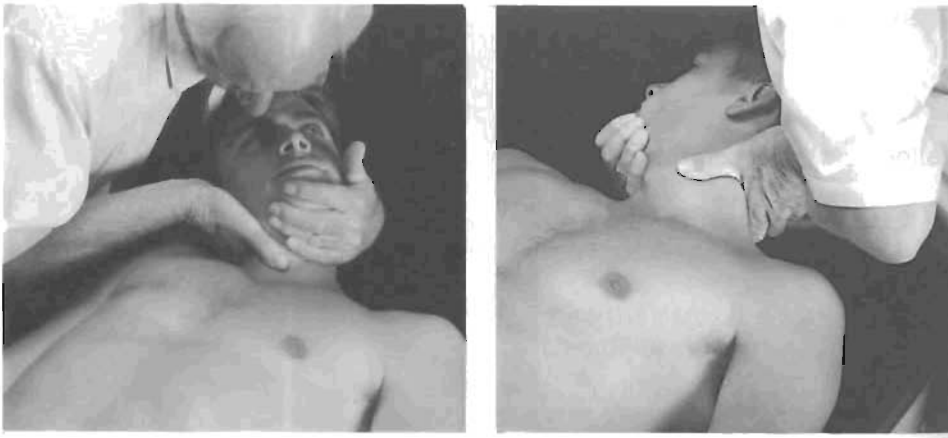


Fig 20:4d. *Showing Proc 7, 9.*
Lateral flexion mobilisation in lying.
Rotation mobilisation in lying.

Once the patient's symptoms are reduced or as soon as they have centralised, extension must be introduced and the derangement treated as for Derangement One.

Because this disorder occurs mostly in young persons, it is rare to find any residual loss of movement once pain has resolved. A check on the range of full function should be made nevertheless.

The stability of the reduction must be achieved by teaching the correction and maintenance of good posture.

Measures and procedures used for the recovery of function and prevention of recurrence are the same as described under Derangement One.

DERANGEMENT FIVE (QTF Classification 3)

Unilateral or asymmetrical pain about C5-6-7.
With or without scapula or shoulder pain and with arm symptoms distal to the elbow.
No deformity.
Extension and lateral flexion towards the side of pain obstructed.
Often rapidly reversible.
A small percentage fail to respond to mechanical therapy.
Comprises approximately 15% of cervical spectrum.

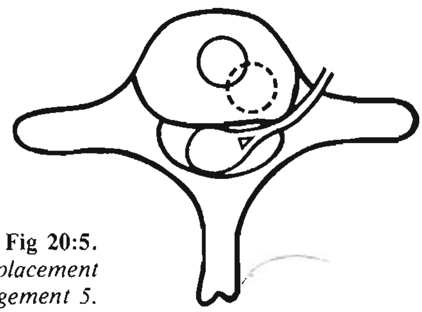


Fig 20:5.
Diagram of displacement in Derangement 5.

Derangement Five is a progression of Derangement Three and may be treated similarly. In Derangement Five the magnitude and location of flow or displacement is not yet sufficient to force deformity. The displacement is usually such that impingement of the nerve root and or dural sleeve occurs only intermittently, when the patient performs movements that cause pressure to be exerted on the neural tissues. Other movements or positions do not exert pressure on the neural tissues. Therefore, there are times in the day when the patient experiences no symtoms distally. Because of the intermittent nature of the nerve root compression in patients with derangement five, neurological deficit is the exception rather than the rule.

If the history is of recent onset, the patient must be treated with care. Mismanagement of a simple Derangement Five with intermittent distal symptoms can lead to the development of the more complicated and severe Derangement Six with deformity and constant distal symptoms. It is essential to determine whether the brachialgia is constant or intermittent as this will influence our treatment strategy.

INTERMITTENT BRACHIALGIA

If the brachialgia has been present for several weeks or months as sometimes occurs, the constant arm pain felt in the acute stages may have altered with time and now has become intermittent. We require to know when and under what circumstances the distal symptoms appear and disappear. In other words, what increases the derangement and what reduces the derangement. Perhaps even more importantly, is this problem still a derangement? Has repair and fibrosis developed to the extent that the problem is now one of dysfunction or in simpler terms, the consequences of repair?

Usually, the patient with Derangement Five has intermittent distal symptoms. There are times in the day when nerve root irritation or compression ceases. Neurological deficit in such cases is unlikely to develop, as even short periods without root compression allow physiological recovery.

Intermittent brachialgia may be caused by a small disc bulge which is, depending on the patient's activities, alternately increasing and decreasing. Intermittent brachialgia may also be caused by nerve root adherence or entrapment. This occurs when tension on the tethered nerve root increases as certain movements are performed or positions are adopted.

For example, a patient with persistent brachialgia following injury eight weeks earlier presents for treatment. The symptoms are now intermittent; we must determine whether the brachialgia arises from an increase of disc bulging (requiring extension procedures) or by increased nerve root tension due to adherence or scarring. (Requiring flexion procedures) When adherence of the nerve root is thought to be the cause, we must determine whether it is safe at this stage to stretch the fibrosis without causing further disc prolapse.

To differentiate between brachialgia caused by a reducable disc bulge, an irreducible disc bulge (entrapment), or nerve root adherence, careful assessment of the flexion test movements is essential. Flexion of the head and neck, with overpressure if necessary and performed with the arm externally rotated, extended and abducted just below the horizontal, will usually enhance the brachialgia in derangement, entrapment and in nerve root adherence. (Fig 20:5a)[48] However, when repetition of this cervical movement is applied, a different response is obtained in all three situations.

Nerve root tension tests will be positive whether nerve root adherence, entrapment or derangement is responsible for the symptoms. As in the straight leg raising test, Lasegues test, and slump test,[105] the information adduced from these procedures is unhelpful unless a distinction is made between the syndromes of dysfunction and derangement (or fibrosis and compression). Failure to eliminate derangement as the cause of the pain has caused much unnecesary prolongation and aggravation of symptoms in patients where treatment has been applied to derangement in order to "stretch" the tense structures. When the derangement is reduced, such signs disappear immediately in much the same way as trigger points disappear after the reduction of derangement.

DIFFERENTIAL TESTING

In derangement:

Intermittent brachialgia present for less than eight weeks.

Repeated application of flexion will cause the distal symptoms to progressively worsen or peripheralise. The pain is experienced during the

Fig 20:5a. *Cervical nerve root tension test. (48)*

movement itself. The patients range of extension and perhaps other movements will become progressively reduced. This indicates that the derangement is increasing. The symptoms will remain worse as a result. However it also indicates that the displacement can still be influenced and that repetitive extension may have the opposite effect and reduce the derangement. The patient should be treated with extension.

In entrapment:

Constant brachialgia since onset.

Repeated application of flexion will cause the distal symptoms to increase with each movement and then subside to their former level immediately after each movement is completed. The pain is experienced during the movement itself. The distal symptoms will not progressively worsen and may temporarily lessen. The range of movement may progressively increase.

Once the patient moves about or waits for five or ten minutes, the symptoms will return to their former intensity and the range of movement will reduce to its former level. Irrespective of how often the procedure is applied, a temporary increase in movement and a slight reduction in pain follows, but the patient does not remain better as a result nor does the practice of the exercise for weeks effect improvement. The patient with brachialgia secondary to entrapment does not respond to mechanical therapy but over many months resolution may occur as adjacent structures accomodate the intrusion.

In nerve root adherence:

Intermittent symptoms present for eight weeks or longer.

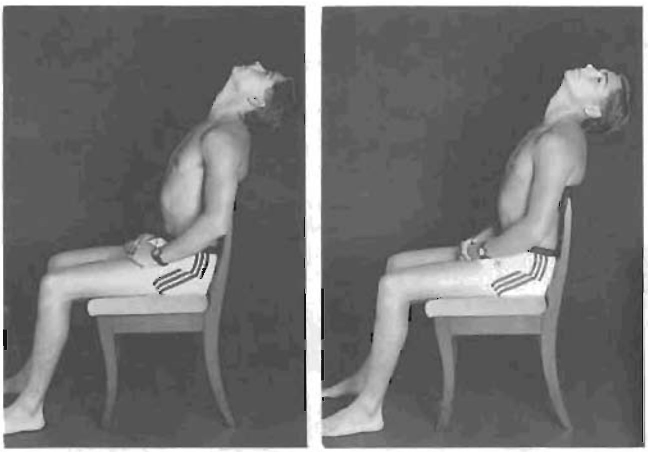
The distal symptoms will appear at the end range of the movement when Elvey's or other appropriate tension tests are applied. (Fig 20:5a) The symptoms will not worsen with repetition and will appear only at the end range of each movement. Pain is not experienced during the movement itself. The range of motion will be slightly limited, and will not increase or decrease with repetition.

Thus, using repetitive motion it is possible to distinguish between these apparently similar disorders of derangement and entrapment, and identify the patient with nerve root tension signs caused by root adherence. Nerve root adherence is the only condition in which the deliberate provocation of distal symptoms can be permitted during the application of the treatment itself.

The procedures for reduction of derangement

If nerve root irritation is indeed intermittent, the patient can be treated using mechanical therapy, but caution must be exercised. In the treatment we must make use of those positions and movements which are found to reduce or abolish the distal symptoms. It must be emphasised that any position or movement which produces or enhances referred or nerve root symptoms should be discontinued.

The extension principle should be applied immediately and the patient treated as for Derangement One for a period of twenty-four hours. (Fig 20:5b) Only after this time can the diagnosis be confirmed.



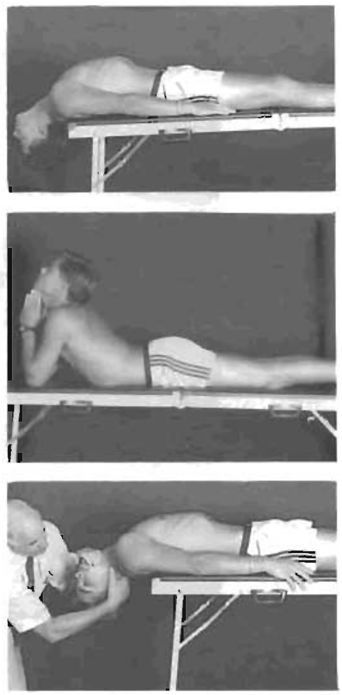
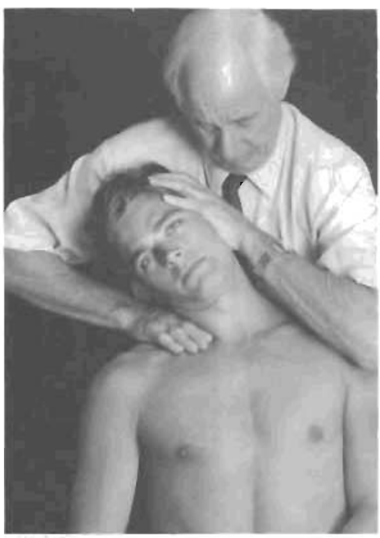


Fig 20:5b. *Showing Proc 1, 2, 3, 4.*
Head Retraction.
Retraction with overpressure in sitting.
Retraction with therapist overpressure.
Extension in sitting.
Rotation in extension in sitting.
Extension in lying supine.
Extension in lying prone.
Extension with traction and rotation in lying.

If on the following day the patient returns a positive response to extension, the extension principle may be continued as recommended for Derangement One. If the response to extension appears to be negative or progress appears to be slow, the whole treatment protocol as described for Derangement Three should be applied. This includes, if necessary, the use of unilateral mobilisation and manipulation procedures as indicated for Derangement Three. (Fig 20:5c)

It will be understood that, once full centralisation is obtained, treatment should be continued and progressed exactly as described for Derangement One.

Fig 20:5c. *Showing Proc 5, 6, 7.*
Extension mobilisation.
Lateral flexion with overpressure.
Lateral flexion mobilisation in sitting.
Lateral flexion mobilisation in lying.



In the presence of significant neurological motor impairment, the chances of successfully reducing the derangement are greatly reduced. Some patients will not benefit from the mechanical approach. However, the natural history of brachialgia indicates that most of these patients recover, but it may take twelve to sixteen weeks for complete resolution.

Should the test movements indicate that brachialgia is caused by entrapment, the patient should be referred to the appropriate specialist. If the test movements indicate the presence of nerve root adherence, the treatment described for this under Derangement Six should be applied. Remember, however, that the treatment to be administered must be that required for dysfunction. The derangement stage has now passed and the damage repaired.

Measures and procedures used for the recovery of function and prevention of recurrence are the same as described under Derangement One.

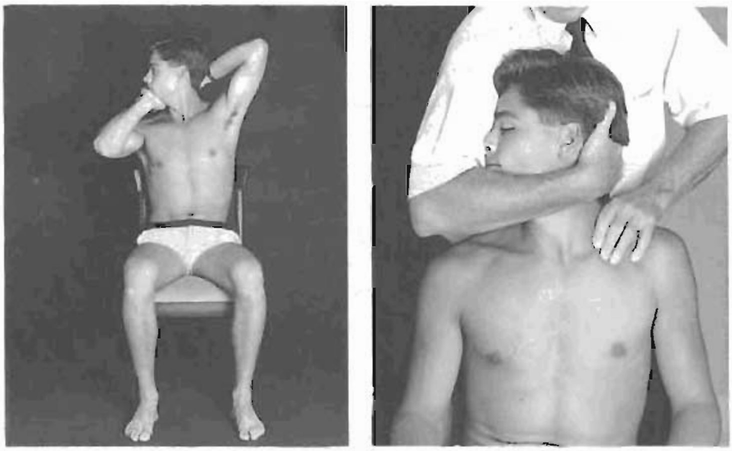


Fig 20:5c.—*continued*
Rotation with overpressure in sitting.
Rotation mobilisation in sitting.
Rotation mobilisation in lying.

DERANGEMENT SIX (QTF Classficiation 4)

Unilateral or asymmetrical pain about C5-6-7.
With arm symptoms distal to the elbow.
With deformity of cervical kyphosis, acute wry neck or torticollis.
Extension and lateral flexion towards the side of pain obstructed.
Neurological motor deficit is common.
Not rapidly reversible.
A significant number of patients fail to respond to mechanical therapy.
Comprises approximately 6% of cervical spectrum.

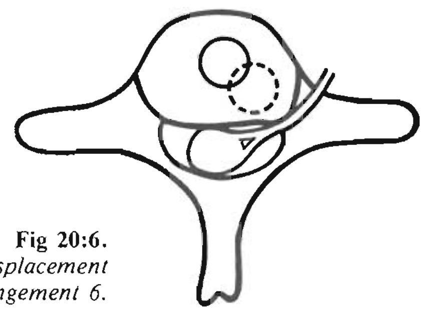


Fig 20:6.
Diagram of displacement in Derangement 6.

Derangement Six is often a progression of Derangement Five. Progressive displacement postero-laterally eventually forces deformity and at the same time causes nerve root compression. Brachialgia in Derangement Six is usually constant and neurological motor deficit common in patients with this disorder. Recovery is usually protracted.

