THE VALUE OF THERAPEUTIC EXERCISE IN THE MANAGEMENT OF CHRONIC MECHANICAL CERVICAL SPINE CONDITIONS

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I, Theo Manie Fourie, do hereby declare that this dissertation represents my own work, both in conception and execution.

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ABSTRACT

The purpose of this investigation was to compare the effectiveness of chiropractic manipulation alone to the use of chiropractic manipulation together with therapeutic exercise in the management of chronic mechanical cervical spine conditions.
Measurements in terms of objective and subjective clinical findings, were to be used to substantiate or refute the use of auxiliary therapeutic exercise in these conditions.

It was hypothesised that therapeutic exercise would be a valuable adjunct to the chiropractic management of chronic mechanical cervical spine conditions in terms of objective (flexibility) and subjective (pain and disability) clinical findings.

Thirty consecutive subjects suffering from chronic neck pain were obtained from local advertising (radio and newspapers) and randomly placed into two groups for comparison. The age group of subjects accepted ranged from 16 to 60 and included both sexes from any race, who had suffered from neck pain for six weeks or longer. Subjects were assessed to determine whether there were any contra-indications to manipulation or exercise. Treatment commenced for a month with both groups receiving spinal manipulative therapy and one group doing daily therapeutic exercises. The CROM goniometer, McGill Pain Questionnaire, Numerical Pain Rating Scale - 101 Questionnaire and the CMCC Neck Disability Index were

used to measure objective and subjective responses before, during and at the end of treatment and after a one month rest period.

The data was then transferred to spreadsheets and underwent statistical analysis. Analysis within each group was performed using the Wilcoxon Signed Rank Test to compare the pre-treatment readings to follow up assessment readings. Comparison between the two groups was performed using the Mann Whitney Unpaired Test at the four measurement stages. The alpha value was set at the 0.05 level of significance.

A statistically significant improvement ($p < 0.05$) was seen within the group receiving spinal manipulative therapy in terms of subjective (disability) findings. Statistically significant improvements ($p < 0.05$) were seen within the exercise group in terms of objective (flexibility) and subjective (disability and pain) findings.

The Mann Whitney Unpaired Test comparison (between the two groups) indicated a statistically significant improvement in flexibility (flexion at the end of the treatment period and extension at the end of the rest month) and in the level of disability (at the end of the rest month) in the exercise group.

The results indicate that auxillary therapeutic exercises are a valuable adjunct to spinal manipulative therapy in the management of chronic mechanical cervical spine conditions. Specifically, improvements in flexibility and in the patients' perception of their state of well-being, support the hypothesis. Evidence in this and in other studies also suggest that the entity of therapeutic exercise may be a valuable tool in pain control.

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1.0 Introduction

Neck pain and syndromes relating to neck pain are a common occurrence .Takala et al.(1982)suggested that the prevalence of neck pain in the middle aged population was 18% in women and 16% in men.

The magnitude of the neck pain problem may, however, be masked by the involvement of structures related to the cervical spine with respect to function and pain referral (such as the occiput ,mandible, upper thoracic spine and shoulder girdle) which are dealt with as separate entities (Porterfield, 1995:3).Appropriate treatment of the neck with specific reference to exercise, will result in the resolution of its related pain syndromes (McKenzie, 198:38)

Janda (1974) states that society in developed countries suffers not only from insufficient movement but also from lack of variety of movement .thus we activate more muscles which show a tendency to get tight and shortened because of chronic strain and neglect muscles that are getting weak because of disuse .The concept of connective tissue tightness is not new .Mennel postulated in 1952 that the symptoms of unduly tight fascial planes are remarkably widespread and that the fascial planes play an important role in the mobility of the human and are conductive to the binding between joints surfaces. He also stated that it is of the utmost importance to restore joint motion before attempting to stretch fascial planes. If the mobility the fascial planes was not restored recurrence of binding between joints would be inevitable .(Mennel, 1952).

With respect to spinal manipulative therapy ,research has shown that manipulation of the cervical spine has a positive effect in pain control ,however, this response is temporal (Otto&Ratkolb, 1987).

A review of the literature concerning therapeutic exercise in benign chronic axial pain indicated that :

* There is a paucity of research in the area of the cervical spine as compared to the lumbar spine. The researcher often extrapolates research from one area of the spine to explain phenomena in another area. (Porterfield, 1995:83)

*Both chronic low back and chronic neck pain are associated with weakness in the trunk and neck musculature respectively ,however it is unknown wether weakness is a cause or effect (Biering-Sorensen, 1984). Exercise is associated with improved strength and endurance and decreased pain in subjects with low back pain but literature is very sparse with respect to chronic neck pain (Rodriguez et al.,1992)

*Range of motion is also diminished in those with low back pain and improves with exercise and is associated with abatement of symptoms (Mellin, 1989).