In Derangement Six the patient commonly exhibits a kyphotic deformity and in some a lateral shift or cervical list can be seen. Many patients state that movement brings reduction in intensity of pain. However, movement or a change of position gives a short-lived respite only.

In patients without significant neurological deficit the prognosis is better. Sufficient numbers of patients in this group respond to mechanical therapy to justify its application.

If in a patient with Derangement Six and constant brachialgia most test movements are found to enhance distal symptoms and no movement reduces them, a provisional diagnosis of intervertebral disc prolapse can be made. The presence of neurological deficits, reflex changes and positive radiological findings (myelogram CT Scan and MRI) will eventually support the conclusion. The condition is probably irreversible using dynamic mechanical therapy. However, traction in flexion, (Proc 12) (Fig 20:6c) applied for ten to fifteen minutes a day on an out-patient basis appears to be of benefit. In contrast to traction applied to the lumbar spine, it has been my experience that cervical traction may hasten the recovery process in the treatment of brachialgia. Although the benefits appear to be marginal, enough patients claim improvement to justify its use.

The procedures for reduction

If test movements indicate that reduction of the derangement is possible, treatment should be commenced by applying those movements causing a reduction or centralisation of the distal symptoms. The Procedures most likely to effect improvement are as follows and should be applied strictly in the recommended sequence.

Retraction in sitting, (Proc 1) (Fig 20:6a) retraction and extension in lying, (Proc 3),(Fig 20:6a) and extension with traction and rotation in lying (Proc 4) (Fig 20:6a) should be attempted on the first treatment day. If any of these procedures reduce or centralise the patients symptoms, they should be continued every two hours at home or at work.

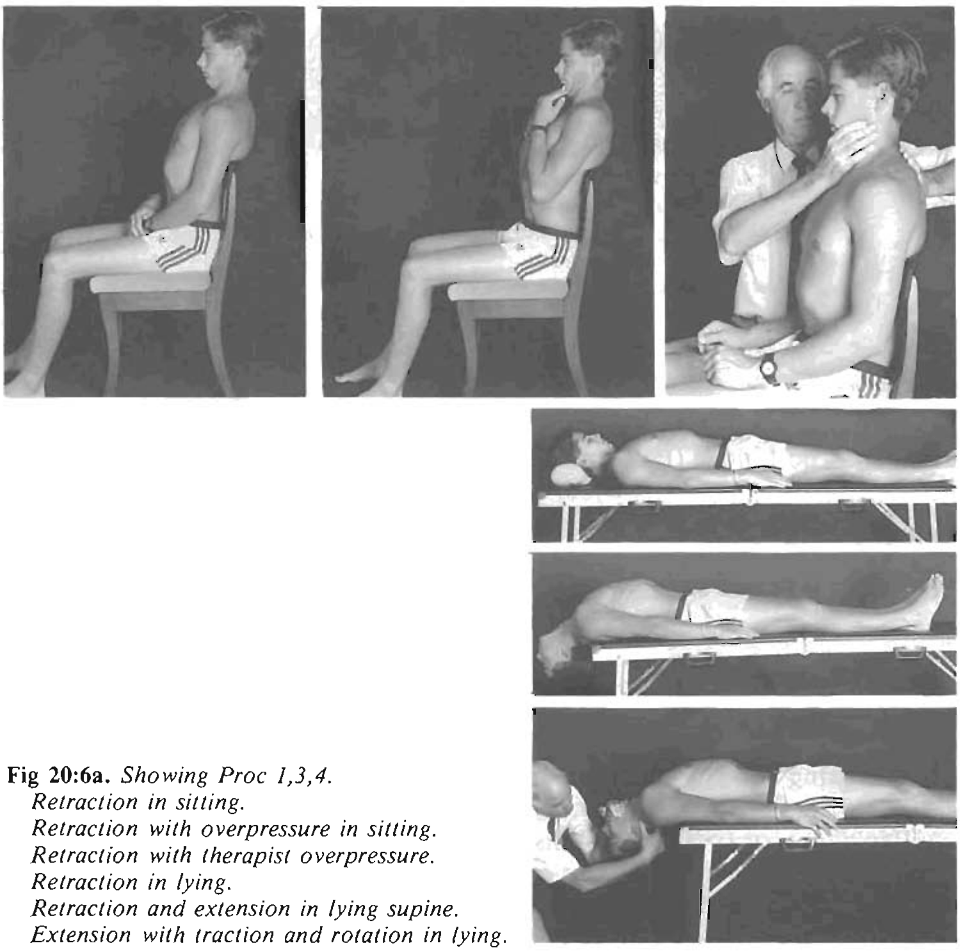


Fig 20:6a. *Showing Proc 1,3,4.*
Retraction in sitting.
Retraction with overpressure in sitting.
Retraction with therapist overpressure.
Retraction in lying.
Retraction and extension in lying supine.
Extension with traction and rotation in lying.

If on the following day the patient continues to improve, no change should be made to the treatment programme. If no improvement follows, the application of patient applied lateral flexion (Proc 6)(Fig 20:6b) or rotation (Proc 8) (Fig 20:6b) (both modified for the lying position), should be commenced, and if helpful the patient must continue to apply these movements at home or at work.

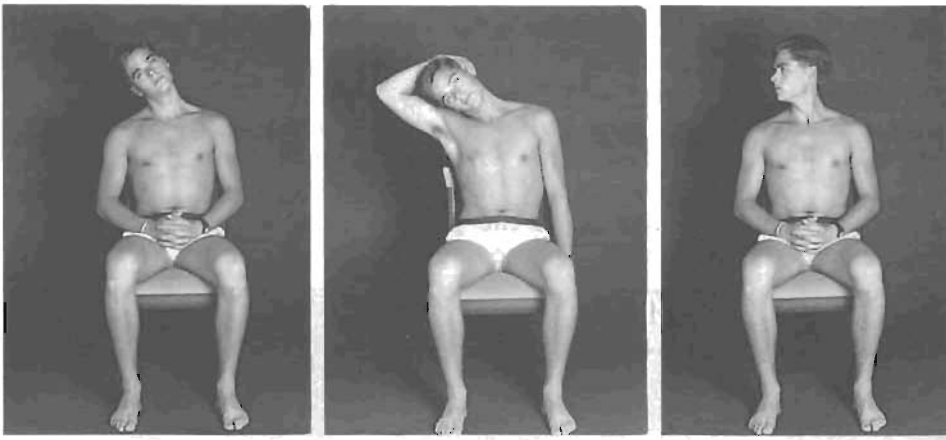


Fig 20:6b. *Showing Proc 6, 8.*
Retraction and lateral flexion.
Retraction and lateral flexion with overpressure.
Retraction and rotation.
Retraction and rotation with overpressure.

If improvement ceases and full centralisation is not achieved, the application of mobilising and manipulative procedures may be indicated. Lateral flexion mobilisation, (Proc 7) (Fig 20:6c), extension mobilisation in rotation, (Proc 5) (Fig 20:6c), or rotation mobilisation, (Proc 9) (Fig 20:6c), may be applied in that order. These procedures may be utilised providing that centralisation of symptoms is possible. If peripheral pain is enhanced in the testing position, the procedures should not be applied.

Fig 20:6c. *Showing Proc 5, 7, 9.*
Lateral flexion mobilisation in lying.
Extension mobilisation in rotation.
Rotation mobilisation in lying.

Should no benefit be obtained from the application of these procedures of mobilisation, traction in flexion (Proc 12) (Fig 20:6d) should be applied on at least five consecutive days.

Fig 20:6d *Showing Proc 12.*
Traction in flexion.

Should improvement result, traction may be continued as required. If no improvement is derived from traction applied daily for one week, it is unlikely the procedure will be of benefit.

The recovery of full flexion or the treatment of any residual flexion dysfunction must be delayed much longer after the resolution of a severe brachialgia than is usually the case in patients with cervical pain only. Where brachialgia is but recently resolved, six to eight weeks from the time of onset of peripheral symptoms should be allowed before implementing vigorous flexion procedures.

Stretching of nerve root adherence

Once the acute pain has subsided, whether spontaneously or as a result of treatment, and the patient is able to attend to his occupation, nerve root adherence, or tethering, as a result of fibrosis may cause persistent neuralgic symptoms which, in some cases, may last for years. This disability is unlikely to produce neurological deficit if the initial episode has not already done so.

It is possible to treat the nerve root adherence, and in many patients this may be done successfully by using the procedures for flexion dysfunction. The shortened structures should be remodelled by frequent stretching every day until the adherence is resolved.

When flexion procedures are applied in the treatment of an adherent nerve root, they should not be attempted during the first three to four hours of the day. During this time period the disc is under increased pressure due to nocturnal imbibition and absorption of fluid. In the initial stages of treatment it is best to commence the stretching procedures midway through the day.

To achieve this, flexion of the head and neck is necessary. (Proc 10) (Fig 20:6e). The stretch should be applied repetitively four or five times in a gentle rythmical fashion, twice per day for one week.

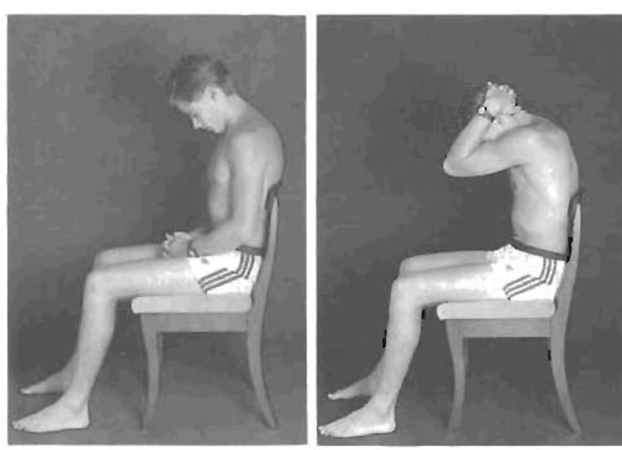


Fig 20:6e. *Showing Proc 10. Flexion in sitting. Flexion with overpressure in sitting.*

After one week of testing the integrity of the repair, the exercise should be progressed and overpressure applied. (Fig 20:6e)

In addition the patient should be instructed to flex and laterally flex the head and neck away from the affected side, with overpressure if necessary. At the same time, the arm on the affected side, held in abduction just below the horizontal, should be externally rotated and extended to the maximum in order to provoke the distal symptoms. (Fig 20:6f) The number of movements and the frequency can be increased to five or six repetitions every two hours or according to the patient's tolerance. If practised regularly for six to ten weeks, this exercise should encourage remodelling of the adherent structures.

Fig 20:6f. *Stretch for nerve root adherence.*

To restore the extensibility of the adherent nerve root or sheath, the exercises must be performed often enough to remodel the tethering without causing further damage to the repair or increase bulging of the disc wall itself.

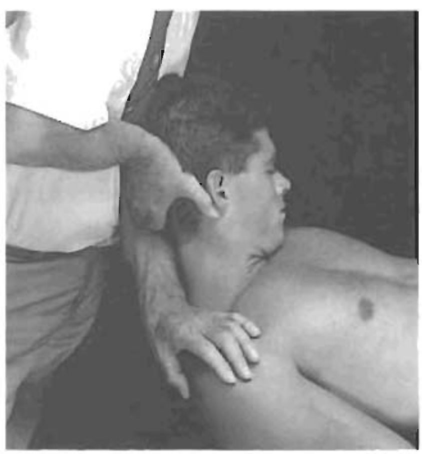


Fig 20:6g *Showing Proc 11. Unilateral flexion mobilisation.*

If little improvement is evident after 10 to 14 days, flexion mobilisation (Proc 11) (Fig 20:6g) should be applied. If performed with the arm in abduction just below the horizontal, externally rotated and extended, the distal symptoms will be enhanced as tension is applied to the nerve root and or dura. By applying the flexion in this position a better stretching is obtained. Should it become necessary, traction in flexion (Proc 12) (Fig 20:6d) may help in resistant cases. It must be emphasised that these procedures are certain to produce a severe exaccerbation of the problem if they are mistakenly applied to patients with posterior derangement. Nerve root adherence is strictly a dysfunction.

Because the introduction of flexion procedures (Proc 10,11, 12) to stretch nerve root adherence place stress on the posterior annulus, there is always the risk of causing a recurrence of derangement following stretching of an adherent nerve root, especially in the initial stages. Therefore, the recommended flexion procedures must always be immediately followed by extension in sitting, (Proc 2) (Fig 20:6h).

Fig 20:6h. *Proc 2. Retraction and extension in sitting.*

As nerve root stretching becomes effective, the patient may still perceive the same amount of pain but the movement will be further towards the end of the range before pain is perceived. When the range of motion approaches the normal, the level of pain will lessen rapidly. Once remodellng is sufficiently advanced, no tension will exist and no pain will be felt when the patient performs full end range movements.

Measures and procedures used for the recovery of function and prevention of recurrence are the same as described under Derangement One.

DERANGEMENT SEVEN (ANTERIOR) (QTF Classification 1)

Symmetrical or asymmetrical pain about C4/5/6.
With or without anterior/anterolateral neck pain.
Dysphagia common.
No deformity.
Flexion obstructed.
Rapidly reversible.
Comprises approximately 4% of cervical spectrum.

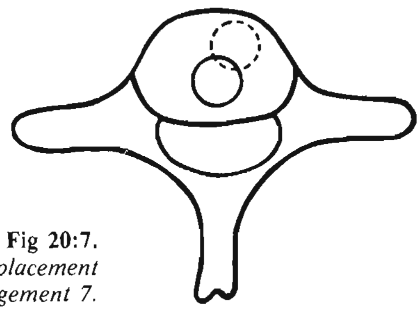


Fig 20:7.
Diagram of displacement in Derangement 7.

In Derangement Seven the flow or displacement within the intervertebral disc appears to be located anteriorly or antero-laterally.[6] This type of derangement is not common and therefore is easily overlooked. It should be suspected whenever acceleration injuries such as rear end motor vehicle accidents have occured prior to onset. The patient will describe pain in the area about the mid to lower cervical spine and additional pain may occur anteriorly about the throat, especially on swallowing. (Dysphagia)

The patient with Derangement Seven will have obstruction of cervical flexion and will find it difficult to look down at the feet.

If the history provides no indication that the derangement is anything unusual, the test movements should expose the presence of the anterior derangement. Firstly, test movements in extension will not be obstructed and will remain painless with repetition. Pain may be felt on return from extension as the patient moves towards flexion. Test movements in flexion will be obstructed and produce the patients symptoms.

The procedures for reduction

The flexion principle should be applied. The patient must perform flexion in sitting (Proc 10) (Fig 20:7a) which should reduce or centralise the symptoms once overpressure is applied. Only rarely does Derangement Seven require the application of therapist-generated forces. Should this be the case, however, flexion mobilisation is the treatment of choice. (Proc 11)(Fig 20:7a)

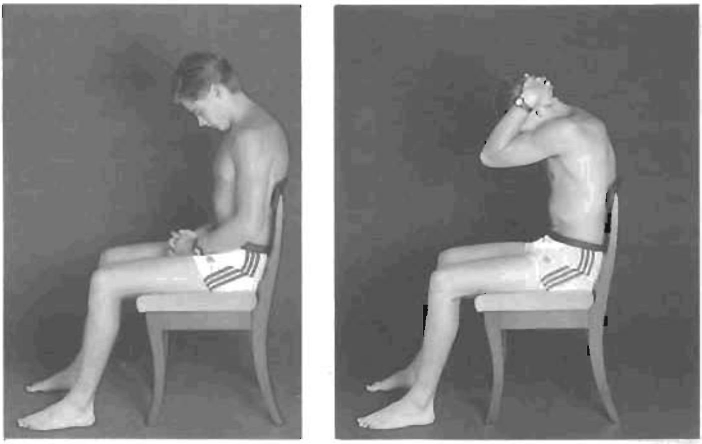


Fig 20:7a. *Proc 10, 11.*
Flexion.
Flexion with overpressure in sitting.
Flexion mobilisation.

If some improvement occurs but the patient has persisting unilateral symptoms which do not fully centralise or reduce with repeated movements, the application of unilateral techniques may be indicated. Unilateral flexion mobilisation, (Proc 11) (Fig 20:7b), or rotation mobilisation or manipulation, (Proc 9) (Fig 20:7b) in flexion are then indicated. Rarely is traction in flexion (Proc 12) required.

The patient should receive routine postural instruction and tested to ensure that a full range of motion exists following resolution of pain.

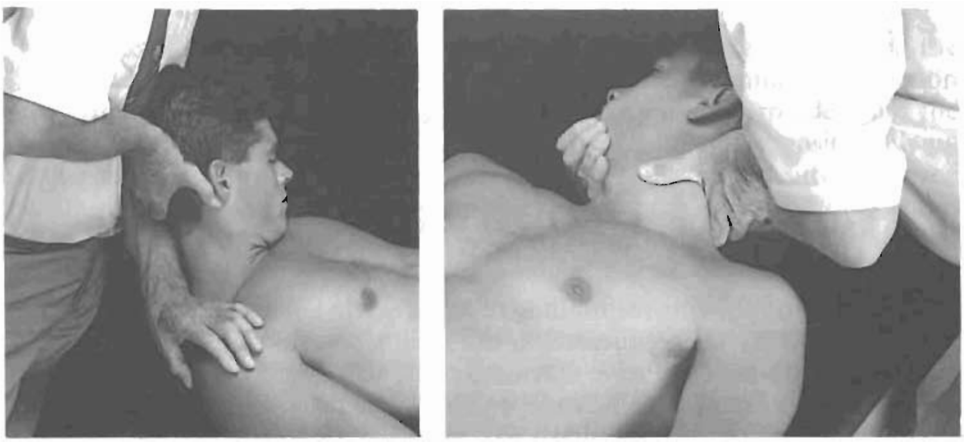


Fig 20:7b. *Showing Proc 11, 9.*
Unilateral flexion mobilisation.
Rotation mobilisation in lying.

Recovery of function

It is unusual to find extension mobility reduced following resolution of the anterior derangement. Should any limitation of extension occur, it may be necessary to apply retraction (Proc 1) or retraction and extension. (Proc 2)

CHAPTER TWENTY-ONE

Prophylaxis

The majority of patients responding to basic extension and flexion principles of treatment have been educated in the means of achieving pain relief and restoring function. They have carried out the self treatment procedures and have to a large extent become independent of therapy. Following successful treatment it requires little emphasis to convince patients that if they were able to reduce and abolish pain already present, it should also be possible to use the same exercises to prevent the onset of any significant future upper back and neck pain.

Of all the factors *predisposing* to upper back and neck pain, only postural stresses can be easily influenced and fully controlled. We must develop this potential ingredient of prophylaxis to the full. The patient must understand that the risks of developing these pains are particularly great when the upper back and neck are held in sustained flexed or protruded postures; and that when the upper back is rounded and the head protruded for prolonged periods, it is necessary at regular intervals and before the onset of pain to make a conscious effort to interrupt flexion, extend the head and neck momentarily to the maximum and maintain the correct posture for as long as possible. It is essential that the patient knows the reasons for doing this, and therefore we must explain to him in lay terms that on extending to the maximum the affected structures are released from stress, any displacement is corrected and the pressures inside the disc are reduced.

Briefly summarised, the following prophylactic measures should always be taken:

Prolonged sitting requires

(a) Maintenance of the lumbar lordosis.
(b) An erect slightly retracted position for the head and neck. The use of a lumbar roll will facilitate this correction.
(c) Retraction and extension movements (Proc 2) applied regularly and whenever the slightest sign of discomfort or pain appears.
(d) Hourly interruption of sitting by standing up and walking tall for a few minutes.

Activities involving prolonged bending of the head and neck require

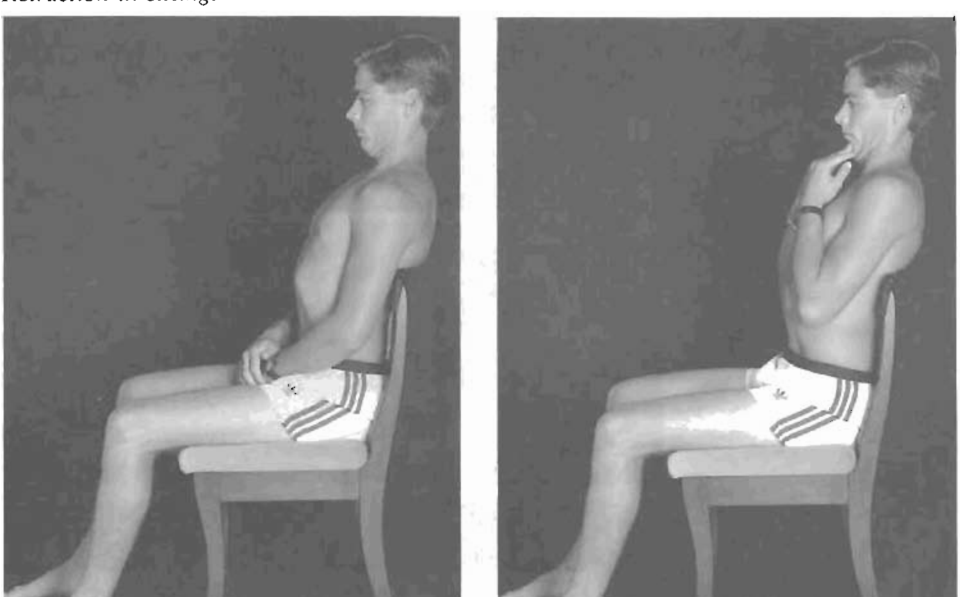
(a) Retraction and extension movements (Proc 2) applied regularly and whenever the slightest sign of discomfort or pain appears.
(b) Regular interruption by standing upright and walking tall for a few minutes.

RECURRENCE

If pain has developed after periods of prolonged sitting or on bending the head and neck forwards, the patient should immediately commence retraction and extension in sitting (Proc 2).(Fig 21:1) If this fails to provide relief the patient must as soon as practicable commence retraction and extension in lying supine or prone. (Proc.3) (Fig 21:1) This procedure, performed either in prone or supine lying, is the technique of first aid for upper back and neck pain. Although an episode of acute neck pain can commence suddenly and without warning, many patients are aware of a minor degree of discomfort before the onset of severe pain. If the patient receives this type of warning, there is an excellent chance to prevent the development of significant symptoms, provided the appropriate procedures are applied immediately.

It is not possible for patients to remember all verbal instructions and advice given during the first treatment. To avoid tedious repetition and to ensure the necessary information is conveyed to the patient, a list of instructions should be supplied on the first visit. This list firstly provides information for patients in the acute stages of neck and upper back pain, and secondly provides information required once recovery has taken place. These instructions form an important part of self treatment because, when followed properly, they will help in reduction of present symptoms and prevention of their recurrence.

Fig 21:1. *Showing Proc 2, 3. Retraction in sitting.*



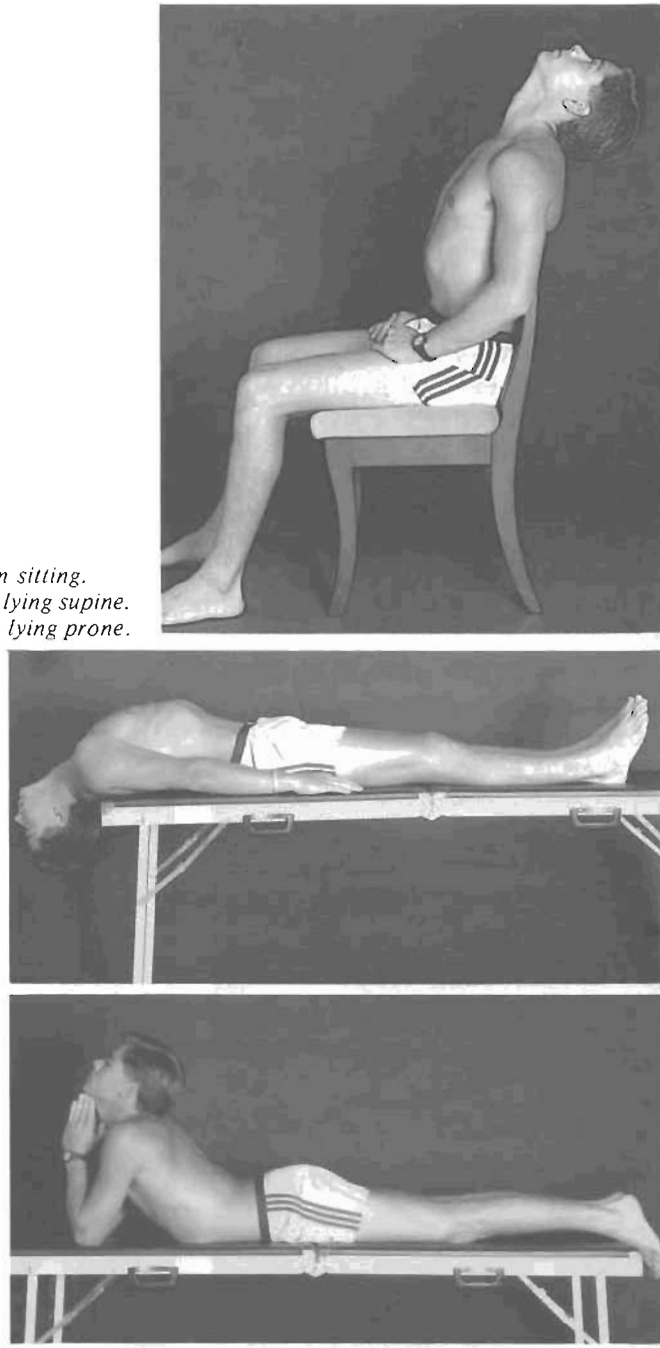


Fig 21:1. *Continued*
Retraction and extension in sitting.
Retraction and extension in lying supine.
Retraction and extension in lying prone.

SURGERY

In New Zealand, surgery is not frequently performed for the relief of cervical nerve root compression. Most patients are treated conservatively. I have never seen a patient who has had surgery for the relief of neck pain alone. In the United States surgery for the relief of brachialgia is not an uncommon procedure.

Surgery in the absence of radiculopathy is also a common procedure in the United States. Whitecloud and Seago,[165] performed arthrodesis on 34 patients complaining of occipital headache, chronic neck pain, shoulder discomfort, and/or referred pain to the mid thoracic or paravertebral border of the scapula. None experienced radicular symptoms. The symptomatic cervical levels were selected by reproduction of the patient's symptoms at discography. Duration of symptoms was 27 months prior to operative intervention. Average age of the patients was 35 years, 20 males and 20 females. Seventy percent of the patients had good or excellent results from surgery.

Rothman et al[128] reported on 68 patients treated conservatively with a follow-up of five years, 69% had neck and radicular pain and 31% had neck pain. At five year follow-up, 40% who had not had surgery were considered to be satisfactory, 55% were unsatisfactory, and 23% of these were completely disabled. When the results of the surgical group were reviewed in the context of this non operative group, there were no statistical differences at the five year follow-up period between the two groups.[128] The strong implication of this study is that, in dealing with predominant neck pain in the absence of neurological deficit and discreet radicular symptomatology, the results of surgery do not significantly alter the natural course of the disease.[38]

I am of the opinion that with few exceptions, surgery for mechanical disorders of the cervical spine is unnecessary.

PART B

THE THORACIC SPINE

CHAPTER TWENTY-TWO

The Thoracic Spine

INTRODUCTION

Patients with mechanical disorders of the thoracic spine comprise only 1.96% of all patients experiencing common mechanic back pain.[92] The opportunity to observe large numbers of patients with mechanical thoracic problems is therefore limited. Perhaps the fewer numbers of patients presenting with these disorders limits the potential to improve treatment methods. Whatever the reason, I have little new to offer in the treatment of this region of the spine, and what is contained here is mostly common knowledge to therapists interested in the mechanical approach to the treatment of mechanical disorders. I will not go into great detail, therefore, and will merely outline basic information with regard to the procedures of treatment as is necessary.

ANATOMY

The anatomy of the thoracic spine differs from the other regions mainly because of the rib articulations and their attachments. The thoracic vertebrae have apart from this difference the same basic components as their cervical and lumbar counterparts. The vertebral bodies become progressively smaller cranially and the thoracic cage provides for the thoracic spinal column a stability and strength unknown in the cervical and lumbar regions.

Fig 22:1.
Typical thoracic vertebra.

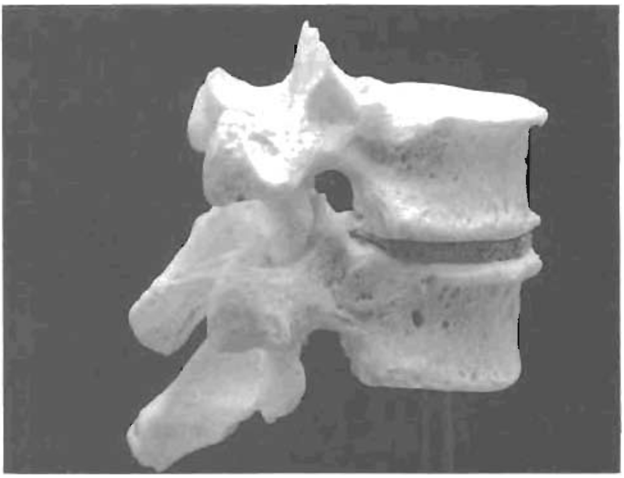


Fig 22:2.
Thoracic motion segment.

The spinal canal is narrower in the thoracic spine, the narrowest part being between T4 and 9, and there is little room for the accomodation of any constriction or displacement. Thoracic discs are narrower than the intervertebral discs in the cervical and lumbar areas and become thicker as the column descends.[92] Intradiscal pressure is higher in the thoracic spine as, due to the convex curvature, the vertebral bodies and discs take all of the loading which in the other regions is shared by the apophyseal joints.