From the above information it can be seen that the common occurrence of mechanical neck pains, which is related to subluxation (segmental hypomobility) and facial tightness, caused by the modern office milieu and the trauma of day to day living, may be positively affected in a cost effective manner by therapeutic exercise.

The purpose of this investigation was to compare the effectiveness of chiropractic manipulation alone to the use of chiropractic manipulation together with therapeutic exercise in the management of chronic mechanical cervical spine conditions. Measurements in terms of objective and subjective clinical findings were to be used to substantiate or refute the use of therapeutic exercise as an adjunct to the chiropractic management of chronic mechanical cervical spine conditions.

2.0 The Review Of The Literature

2.1 Introduction

Hult (1954) noted that the prevalence of neck pain in industrial and forest workers ranged from 35% - 75%.

Takala et al (1982) suggested that the prevalence of neck pain in the middle aged population was 18% in women and 16% in men.

Epidemiological studies suggest that the structures related to the upper extremities and the head often are involved in the painful neck syndrome ie. occiput, mandible, upper thoracic spine and shoulder girdle. The magnitude of the neck pain problem may be masked by these factors as they are often assessed and dealt with as separate entities (Gatterman, 1990: 253) (Porterfield, 1995: 1-3).

Neck pain alone, however, or neck pain associated with upper extremity problems, continues to represent a significant proportion of cases of spinal disorders (Porterfield, 1995: 3).

Chronic neck pain is one of the more debilitating musculoskeletal problems because painless and unrestricted mobility of the neck is a prerequisite for many occupational, recreational and social functions. As a result of the elaborate sensory systems of the head, the neck is involved in nearly all activities. A disruption of neck function (ie. with the emphasis on mobility and fine co-ordination) can have a significant impact on the activities of daily living or on occupational demands (McKenzie, 1989: 9) (Porterfield, 1995: 14).

Care for spinal disorders is rapidly changing from a passive to an active approach (McKenzie, 1983: 10) (Porterfield, 1995: 5). This corresponds to the trend in health care toward prevention and rehabilitative care, oriented toward habit and lifestyle change, for the express purpose of decreasing incidence and severity of disease (Winterstein in Ordet & Grand, 1992: vii).

Porterfield (1995: 5, 181) states that the primary intent of the management process for mechanical neck pain is to optimize the opportunities for the patient to become involved in his or her treatment process. Self-management has the advantages of decreasing cost and allowing the patient to take responsibility for his or her own health and thus reduce the likelihood of becoming dependant on the clinician or upon medication. Third party reimbursers are seeking health care services that are efficient and cost effective, therefore the successful practitioner of the future will be the one who becomes skilful in the delivery of a practical active treatment approach based on education that places the patient in a position of taking responsibility for the outcome.

Prolonged passive treatment that does not involve therapeutic exercise may realise short term positive results but sends the wrong message to the patient and often does not result in long term benefits.

2.2 Etiology

2.2.1 The Motor System

According to Lewit under, the term "Functional pathology of the motor system" we understand this to mean the vast field comprising functional impairment of the motor system and its interactions (Lewit in Janda, 1974). Reflex neurological changes, due to musculoskeletal abnormalities produce alterations in the expression of human posture and movement. These changes may produce pain syndromes and affect the whole process of motor re-education. (Janda, 1974)

There seem to be multiple factors in the production of the mechanical neck pain syndrome (Porterfield, 1995: 5). The motor system , however, functions as an entity and therefore a local lesion could produce a barrage of aberrant sensory information affecting the motor system as a whole.

The end result would be the typical functional impairments manifested in the osteoarticular and neuromuscular systems.

The study of the etiology of mechanical neck pain is of the utmost importance in the design of a management protocol for this syndrome and should focus on factors which adversely affect the motor system.