In the thoracic area the apophyseal joints and their capsules, the muscles, the costo-transverse joints, the skin and the chest wall are all innervated. There is no experimental evidence that proves that pain can arise from the thoracic discs. Innervation of the intervertebral discs in the cervical and lumbar region has been identified and discography has proven these structures to be pain sensitive. No similar investigations have been carried out in the thoracic region.[12]

PATHOPHYSIOLOGY

Restriction of the mobility of the thoracic spine by the thoracic rib cage limits movement in all planes and axis. Thus the capsules of the apophyseal joints, the surrounding ligaments and the annulus fibrosis are more protected from tension forces than is the case in the cervical and lumbar regions. It is almost certain that the limits of motion imposed by the thoracic cage and contents, protects the thoracic spinal segments and the rib articulations from the common mechanical disorders that occur with such frequency in the other regions of the spinal column where greater movement occurs.

The thoracic spine is frequently the source of pains of postural origin in late adolescence. Although not a pathological entity in itself, I suspect that poor posture may be a very significant contributing factor to the development of Scheuermann's disease in the young, and osteoporosis in the aged.

The spectrum of diseases commonly affecting the lumbar and cervical spine also occur in the thoracic spine but are not as productive of symptoms in this region. Degenerative changes are present in the thoracic spine with the same frequency as in the cervical and lumbar areas. This is especially the case in the middle and lower thoracic spine because of the high loading present in this region. These changes are rarely a cause of pain, however, and Kramer,[92] reports that osteochondrosis and spondylosis, when present in the thoracic spine, "completely lack clinical interest". This further supports the contention that degeneration alone is not a cause of symptoms in spinal disorders. If that were the case, similar numbers of patients should present with thoracic symptoms as do for cervical and lumbar problems.

Moreover, if back pain arises from some chemical response to degeneration, why is the incidence of pain in the thoracic spine so low when the ammount of degeneration reported to occur is similar to that which develops in the cervical and lumbar region?

Acute problems in the cervical and lumbar spine are frequently associated with sudden locking of the joints and the appearance of deformity. The acute torticollis in the cervical spine and acute kyphosis and lumbar scoliosis seen in the lumbar spine are typical examples. Sudden locking or the appearance of deformity does not occur in the thoracic spine. Perhaps the significantly reduced mobility of the thoracic spine prevents the attainment of extremes of motion, which in turn reduces the degree of flow or displacement that may occur.

Derangements occur in the thoracic spine but apart from radiating pains, there is little remarkable to differentiate between them. In my experience all the derangements encountered have been posterior or postero-lateral, and all have required the extension principle for treatment of the posterior component or rotation for any lateral component of the derangement. Even though I have not personally identified an anterior derangement in the thoracic spine, at least one case has been identified.[124]

Intervertebral disc prolapse occurs in the thoracic spine but is rather infrequent in comparison to the incidence of this problem in the cervical and lumbar regions.

Intercostal neuralgia produced by compression or irritation of the intercostal nerve causes radiating symptoms between the intercostal margins, sometimes as far as the sternum anteriorly. Posterior thoracic derangement is commonly the cause of this pain which behaves characteristically for the syndrome.

Perhaps the most common disease affecting the skeletal thoracic spine is osteoporosis, and in the treatment of this disorder the value of physiotherapy has gone largely unrecognised. Of course there is no doubt that the disease itself affects the body's ability to retain calcium which drains from the bony structures, especially in the wake of inactivity. Further, the effects of this loss of bone density is catastrophic for the vertebral body, if the patient allows the vertebrae to act collectively as a series of nutcrackers. Why decompression of the vertebral bodies by postural correction is not considered more important remains a mystery. The correction of the slouched posture must remove considerable compression forces from the vertebral bodies themselves and this must in turn minimise the incidence of compression fractures.

The performance of active back extension exercises has been shown to reduce the incidence of compression fractures in patients with post menopausal osteoporosis,[135] and yet this procedure is not widely recommended either.

THE THORACIC SYNDROME

Frequency of thoracic syndrome

Little investigation of epidemiological factors relating to mechanical thoracic syndrome or non-specific disorders of the thoracic spine has been undertaken. As was noted earlier patients with thoracic back pain of discogenic origin comprised only 1.96% of all patients experiencing back pain. Pain felt in the thoracic area is frequently referred from the cervical spine and this may create the impression that the incidence is higher than it is.

Love,[96] reports that the incidence of thoracic disc lesions is evenly distributed between the sexes, and that it is most common in patients from the fourth and sixth decade. It occurs especially between the segments T8-12. However protrusions have been found at every level in the thoracic spine.

Intervertebral disc prolapse requiring surgery is not common according to De Palma and Rothman,[35] who reported in 1970 that of 1000 intervertebral disc operations only one was for thoracic disc pathology. Others,[24, 25, 54, 81] also report isolated cases of thoracic intervertebral disc protrusion.

Natural history of thoracic syndrome

As in non-specific mechanical disorders of the cervical and lumbar regions, the great majority of patients with non- specific mechanical disorders of the thoracic spine resolve in two months. Non-specific thoracic problems are less recurrent than the same disorders occurring in the other regions of the spine.

CHAPTER TWENTY-THREE

Assessment of the Thoracic Spine

HISTORY

The interview

The interview of the patient with thoracic syndrome can be conducted with the same format as is used for the cervical spine and with few exceptions the information can be simply transposed.

The location of pain in mechanical disorders of the thoracic spine can be classified as symmetrical or asymmetrical. Pain patterns of Derangement One (Central/Symmetrical) requiring the extension principle and Derangement Three (Unilateral/Asymmetrical) requiring extension and rotation will suffice to identify the two groups.

CLINICAL EXAMINATION

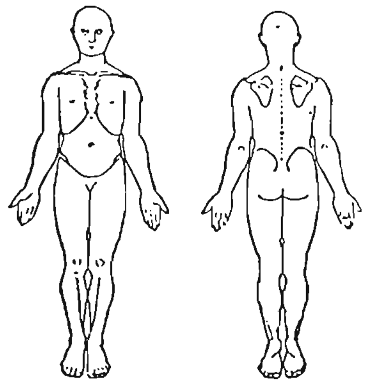
The examination of the patient with thoracic syndrome can also be conducted using the same format as described for the cervical spine and with few exceptions the information can be simply transposed. The examination of setting and standing posture and the quality of mount must be recorded prior to the commencement of the dynamic evaluation.

DYNAMIC MECHANICAL EVALUATION

In order to determine the true source of pain, it is necessary to affect the patients symptoms by moving and stressing the structures from which the pain is believed to originate. In the thoracic spine this can be confusing because of the frequency with which pain felt in this area is caused by pathology in the cervical spine.

Many regard the thoracic spine as a region particularly prone to common mechanical aches and pains. This arises in part because pains are frequently reported to be felt between the scapula, around the lower border of the scapula, and centrally in the area between T1 and T7. Much of the symptomatology felt in the thoracic region actually originates from the cervical spine.[26] If the patient's symptoms are located above a line drawn across the inferior border of the scapulae, they should be considered to be cervical in origin until it is proven otherwise. Much time can be spent in palpating the thoracic area seeking the source of referred symptoms when the actual origin lies in the region of the cervical spine.

THORACIC SPINE ASSESSMENT



Date ____________________

Name ____________________

Address ____________________

Telephone ____________________

Date of birth ____________________

Occupation ____________________

Postures/stresses ____________________

Doctor ____________________

HISTORY

Symptoms now ____________________

____

At onset ____________________ Date ____________________

Present for ____________________

Improving/stationary/worsening ____________________

Commenced as a result of ____________________

For no apparent reason ☐

Onset ______ fast/slow Time of day ____________________

Symptoms ______ constant/intermittent ____________________

Worse

bending sitting or rising standing walking lying

am/as day progresses / pm stationary / on the move

other ____________________

Better

bending sitting or rising standing walking lying

am/as day progresses / pm stationary / on the move

other ____________________

Disturbed sleep ____________________

Sleeping postures ______ prone/supine/sidely

Surface ______ firm/soft/sagging

Cough/sneeze/Dp Br ______ +ve/-ve

Previous history ____________________

____

Treatment ____________________

X-rays ____________________

General health ____________________

Meds/steroids ____________________

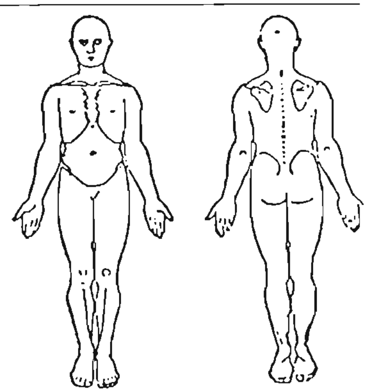
Recent surgery ____________________

Accidents ____________________

Bilat arm/hand symptoms ____________________

Disturbed gait ____________________

Other ____________________



Date ____________________

Fig 23:1. *Thoracic spine Assessment form.*

THORACIC SPINE - EXAMINATION

OBSERVATION

Posture sitting__________ Posture standing__________

Kyphosis_____ accentuated / reduced / normal__________

Structural scoliosis__________ Other__________

MOVEMENT LOSS

(tick appropriately)	MAJOR	MODERATE	MINOR	NIL
Flexion				
Extension				
Rotation (R)				
Rotation (L)				

TEST MOVEMENTS

	PDM	ERP
Symptoms in sitting		
FLEX		
Rep FLEX		
EXT		
Rep EXT		
ROT (R)		
Rep ROT (R)		
ROT (L)		
Rep ROT (L)		

NEUROLOGICAL

Sensation__________ Dural signs__________

OTHER

Cervical spine__________

Ribs__________

__________ Other__________

CONCLUSION

Trauma Posture Dysfunction Derangement__________

Other__________

PRINCIPLE OF TREATMENT

Posture correction Extension Flexion Other__________

To determine whether the cervical spine is responsible for the production of pain felt in the thoracic region, it is necessary to move the cervical area and at the same time keep the thoracic spine immobile. One way to achieve this is to seat the patient on the treatment table unsupported. The patient must then adopt a completely flexed sitting posture from the cervical to the sacral area.

The location and intensity of any pain present is recorded prior to the test movements being performed. Test movements for the cervical spine are then applied whilst the thoracic spine is kept in a fully flexed position.(See Chapter 10 Clinical Examination, Test movements.) The therapist may need to restrain or stabilise the thoracic spine in some cases.

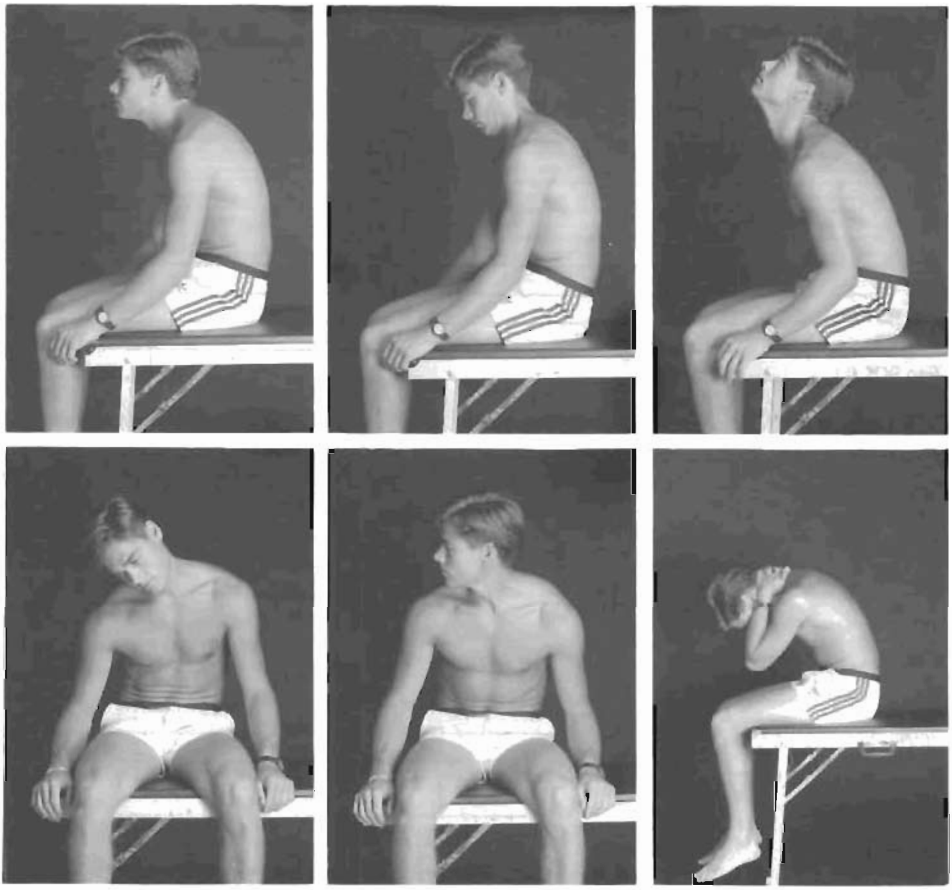


Fig 23:2. *Differential test movements.*
Head protrusion – thoracic spine flexed.
Head retraction – thoracic spine flexed.
Cervical extension – thoracic spine flexed.
Cervical lateral flexion – thoracic spine flexed.
Cervical rotation – thoracic spine flexed.
Cervical flexion – thoracic spine flexed.

If the patient's thoracic symptoms are produced or increased, or reduced or abolished by the cervical test movements performed from this position, it is likely they arise from the cervical spine. In the presence of posterior cervical derangement, repetition of cervical flexion should cause the symptoms to peripheralise or increase. Repetition of cervical extension should cause the symptoms to centralise reduce or cease.

Note that if the cervical test movements are applied only with the patient sitting in the upright position a negative response may be obtained giving the impression that the symptoms arise from the thoracic spine. In the upright position the neural components are relaxed and radiating or referred symptoms may not be provoked.

Where difficulty is encountered in the assessment process, the tests may need to be repeated in the upright position. If the cervical spine is not the source of the symptoms, examination of the thoracic region should be performed.

The principles of assessment based on the location and intensity of pain are the same in the thoracic spine as in the cervical and lumbar region. That is, we will apply repeated movements that centralise reduce or abolish the patient's symptoms. Movements that produce increase or peripheralise the patients symptoms are contraindicated.

The test movements

Test 1. *Erect sitting flexion*

The intensity and location of any pain and other symptoms present are recorded. In particular, always establish the location of the most distal symptom.

The patient sits upright on the treatment table with the hands clasped behind the neck. The hands are clasped in order to apply overpressure. (Fig 23:3) From this posture the patient is instructed to slouch into a fully flexed position. (Fig 23:3a) The whole spine in this position should be flexed from the mid cervical to the sacral region. On reaching the position of maximum flexion the patient immediately returns to the upright position. (Fig 23:3) The effects of performing the movement once are recorded.

Fig 23:3. *Starting position for thoracic flexion in sitting.*

Fig 23:3a. *Thoracic flexion in sitting.*

The test should be repeated five to fifteen times or as required in order to influence the symptoms and the effects of repetition must be recorded.

Test 2. *Erect sitting extension*

The intensity and location of any pain and other symptoms present are recorded. In particular, always establish the location of the most distal symptom.

The patient sits upright on the treatment table with the hands clasped behind the neck. (Fig 23:4) From this position the patient is instructed to stretch the head, neck and trunk backwards towards the extended position as far as possible. (Fig 23:4a) The patient without pausing then returns to the neutral upright position. (Fig 23:4) The effects of performing the movement once are recorded.

The test should be repeated five to fifteen times or as required in order to influence the symptoms and the effects of repetition must be recorded.

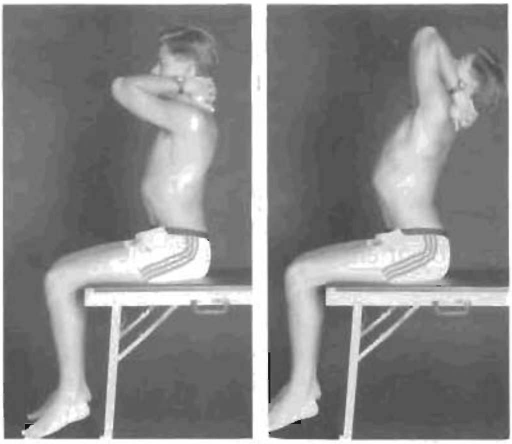


Fig 23:4.
Starting position for thoracic extension in sitting.

Fig 23:4a.
Thoracic extension in sitting.

(In some cases it may be necessary for the therapist to apply overpressure before a response to the stress is perceived.)

Test 3. *Erect sitting rotation*

The intensity and location of any pain and other symptoms present are recorded. In particular, always establish the location of the most distal symptom.

The patient sits upright on the treatment table with the fingers interlocked under the chin and the elbows and hands raised to chest height. (Fig 23:5) The patient is instructed to turn the body towards the side of pain and to reach as far behind with the elbow as is possible. (Fig 23:5a) The patient then returns to the neutral position. (Fig 23:5) The effects of performing the movement once are recorded.

The test should be repeated five to fifteen times or as required in order to influence the symptoms. This is best done by repeatedly turning vigorously as if to strike some object behind with the elbow. The effects of repetition must be recorded.

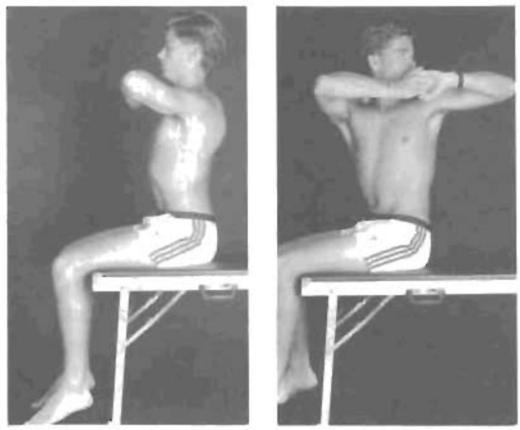


Fig 23:5.
Starting position for thoracic rotation in sitting.

Fig 23:5a.
Thoracic rotation in sitting.

Test 4. *Extension in lying*

Extension in prone lying affects the thoracic spine only up to the area of the fourth or fifth thoracic vertebra. To test extension in the thoracic spine above that level it is therefore necessary to perform the exercise supine.

The intensity and location of any pain and other symptoms present are recorded. In particular, always establish the location of the most distal symptom.

Prone

The patient lies prone on the treatment table with the hands palm down alongside the shoulders as for the traditional press-up exercise. (Fig 23:6) The patient is then instructed to press the top half of the body upwards by straightening the arms while the bottom half, from the pelvis down, is allowed to sag with gravity. (Fig 23:6a) The top half of the body is then lowered to the starting position (Fig 23:6) The effects of performing the movement once are recorded.

The test should be repeated five to fifteen times or as required in order to influence the symptoms and the effects of repetition must be recorded. It is important that the patient straightens the arms as much as possible and sags the trunk from mid scapula to the pelvis to obtain as much extension as possible. At the same time the neck should be extended.

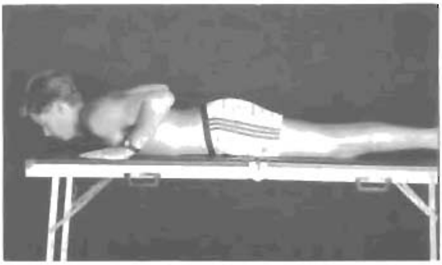


Fig 23:6.
Starting position for thoracic extension in lying.

Fig 23:6a.
Thoracic extension in lying.

Supine

The patient lies supine on the treatment table with the head, neck and shoulders unsupported down to the level of the fourth thoracic vertebra and then lowers the head until the neck and upper thoracic segments are fully extended. (Fig 23:7) It is important that the movement be made to the maximum end range of extension. The head is then returned to the neutral position by using the patient's own hand. The effects of performing the movement once are recorded.

The test should be repeated five to fifteen times or as required in order to influence the symptoms and the effects of repetition must be recorded.

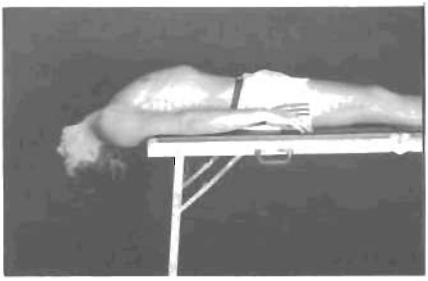


Fig 23:7.
Upper thoracic extension in lying (supine).

STATIC MECHANICAL EVALUATION

Some individuals with pain of purely postural origin will not experience pain provocation from the application of repeated movements and overpressure. In such patients it will be necessary to load the structures for a prolonged period of time before deformation is sufficient to reproduce the sensation of pain.

Whilst extreme positions in any direction can become painful if maintained for long periods, most often the totally flexed posture is responsible for the production of mechanical thoracic pains. The test postures described below will tend to provoke pain in the flexed posture and abolish it in the upright position. This is particularly so in the case of the thoracic postural syndrome. In the thoracic dysfunction syndrome the opposite is more likely to occur and it is extension that will provoke the symptoms. In the thoracic derangement syndrome, the flexed posture often relieves the symptoms whilst the patient remains in the flexed position. In the extended position the symptoms will be increased, usually centrally. This can be misleading as it can create the impression that the patient should be flexed. In the flexed posture, posterior displacement in the thoracic spine is under reduced compression and this explains the comfort derived by the flexed patient. The adoption of the flexed posture does nothing to influence the location of displacement, however, and the patient does not remain better as a result of being in flexion. The presence of posterior derangement which obstructs extension, is usually the cause of this pain behaviour and is identified using repetitive extension movements that will in the case of derangement cause a reduction or abolition of the symptoms.

THE TEST POSTURES

Sitting flexion

The intensity and location of any pain and other symptoms present are recorded prior to the adoption of the flexed posture. In particular, always establish the location of the most distal symptom.

The seated patient is instructed to sit slouched with the back totally rounded in flexion. (Fig 23:8) Record the nature and location of any symptoms present.

Fig 23:8.
Static thoracic flexion.

After a maximum of three minutes the effects on the symptoms *felt in this position* are recorded. The patient may then return to the neutral upright position. (Fig 23:8a) On return to the neutral position the patient should be asked "As a result of adopting that posture are you in more pain or less pain than before?" A check should also be made on whether or not the symptom location has altered. The effects, if any, are recorded.

Fig 23:8a.
Neutral upright position.

Lying prone in extension

This position will passively extend the thoracic spine from about T4/5 to L1 and is useful for assessing symptoms felt in this region. The intensity and location of any pain and other symptoms present are recorded prior to the adoption of the extended position. In particular, always establish the location of the most distal symptom.

The patient lies prone on the treatment table leaning on the elbows. (Fig 23:9) It is important to have the patient as relaxed as possible in order that a passive overpressure can develop as the position is maintained. Record the nature and location of any symptoms present.

Fig 23:9.
Static lower thoracic extension in lying.

After a maximum of three minutes the effects on the symptoms *felt in this position are again recorded.* The patient may then return to the neutral lying position. (Fig 23:9a) On return to the neutral position the patient should be asked, "As a result of adopting that posture are you in more pain or less pain than before?" A check should also be made on whether or not the symptom location has altered. The effects, if any, are recorded.

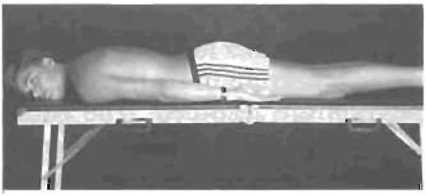


Fig 23:9a.
Neutral lying position.

Lying supine in extension

This position will passively extend the thoracic spine from about T1 to T4/5. and is useful for assessing symptoms felt in this region. The intensity and location of any pain and other symptoms present are recorded prior to the adoption of the extended position. In particular, always establish the location of the most distal symptom.

The patient should be instructed to lie supine and move over the end of the treatment table so that the head, neck and shoulders are unsupported down to the level of the fourth thoracic vertebrae. The patient, with support from one hand, then lowers the head until the neck and upper thoracic spine is fully extended. (Fig 23:10) *It is important that the movement be made to the maximum end range of extension.* Record the nature of any symptoms present.

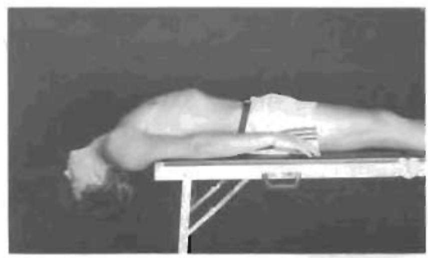


Fig 23:10.
Static upper thoracic extension in lying.

After a maximum of three minutes the effects on the symptoms *felt in this position are recorded.* The patient may then return to the supported supine position. On return to the neutral position the patient should be asked again, "As a result of adopting that posture are you in more pain or less pain than before?" A check should also be made on whether or not the symptom location has altered. The effects, if any, are recorded.

OTHER EXAMINATION PROCEDURES

On occasions, if the symptoms are referred to the chest wall, it may be necessary to assess the effects of static end range rotation. To achieve this the patient should be seated. The therapist holds the patient by the shoulders and turns the patients trunk to the maximum possible rotation range. This position must be maintained for up to three minutes. The effects on the referred symptoms are noted.

Conclusions following the examination

It should be possible at the conclusion of the examination to identify the predominant syndrome and, if derangement is identified, which sub-category is responsible for the symptoms.

CHAPTER TWENTY-FOUR

Procedures and Techniques of Mechanical Therapy

TABLE OF PROCEDURES AND TECHNIQUES

PROCEDURE ONE

Erect sitting flexion

The intensity and location of any pain and other symptoms present are recorded. In particular, always establish the location of the most distal symptom.

The patient sits upright on the treatment table with the hands clasped behind the neck. (Fig 24:1) From this posture the patient is instructed to slouch into a fully flexed position, at the same time applying overpressure with the clasped hands. (Fig 24:1a) Overpressure may be required in order to influence the symptoms. In this position the whole spine should be flexed from the mid cervical to the sacral region. On reaching the position of maximum flexion the patient immediately returns to the upright position. (Fig 24:1) The effects of performing the movement once are recorded.

The procedure should then be repeated five to fifteen times or as required in order to influence the symptoms. The effects of repetition must be recorded.

Effects and clinical application

The performance of repetitive flexion is designed to stretch posterior ligamentous and capsular soft tissue and to increase flow or displacement of disc content posteriorly. This in turn should reproduce or increase the patient's symptoms.

This procedure is almost exclusively used for the provocation of the symptoms of posterior derangement. By so doing we identify the direction of displacement. Although limitation of thoracic flexion is not frequently encountered in practice, the procedure may be used for the treatment of flexion dysfunction.

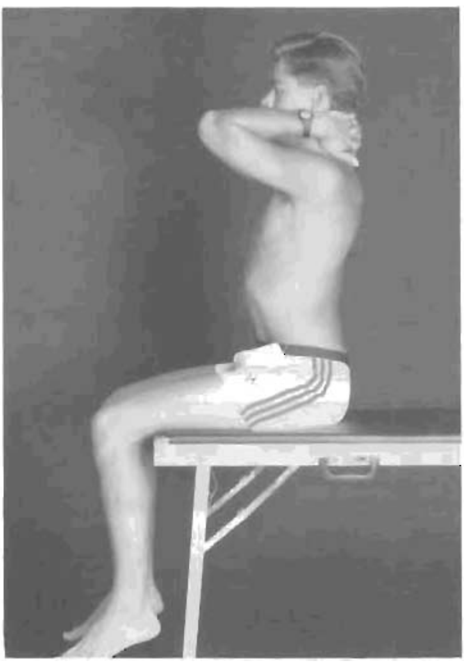


Fig 24:1.
Starting position for thoracic flexion in sitting.

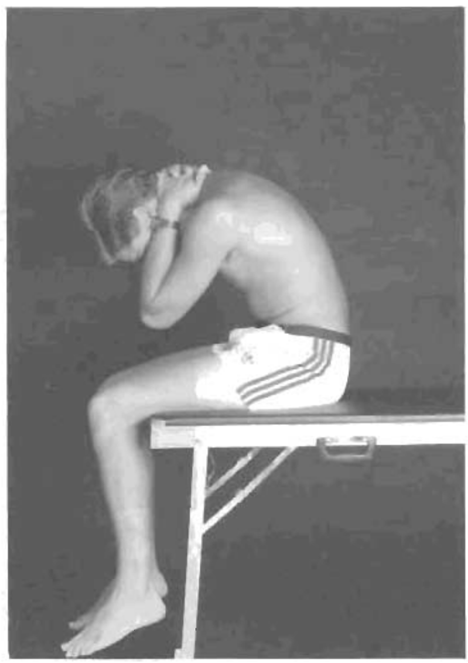


Fig 24:1a.
Thoracic flexion.

PROCEDURE TWO

Extension in lying (prone or supine)

Prone

The intensity and location of any pain and other symptoms present are recorded. In particular, always establish the location of the most distal symptom.

The patient lies prone on the treatment table with the hands palm down alongside the shoulders as for the traditional press up exercise. (Fig 24:2) The intensity and location of pain are recorded.

The patient must be instructed to press the top half of the body upwards by straightening the arms while the bottom half, from the pelvis down, is allowed to sag with gravity. (Fig 24:2a) The top half of the body is then lowered to the starting position. (Fig 24:2) The effects of performing the movement once are recorded.

The procedure should be repeated five to fifteen times or as required in order to influence the symptoms and the effects of repetition recorded.

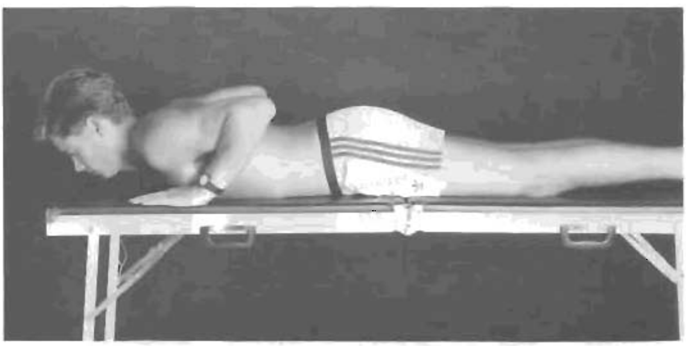


Fig 24:2. *Starting position for thoracic extension in lying.*

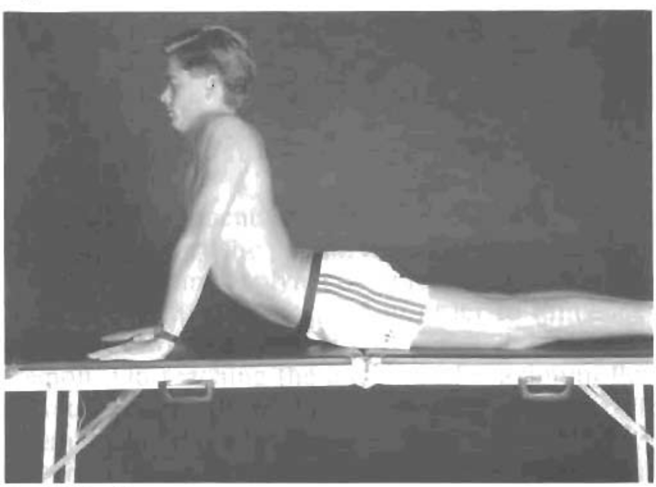


Fig 24:2a. *Thoracic extension in lying prone.*

Supine

The intensity and location of any pain and other symptoms present are recorded. In particular, always establish the location of the most distal symptom.

The patient should be instructed to lie supine and move over the end of the treatment table so that the head, neck and shoulders are unsupported down to the level of the fourth thoracic vertebrae. The patient, with support from one hand, then lowers the head until the neck and upper thoracic spine are fully extended. (Fig 24:2b) After a second, or longer if possible, the patient should, using the hand to assist, return the head to the starting position. The effects of performing the movement once are recorded.

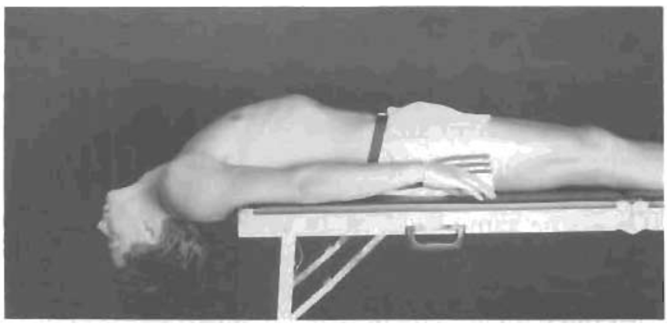


Fig 24:2b. *Upper thoracic extension in lying supine.*

The procedure should be repeated five to fifteen times or as required in order to influence the symptoms. The effects of repetition are recorded.

Effects and clinical application

These procedures apply extension forces to the thoracic spine. When performed prone the forces are directed mainly to the mid and lower regions, and when performed supine the upper thoracic spine is mostly affected. The procedure will increase compression in the posterior compartment, and reduce compression in the anterior compartment of the intervertebral disc.

Procedure Two is the first treatment for the reduction of Derangement One and Three. This procedure is also required in the treatment of extension dysfunction.

PROCEDURE THREE

Extension mobilisation or manipulation

Mobilisation

This Procedure is required for those patients whose symptoms are resistant to extension in lying. (Proc 2) Although symptoms may be reduced or centralised by extension in lying, they do not remain reduced and return shortly after the performance of the exercise. The direction chosen for delivery of the exercise has been determined to be appropriate, but patient generated force is inadequate to reduce the derangement. The addition of therapist generated force is now indicated.

The intensity and location of any pain and other symptoms present are recorded. In particular, always establish the location of the most distal symptom.

The patient lies prone on the treatment table with the arms alongside the trunk and the head turned to one side. (Fig 24:3) The therapist stands to one side of the patient and places the heel of one hand on the transverse process of the appropriate segment.(Fig 24:3a) The therapist then crosses the arms and places the heel of the other hand on the transverse process on the opposite side at the same level. With both hands the therapist applies symmetrical pressure to the transverse process on either side. (Fig 24:3b) The therapist then slowly releases the pressure being careful however to maintain firm contact with the patient. The pressure is then reapplied in a rhythmical fashion five to fifteen times, each pressure being a little stronger than the previous one, depending on the patient's tolerance and the behaviour of the pain. Providing the patient's pain is reducing or centralising the procedure may be repeated and, if indicated, applied to adjacent segments.

Should extension mobilisation fail to reduce or centralise the patient's pain it will be necessary to apply extension manipulation.

Manipulation

To progress the technique of mobilisation to that of manipulation, the positioning of both patient and therapist can remain the same.

The intensity and location of any pain and other symptoms present are recorded. In particular, always establish the location of the most distal symptom.

Extension mobilisation is applied as a premanipulative testing procedure. The information obtained from the mobilising procedure is important. By using the centralisation or reduction of pain as a guide, we can determine the level at which the manipulation can be safely applied.

If following premanipulative testing manipulation is indicated, the therapist places the heel of the hands firmly on the transverse processes of the appropriate segment. With the arms at right angles to the spine the therapist moves the spine towards the extended position until the segments feel taut. A high velocity thrust of very short amplitude is then applied and immediately released. (Fig 24:3b)

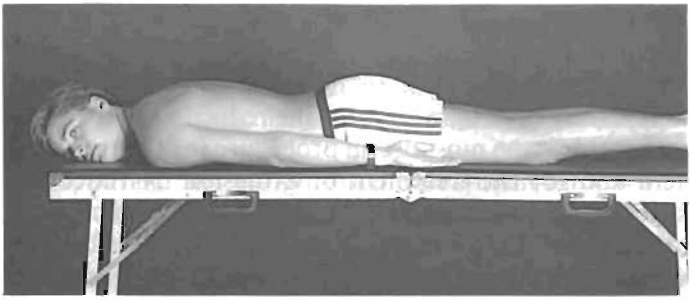


Fig. 24:3. *Neutral lying position.*

Fig. 24:3a. *Hand position for extension mobilisation.*

Fig. 24:3b. *Extension mobilisation.*

Effects and clinical application

These two procedures progressively enhance the effects of the patient generated extension forces of Procedure Two.

Extension mobilisation is the first progression for the reduction of Thoracic Derangement One and Three. It is the most useful procedure for the treatment of resistant derangement and for the treatment of extension dysfunction.

Extension manipulation is the second progression for the reduction of Thoracic Derangement One and Three but should be applied only after four or five treatments of extension mobilisation (Proc 3) have failed to produce improvement.

PROCEDURE FOUR

Erect sitting rotation

The intensity and location of any pain and other symptoms present are recorded. In particular, always establish the location of the most distal symptom.

The patient sits upright on the treatment table with the fingers interlocked just under the chin. The elbows and hands are raised to chest height. (Fig 24:4)

The patient is then instructed to turn the body towards the side of pain and to reach as far behind with the elbow as is possible. (Fig 24:4a) The patient then returns to the neutral position. (Fig 24:4) The effects of performing the movement once are recorded.

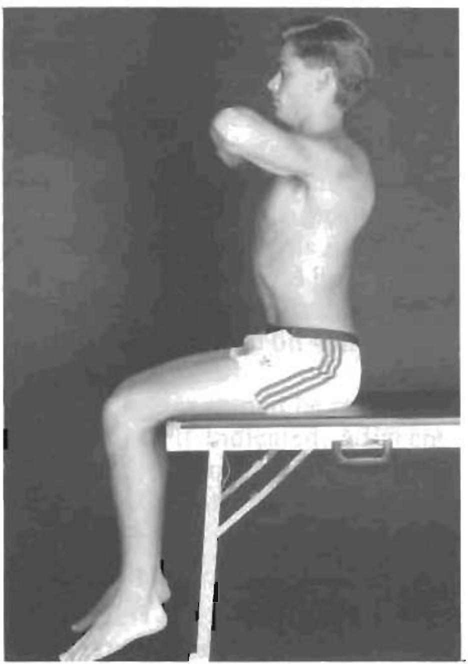


Fig 24:4. *Starting position for thoracic rotation in sitting.*

Fig 24:4a. *Thoracic rotation in sitting.*

The procedure should be repeated rhythmically with increasing vigour and momentum as if to strike some object behind with the elbow. It should be repeated five to fifteen times or as required in order to influence the symptoms. The effects of repetition are recorded.

If the symptoms are reducing or centralising by performing the movement towards the painful side, the patient must be instructed to repeat the procedure five to fifteen times every two hours for the following twenty-four hours.

Most patients will reduce or centralise their symptoms by rotating towards the painful side. However, in the event that the symptoms increase with rotation *towards* the side of pain, the patient must be instructed to carry out the same procedure by turning away from the painful side.

Effects and clinical application

This procedure applies torsion to the thoracic spine with a resultant compression of the lateral compartment of the intervertebral disc. The asymmetrical pressure generated from rotation is intended to influence postero-lateral displacement in Thoracic Derangement Three.

Sitting rotation is the second progression for the reduction of Derangement Three. The procedure is also required for the treatment of rotation dysfunction, an entity that is not uncommon.

PROCEDURE FIVE

Rotation mobilisation or manipulation in extension

Mobilisation

This Procedure is required for those patients whose symptoms are resistant to erect sitting rotation (Proc 4). Although the patient's symptoms may be reduced or centralised by erect sitting rotation, the symptoms do not remain reduced and return shortly after the performance of the exercise. The direction chosen for delivery of the exercise has been determined to be appropriate, but patient generated force is inadequate to reduce the derangement. The addition of therapist generated force is now indicated.

The intensity and location of any pain and other symptoms are recorded. In particular, always establish the location of the most distal symptom.

The patient lies prone on the treatment table with the arms alongside the trunk and the head turned to one side. (Fig 24:5) The therapist stands to one side of the patient, crosses the arms and places the heels of the hands on the transverse processes of the appropriate thoracic segment. (Fig 24:5a) With the hand, the therapist applies pressure to the transverse process on one side of the segment. The therapist then slowly releases pressure on that side while the other hand simultaneously applies pressure to the transverse process on the opposite side. The manoeuvre is repeated so that an alternating rotary effect is obtained. Each pressure is a little stronger than the previous one, depending on the patients tolerance and the behaviour of the pain. After ten to fifteen cycles it should be possible to identify the side on which mobilising pressure causes centralisation or reduction of the symptoms. This indicates the direction and side on which all further mobilising or manipulative forces should be applied.

The technique should be repeated about five to fifteen times on the involved segment and, if indicated, adjacent segments should be treated as well.

Should rotation mobilisation fail to reduce or centralise the patient's pain it will be necessary to apply rotation manipulation.

Manipulation

To progress the technique of mobilisation to that of manipulation, the positioning of both patient and therapist can remain the same.

Rotation mobilisation is applied as a premanipulative testing procedure. The information obtained from the mobilising procedure is important. By using the centralisation or reduction of pain as a guide, we can determine on which side and in which direction the manipulation is to be performed.

The intensity and location of any pain and other symptoms present are recorded. In particular, always establish the location of the most distal symptom.

If following premanipulative testing the manipulation is indicated, the therapist places the heel of one hand on the appropriate transverse process. The other hand is superimposed to reinforce the pressure. With the arms at right angles, the therapist moves the spine towards an extended position until the segments feel taut. A high velocity thrust of very short amplitude is then applied and immediately released. (Fig 24:5a)

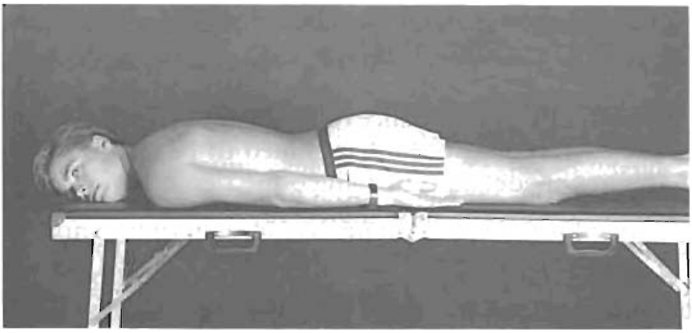


Fig 24:5 *Neutral lying position.*

Fig 24:5a. *Rotation mobilisation.*

Effects and clinical application

The external forces applied by the therapist enhance the effects on derangement and dysfunction as described for the self treatment procedures of rotation in extension.

Rotation mobilisation in extension is the third progression for the reduction of Derangement Three. When the desired result is not obtained with the mobilising technique, manipulation is indicated. Rotation manipulation in extension is the fourth progression for the reduction of Derangement Three.

CHAPTER TWENTY-FIVE

Treatment

THE POSTURAL SYNDROME

The treatment of the postural syndrome in the thoracic spine is precisely the same as is described for the postural syndrome in the cervical spine. It may be necessary to advise the patient specifically regarding problems peculiar to his occupation.

Correction of sitting posture

All patients who have upper back and neck pain produced or enhanced by prolonged sitting should receive an adequate explanation regarding the cause of pain and the need for maintenance of the correct sitting posture.

They should be taught how to obtain the correct sitting position by using the "slouch overcorrect procedure" (Fig 25:1)

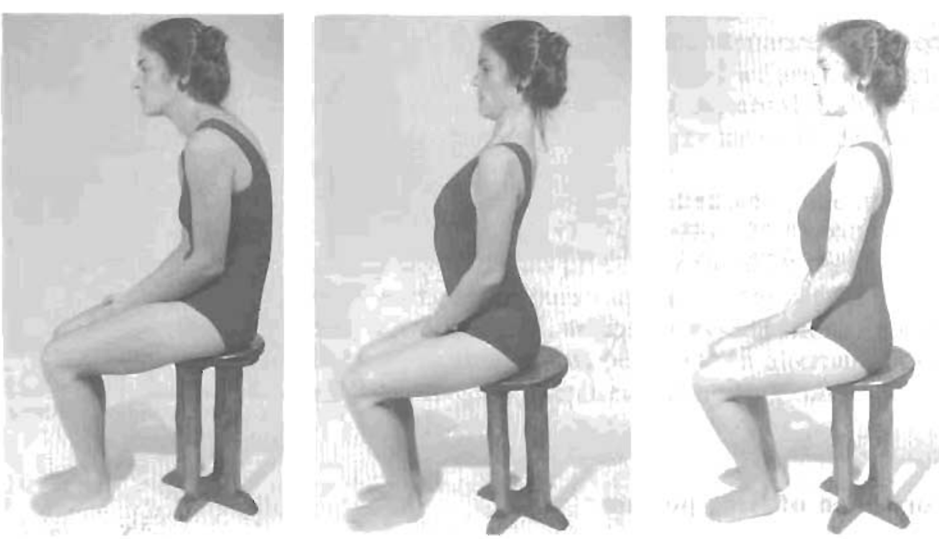


Fig 25:1. *Extreme of of the good sitting posture.*
Extreme of the bad sitting posture.
Correct sitting posture.

It is essential that the patient with thoracic problems routinely uses a lumbar roll in all sitting environments. (Fig 25:2)

Correction of standing posture

Poor standing postures frequently cause exacerbation of symptoms in the thoracic spine. The relaxed standing position allows the thoracic kyphosis to increase so that the patient "hangs" at end range. Correction of the patient's standing posture can be modelled on that for correction of the cervical standing posture. Usually, the patient can be seen to stand with a protruding abdomen and the lordosis at its extreme, 'hanging' on the lumbo-sacral ligaments at the end of the range of extension. The thoracic spine tends to become a long "C" curve and the cervical spine and head protrude. To achieve postural correction in standing the patient must be shown how to take the lumbar lordosis off end range and move the lower part of the spine backwards by tightening the abdominal muscles and tilting the pelvis backwards, while at the same time moving the upper spine forwards, raising the chest and retracting the head and neck. (Fig 25:3)

Fig 25:2.
Correction of posture using a lumbar roll.

Fig 25:3.
Correct standing posture.

Correction of lying posture

Pain felt in the thoracic spine whilst lying in bed is not an uncommon complaint of patients with non specific symptoms in this region. The patients affected in this way often have an accentuated thoracic kyphosis. Patients with back pain are generally advised to use a firm matress. In the case of patients experiencing pain in the thoracic spine when lying in bed, this advice often leads to aggravation of the symptoms rather than a resolution of the problem.

Patients with thoracic pain that becomes worse when lying should be advised to deliberately "sag" the mattress. This can be achieved by placing pillows under each end of the mattress so that it becomes dished. In this way the thoracic kyphosis is not forced into the extended range when lying supine and the removal of this stress allows a comfortable nights sleep. The correction is purely postural and the long term aim must be to improve the range of extension.

THE DYSFUNCTION SYNDROME

Small reductions in range of motion are difficult to detect in the thoracic spine as the motion normally available in this region of the column is of minor degree.

Extension dysfunction

Extension dysfunction will develop in patients with both Scheuermann's disease and osteoporosis. Many patients lose mobility in extension and rotation as a result of poor postural habits.

All patients with extension dysfunction of the thoracic spine must firstly receive instruction in posture correction. Explanations regarding the problems that may arise as a result of prolonged flexion loading together with reasons for remaining active are all part of the education of these patients. The use of a lumbar support is essential in this process, therefore it should be introduced at an early stage in the treatment programme. (See Fig 25:2)

In extension dysfunction of the thoracic spine, the maintenance of correct posture is a lifelong project. Our intervention is essential if we are to prevent the inevitable progressive compression of the thoracic vertebral bodies that occurs with ageing. This situation is compounded in the female with developing osteoporotic changes. (See below "Osteoporosis")

The application of the extension principle is indicated for patients with extension dysfunction. Extension in lying (Proc 2) (Fig 25:5) should be introduced in the first treatment session. This procedure should be performed regularly five to fifteen times every two hours during the day. If after one week of treatment the patient is unimproved, extension mobilisation (Proc 3) (Fig 25:5) should be applied two or three times per week on alternate days. The patient will continue with extension exercises during this time.

Fig 25:5. *Showing Proc 2, 3.*
Thoracic extension in lying.
Extension mobilisation.

Rotation dysfunction

The patient must perform erect sitting rotation (Proc 4) (Fig 25:6) regularly every two hours and follow this with extension in lying (Proc 2) (Fig 25:6) If after one week little or no improvement is reported, rotation mobilisation (Proc 5) (Fig 25:6) and extension in lying (Proc 2) (Fig 25:6) may be required.

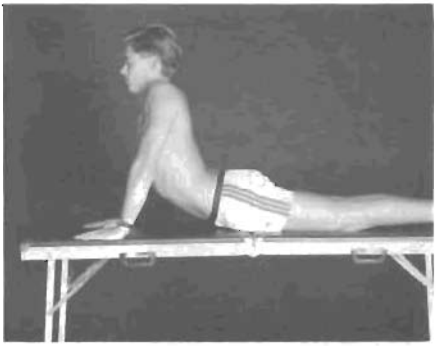


Fig 25:6. *Showing Proc 4, 2, 5.*
Thoracic rotation in sitting.
Thoracic extension in lying.
Rotation mobilisation.

Flexion dysfunction

Flexion dysfunction is uncommon. When present, it can usually be traced to previous posterior derangement. To treat this problem it is necessary to apply flexion exercises. To ensure that flexion may commence without the risk of disrupting repair or producing a recurrence of the derangement, reassessment of the test movement of flexion in sitting (Proc 1) (Fig 25:7) is essential.

Fig 25:7.
Thoracic flexion in sitting.

If flexion in sitting becomes progressively more painful with repetition the manoeuvre should be abandoned as the continuation will either produce a recurrence in the derangement or disrupt the repair.

If flexion causes pain at the end range which does not progressively worsen with repetition, it is safe to commence the recovery of flexion.

If flexion becomes less painful with repetition it is likely that the collagen repair is not yet dense or contracted but is sufficiently plastic to adapt to the applied forces without damage. Flexion procedures may now be applied with safety.

In order to recover flexion the patient must perform flexion in sitting. (Proc 1). (Fig 25:7) Because there is a risk attached to the performance of flexion exercises following recent posterior derangement, care should be taken and some precautions exercised. The patient must be adequately informed regarding the process of repair, the need to restore elasticity to the damaged structures, and the methods by which he may safely assist in the restoration of that mobility. For the first few days after the introduction of flexion no overpressure should be applied either by the patient or the therapist.

When first commencing flexion in sitting (Proc.1) (Fig 25:7) the patient should reduce the number of exercises performed at each session, as well as the frequency of the sessions per day—for example, five or six repetitions only should be done two or three times per day. Once the condition proves stable, the patient may gradually work towards a full programme of five to fifteen repetitions performed every two hours.

Flexion in sitting (Proc.1) (Fig 25:7) *must always be followed by extension in lying* (Proc 2) (Fig 25:7a) to ensure that any flow or displacement that may have been initiated by the application of flexion forces is reversed, thereby removing the risk of recurrence of the derangement.

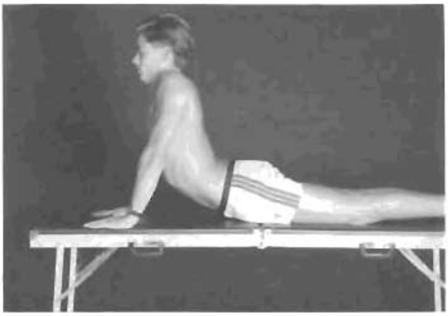


Fig 25:7a.
Thoracic extension in lying.

Flexion in sitting (Proc 1) (Fig 25:7) with or without overpressure should not be done during the first few hours of the day. In this time period the risk of incurring derangement is increased due to the nocturnal increase in the fluid volume within the intervertebral disc. This has been discussed previously. (Chapter 11).

Recovery of flexion is considered to be complete when on performance of flexion in sitting, full range of movement is achieved without pain, although a strain may be felt.

OSTEOPOROSIS

From middle age many women are affected by osteoporosis. Essentially a mineral deficiency disorder, osteoporosis develops during menopause and progresses with ageing. The disease produces a significant and continuing deficiency in calcium replacement which must in many cases be supplemented with calcium tablets on a regular basis. As a consequence of calcium deficiency there is a weakening of bone structure which in the spine causes thinning and wedging of the vertebral bodies. This in turn allows the postures of those affected to become extremely rounded especially in the thoracic region.

In persons affected by this disorder there are risks of fractures occurring without any significant forces being applied to the vertebrae. Research conducted at the Mayo Clinic in the United States[135] has demonstrated that extension exercises performed regularly (Fig 25:8) significantly reduced the number of compression fractures in the group exercising in this manner.

A similar group exercising differently and a group not exercising at all had significantly more fractures when examined at least one year later. This study suggests that women from perhaps the age of forty onwards, should practice this exercise as described on a regular basis. My own recommendation would be that the exercise should be performed fifteen to twenty times, ten to fifteen times per week.

The muscles strengthened by performing the exercises recommended by the Mayo Clinic study, are also the muscles responsible for maintaining the upright posture and it is probable that maintaining good posture at all times will assist in the strengthening process. This may also reduce the likelihood of small compression fractures developing.

The patient should lie face down with a pillow under the abdomen and the hands clasped behind the back. The patient should be instructed to lift the head, shoulders and both legs simultaneously as high as possible. The position should be held for a second and then the patient should relax on the treatment table. The exercise should be repeated as many times as possible. This process should be repeated ten to fifteen times per week. The number of exercises performed at each session should be increased until a minimum of fifteen to twenty are achieved with each session. Patients with this disorder should exercise in this manner for the rest of their lives.

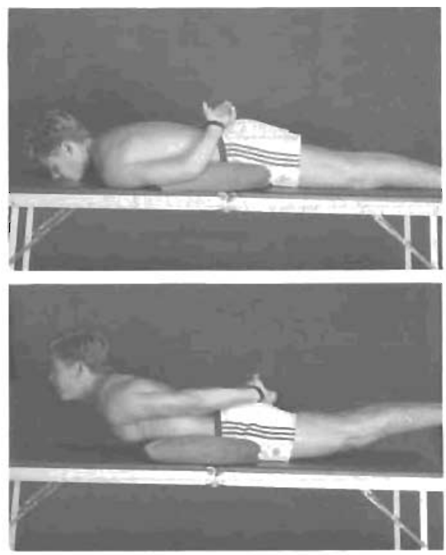
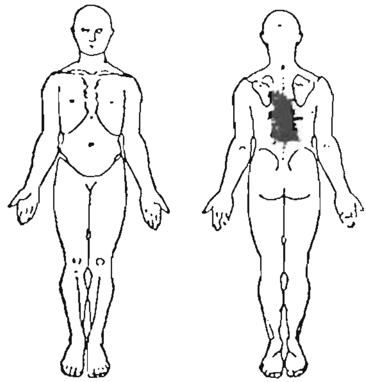


Fig 25:8.
Starting position for back extension exercises for patients with osteoporosis.

THORACIC SPINE ASSESSMENT



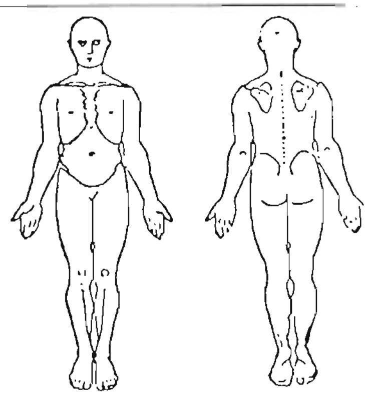
Date 31 FEBRUARY 1991
Name THOMAS SELBY
Address 46 PARLIAMENT STREET, WELLINGTON
Telephone (213) 469-421
Date of birth 1 APRIL 1971
Occupation CARTOGRAPHER
Postures/stresses SITTING
Doctor R MORRISON

HISTORY

Symptoms now CENTRAL T5-12

At onset CENTRAL T7-8 Date 31 FEBRUARY 1991
Present for EIGHT MONTHS
Improving/stationary/worsening
Commenced as a result of
For no apparent reason ☑
Onset fast/slow Time of day
Symptoms constant/intermittent
Worse
bending sitting or rising standing walking lying
am/as day progresses/ pm stationary/ on the move
other
Better
bending sitting or rising standing walking lying
am/as day progresses / pm stationary /on the move
other
Disturbed sleep NO
Sleeping postures prone/supine/sidely
Surface firm/soft/sagging
Cough/sneeze/Dp Br +ve/-ve
Previous history NIL

Treatment NIL
X-rays NORMAL
General health GOOD
Meds/steroids NIL
Recent surgery NIL
Accidents NIL
Bilat arm/hand symptoms NIL
Disturbed gait NIL
Other -



Date

Fig 25.9. *Clinical example of a typical patient with the postural syndrome.*

THORACIC SPINE - EXAMINATION

OBSERVATION

Posture sitting ____ POOR ____ Posture standing ________

Kyphosis ____ accentuated / reduced / normal ________

Structural scoliosis ____ - ____ Other ____ - ________

MOVEMENT LOSS (tick appropriately)

	MAJOR	MODERATE	MINOR	NIL
Flexion				✓
Extension				✓
Rotation (R)				✓
Rotation (L)				✓

TEST MOVEMENTS

		PDM	ERP
Symptoms in sitting	PRESENT AFTER 30 MINUTES WITH SLOUCHED POSTURE		
FLEX)			
Rep FLEX)			
EXT)			
Rep EXT)	ALL TESTS		
ROT (R))	NEGATIVE		
Rep ROT (R))	OF PAIN		
ROT (L))	PRODUCTION		
Rep ROT (L))			

NEUROLOGICAL

Sensation ____ - ____ Dural signs ____ - ________

OTHER

Cervical spine ____ O K ________

Ribs ____ O K ________

________ Other ________

CONCLUSION

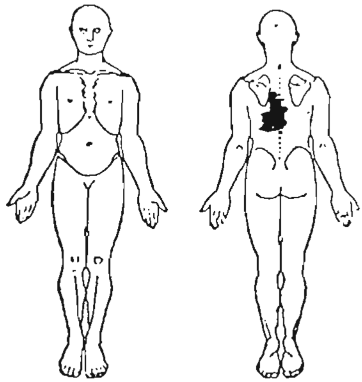
Trauma Posture Dysfunction Derangement ________

Other ________

PRINCIPLE OF TREATMENT

Posture correction Extension Flexion Other ________

THORACIC SPINE ASSESSMENT



Date 31 APRIL 1991

Name HAROLD THOMAS

Address 47 BOTTLE STREET, TAUPO

Telephone (075) 36686

Date of birth 20 APRIL 1961

Occupation DRAIN CLEANER

Postures/stresses FLEXION

Doctor BEASLEY

HISTORY

Symptoms now CENTRAL AND (L) MID THORACIC

At onset CENTRAL (L) MID THORACIC Date 31 APRIL 1991

Present for 4 MONTHS

Improving/stationary/worsening

Commenced as a result of FALL ON (L) SIDE ONTO LARGE DRAINAGE PIPE

For no apparent reason ☐

Onset fast/slow Time of day 4.00 P.M.

Symptoms constant/intermittent

Worse

bending sitting or rising standing walking lying

am/as day progresses / pm stationary / on the move

other

Better

bending sitting or rising standing walking lying

am/as day progresses/ pm stationary / on the move

other

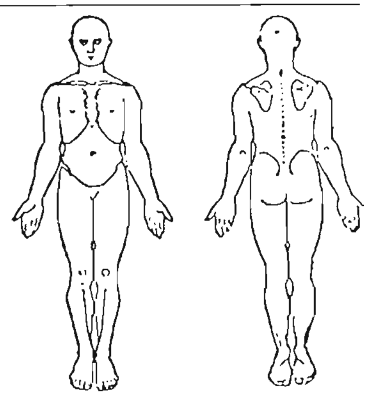
Disturbed sleep YES

Sleeping postures prone/supine/sidely

Surface firm/soft/sagging

Cough/sneeze/Dp Br +ve/-ve

Previous history LBP ONLY



Treatment OSTEOPATH

X-rays OLD SCHUERMANNS DISEASE

General health GOOD

Meds/steroids NIL

Recent surgery NIL

Accidents FALL 15 JANUARY 1991

Bilat arm/hand symptoms NIL

Disturbed gait NIL

Other -

Date

Fig 25:10. *Clinical example of a typical patient with the dysfunction syndrome.*

THORACIC SPINE - EXAMINATION

OBSERVATION

Posture sitting POOR Posture standing POOR

Kyphosis accentuated / reduced / normal

Structural scoliosis NIL Other -

MOVEMENT LOSS

(tick appropriately)	MAJOR	MODERATE	MINOR	NIL
Flexion	✓			
Extension	✓			
Rotation (R)			✓	
Rotation (L)	✓			

TEST MOVEMENTS

		PDM	ERP
Symptoms in sitting	PRESENT AFTER 4-5 MINUTES		
FLEX	PRODUCES (L) MID THOR PAIN		✓
Rep FLEX	DOES NOT WORSEN		
EXT	PRODUCES (L) MID THOR PAIN		✓
Rep EXT	DOES NOT WORSEN		
ROT (R)	NOT PAINFUL		
Rep ROT (R)	NO EFFECT		
ROT (L)	PRODUCES (L) MID THOR PAIN		✓
Rep ROT (L)	DOES NOT WORSEN		

NEUROLOGICAL

Sensation - Dural signs -

OTHER

Cervical spine O K

Ribs O K

Other

CONCLUSION

Trauma Posture Dysfunction Derangement

Other

PRINCIPLE OF TREATMENT

Posture correction Extension Flexion Other (L) ROTATION

CHAPTER TWENTY-SIX

The Thoracic Derangement Syndrome and its Treatment

DERANGEMENT ONE (QTF Classification 1)

Central or symmetrical pain adjacent to the midline between T1 and T12.
No deformity.
Rapidly reversible.

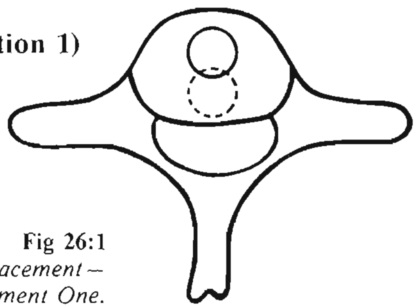


Fig 26:1
Diagram of displacement — Derangement One.

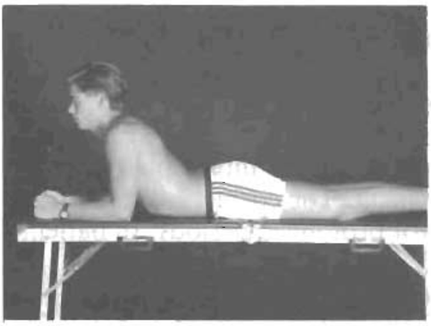
In Thoracic Derangement One flow or displacement within the disc is at a comparatively embryonic stage. The displacement acts as an obstruction to the performance of pain-free extension. A patient may have full range of motion but movement towards extension becomes more painful as the end range is approached. In some patients with more acute pain, the end range of extension is limited. Curve reversal is never affected as thoracic extension to that extent is rarely possible.

In patients with Derangement One the history and symptoms will be typical of the syndrome and the test movements will confirm the diagnosis of derangement.

Reduction of derangement

The patient should lie prone leaning on the elbows for three or four minutes (Fig 26:1a) and then perform extension in lying (Proc Two), in the prone position (Fig 26:1a) for symptoms occurring below T4-5, or supine ((Fig 26:1a) for symptoms arising from segments above T4-5. Should reduction or centralisation of pain occur, the patient must continue with extension exercises every two hours.

If on the following day no improvement has occurred, the patient should receive extension mobilisation. (Proc 3) (Fig 26:1a) This should be applied on alternate days for about a week, after which time the application of extension manipulation (Proc 3) (Fig 26:1a) should be applied if no centralisation or improvement takes place.



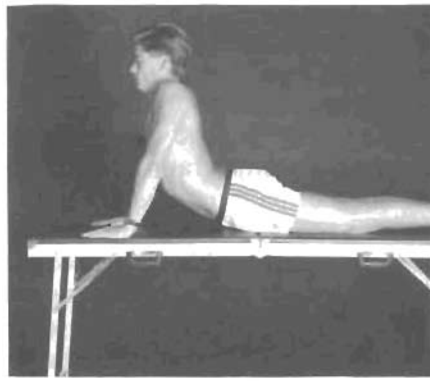
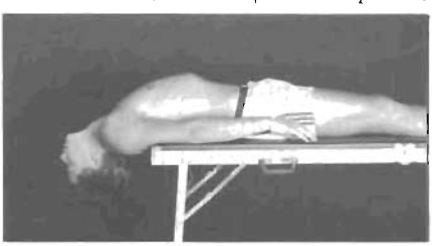


Fig 26:1a. *Showing Proc 2, 3.*
Static thoracic extension.
Thoracic extension in lying (prone).
Upper thoracic extension in lying (supine).
Extension mobilisation (and manipulation).



Maintenance of reduction

From the first treatment session the patient must be instructed to avoid flexion and rotation and encouraged to be meticulous regarding the maintenance of correct posture.

The patient should be instructed in the use of a lumbar roll to maintain correct posture while sitting.

The practice of extension procedures should be continued at home every two hours or whenever the need arises.

When the patient has demonstrated good control of symptoms for twenty four hours or longer, consideration may be given to the recovery of function which in the thoracic spine is rarely significantly impaired.

Recovery of full function

Although uncommon, it may be that following complete reduction of posterior derangement a patient may have persisting symptoms when attempting flexion. If this occurs it is likely that the patient is developing dysfunction and the procedures described for its treatment should be applied. (For recovery of function, see Chapter 25, Dysfunction Syndrome, – "Flexion dysfunction".

Prevention of Recurrence

Once recovery of function is achieved, the patient is advised to continue for up to three months, possibly longer, with extension in lying (Proc.2) (Fig 26:1a) twice per day – in the morning and evening. It is most important for the patient to remember to apply reductive extension pressures (Proc 2) (Fig 26:1a) frequently during the day when engaged in activities that require prolonged flexion. It is important that the frequency of flexion is interrupted prior to the onset of pain to prevent further displacement. The correct sitting posture must of course be maintained when sitting for prolonged periods. In patients with thoracic problems the correction of the posture when standing for prolonged periods is particularly important.

Very few patients require to reduce or discontinue activities following resolution of derangement of the thoracic spine. We must explain that patients may resume all the usual activities such as sports, gardening, concreting, activities involving lifting – provided the advice and instructions given to prevent recurrence of derangement are carried out.

Failure to prevent recurrence is often the result of *our failure* to restore full function following derangement or trauma; *our failure* to ensure the patient has adequate knowledge and full understanding of the prophylactic measures; and, not less often, the *patient's failure* to adhere to the prophylactic measure and to apply self treatment procedures when these are called for.

DERANGEMENT TWO

Acute kyphosis occurs in the thoracic spine usually as a result of trauma, compression fractures and other more serious pathologies.

Acute kyphosis resulting from thoracic derangement appears to be rare. I have personally not encountered the disorder. In the event that a patient with this problem is identified, it would be important to have radiological confirmation of the absence of serious pathology.

If screening eliminates the possibility of disease, it would be appropriate to apply the procedures described for the treatment of Derangement Two as it occurs in the lumbar spine.[100]

DERANGEMENT THREE (QTF Classification 1)

Unilateral or asymmetrical pain across the thoracic region with or without radiation laterally around the chest wall.
Rapidly reversible.

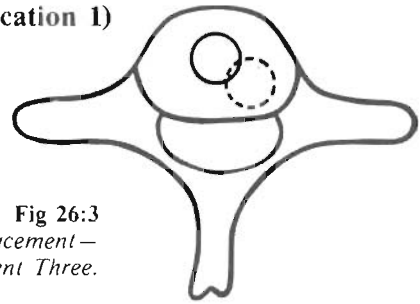


Fig 26:3
Diagram of displacement — Derangement Three.

In patients with Derangement Three, the history and symptoms will be typical of the syndrome and the test movements will confirm the diagnosis of derangement.

The patient should lie prone leaning on the elbows for three or four minutes (Fig 26:3a) and then perform extension in lying prone (Proc Two) (Fig 26:3a) for symptoms occurring below T4-5, or supine (Fig 26:3a) for symptoms arising from segments above T4/5.

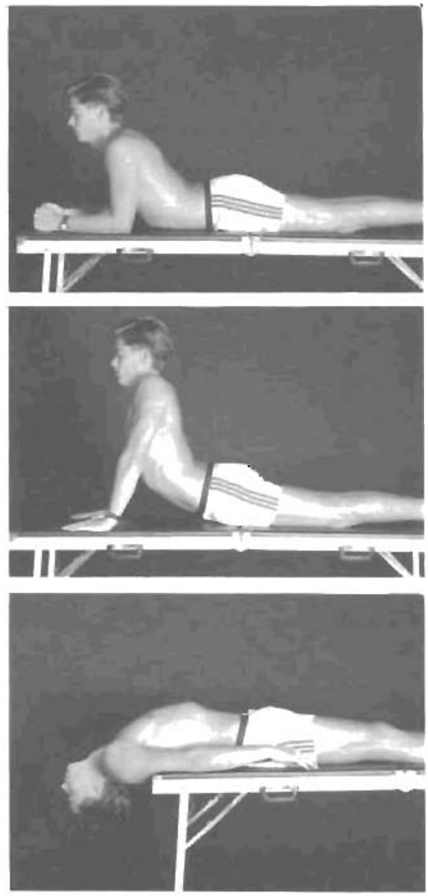


Fig 26:3a.
Static thoracic extension.
Thoracic extension in lying (prone)
Upper thoracic extension in lying (supine).

If the patient's symptoms reduce or centralise with extension, the exercise should be performed five to fifteen times every two hours. If no improvement occurs, the application of rotation in sitting (Proc 4) (Fig 26:3b) is indicated and should this reduce or centralise the symptoms, rotation in sitting should be performed five to fifteen times every two hours.

Fig 26:3b.
Thoracic rotation in extension.

If on the following day no improvement occurs, the patient should receive extension mobilisation (Proc 3).(Fig 26:3c) If no centralisation or improvement occurs, the progression of rotation mobilisation in extension (Proc 5) (Fig 26:3c) should be applied. This should be repeated on alternate days for about a week, after which time the application of rotation manipulation in extension (Proc 5) (Fig 26:3c) should be applied.

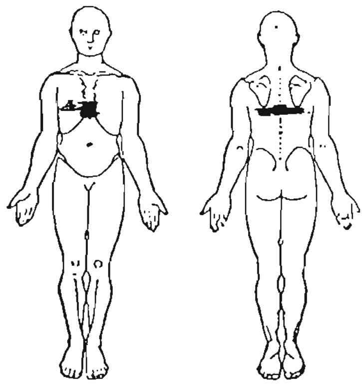
Fig 26:3c.
Extension mobilisation.
Rotation mobilisation in extension.

Recovery of function

Measures and procedures used for the recovery of function and prevention of recurrence are the same as described under Dysfunction, Chapter 25.

(DERANGEMENT)

THORACIC SPINE ASSESSMENT



Date 29 JULY 1990
Name MR NEIL ARCHIBALD
Address 21 SMITHFIELD ROAD, WELLINGTON
Telephone 391-280
Date of birth 3/10/60 (AGE 29)
Occupation PANELBEATER
Postures/stresses STANDING, BENDING
Doctor McCAW

HISTORY

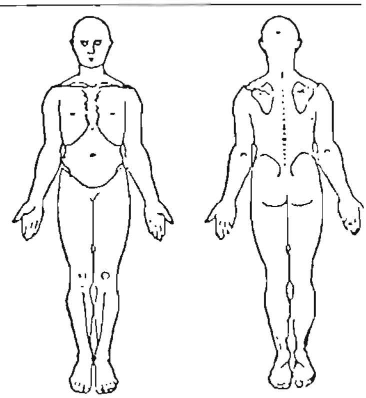
Symptoms now CENTRAL T8-10 AND LOWER STERNAL PAIN

At onset CENTRAL T8-10 PAIN

Date 29 JULY 1990

Present for 3 DAYS
Improving/stationary/worsening
Commenced as a result of SNEEZING
For no apparent reason ☐
Onset fast/slow Excessive force yes/no Time of day 8.45 A.M.
Symptoms constant/intermittent
Worse
bending sitting or rising standing walking lying
am/as day progresses / pm stationary / on the move
other BREATHING, COUGHING, LAUGHING, TURNING IN BED
Better
bending sitting or rising standing walking lying
am/as day progresses / pm stationary / on the move
other
Disturbed sleep YES
Sleeping postures prone/supine/sidely
Surface firm/soft/sagging
Cough/sneeze/Dp Br +ve/-ve
Previous history NIL

Treatment NIL
X-rays NORMAL
General health GOOD
Meds/steroids NIL
Recent surgery NIL
Accidents NIL
Bilat arm/hand symptoms NIL
Disturbed gait NIL
Other NIL



Date

Fig 26:4. *Clinical example of a typical patient with the derangement syndrome.*

(DERANGEMENT)

THORACIC SPINE - EXAMINATION

OBSERVATION

Posture sitting POOR Posture standing GOOD

Kyphosis accentuated / reduced / normal

Structural scoliosis NIL Other

MOVEMENT LOSS

(tick appropriately)	MAJOR	MODERATE	MINOR	NIL
Flexion		✓		
Extension	✓			
Rotation (R)	✓			
Rotation (L)	✓			

TEST MOVEMENTS

		PDM	ERP
Symptoms in sitting	CENTRAL T8-10 PAIN		
FLEX	INCREASES CENTRAL T8-10 PAIN	✓	
Rep FLEX	WORSENS CENTRAL T8-10 PAIN, PRODUCES LOWER STERNAL PAIN	✓	
EXT	DECREASES CENTRAL T8-10 PAIN	✓	
Rep EXT	REDUCES CENTRAL T8-10 PAIN	✓	
ROT (R)	NO CHANGE		
Rep ROT (R)	NO CHANGE		
ROT (L)	NO CHANGE		
Rep ROT (L)	NO CHANGE		

NEUROLOGICAL

Sensation NORMAL Dural signs -VE

OTHER

Cervical spine NORMAL

Ribs - VE

- VE Other - VE

CONCLUSION

Trauma Posture Dysfunction Derangement 3

Other

PRINCIPLE OF TREATMENT

Posture correction Extension Flexion Other

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