The objective would be to produce a system of intervention which would counteract these adverse factors and produce an equilibrium in neuromusculoskeletal function. (Janda, 1974)

2.2.2 Posture

Spinal aches and pains directly attributable to unsuitable posture are well recognised. Common examples are luxuriously soft and comfortable armchairs, prolonged car driving with poorly designed seats, sustained occupational stooping postures of the cervical, thoracic and lumbar regions , prolonged decorating of ceilings and the prone sleeper's spine. (Miller, 1984)

Postural strain aggravated by occupational stress frequently occurs when individuals assume a slumped posture with forward projection of the head with a compensating cervical hypolordosis (Gatterman, 1990: 252). Frequently the postural muscles, of the cervicothoracic spine , are statically loaded and under continuous eccentric contraction while the arms are used in a repetitive manner. Janda (1974) states that society in developed countries suffers not only from insufficient movement but also from lack of variety of movement. Thus we activate relatively more muscles which are under strain and which show a tendency to get tight and shortened, and neglect underused muscles that are getting weak. The concept of connective tissue tightness is not new. Mennel (1952) stated over forty years ago that the symptoms of unduly tight fascial planes are remarkably widespread and that fascial planes play an important role in the mobility of the human and that tight fascial planes (ie. tight neck muscles) may cause binding between joint surfaces. He also stated that it is of the utmost importance to first restore joint motion before attempting to stretch the fascial planes. If the mobility of the fascial planes was not restored recurrence of joint binding (with associated pain and stiffness) would be inevitable.

Cervico-thoracic regions are interrelated, ie. thoracic kyphosis is usually accompanied by cervical lordosis and vice versa (Voutsimas, 1986). The gravity line of the body falls quite anterior to the mid-thoracic region and with fatigue there is a tendency for the thoracic kyphosis to increase. Thus when cervical alignment or posture is poor equal concern must be given to reduce an exaggerated thoracic kyphosis.

If poor posture persists without correction spinal degenerative changes will eventually occur which can be seen in the elderly who have become bent and stooped. When asked to straighten or turn their head they are unable to comply. (McKenzie, 1989: 17) Cervical extension and retraction to the neutral or zero degree position becomes limited. Increasing lordosis occurs on extension with little axial elongation or lengthening of the neck by segmental flexion. The neck angles forward and the jaw juts out as the occiput rolls backward. (Schaefer, 1987: 366)

Changes in fascial planes due to poor posture are not random but follow a typical muscle pattern. Tightness of the cervical extensors and associated fascia frequently occur ie. the upper trapezius, levator scapulae and the fibro-elastic ligamentum nuchae. Adaptive shortening of the anterior thoracic structures also occur ie. the anterior longitudinal ligament, anterior discs, pectorals and intercostal muscles. At the same time deep neck flexors, the posterior thoracic structures, and the lower stabilizers of the scapulae may become weakened and elongated. (Janda, 1974) (Schaefer, 1987: 366)

2.2.3 Muscular Abnormalities

Muscles are broadly classified into tonic or phasic on the basis of function. The tonic, antigravity (or postural) muscles, exhibit the continuous low level of contractile activity required to maintain a given posture. These muscles contain proportionally more red, slow contracting, muscle fibres , providing for a long continued contraction. The more rapidly contracting phasic muscles used in motor skills, contain a larger proportion of white fibres providing for rapid contraction. (Gatterman, 1990: 264)

The muscles direct forces through the specialized connective tissues, by way of their attachments to the various bony levers. The actions of the muscles related to the cervical spine, ultimately depend on the afferent information supplied from the joint and muscle receptors associated with the head. (Porterfield, 1995: 12)

The muscle system not only affects the motor system through normal physiologic functioning but it also produces adverse effects due to abnormal stressors. A large proportion of neuromuscular energy is expended for postural, locomotive, occupational and recreational effort. This loss of energy is perpetuated by emotional disturbance. (Dorpat, 1955)

Kirkaldy-Willis (1988: 52) postulated that emotional disturbances act through the autonomic nervous system to produce local areas of vasoconstriction in muscle and that this predisposes the patient to developing trigger points. Vasoconstriction and sustained muscle contraction with the accumulation of metabolites leads to muscle fatigue. This in turn leads to changes in the recruitment of individual motor units in individual units and muscle groups used for specific movements. One result of these changes is altered muscle contraction of the involuntary (tonic) and other (phasic) muscles. Although what he postulated refers to the lumbar spine, it is reasonable to assume that it may apply to the cervical spine as well, as it is a characteristic of all erector muscles of the axial skeleton to go into a splinting type of painful spasm, when they experience postural and stress related fatigue (Dorpat, 1955).

Myofascial trigger points have been found to be activated directly by acute overload, overwork fatigue, direct trauma and chilling, and indirectly by other trigger points, arthritic joints, and emotional distress (Travell, 1983: 14). Therefore these factors may all affect or combine to affect the tone and function of muscles in the cervical spine area. Trigger points in the neck, related to postural strain, refer pain into the neck, head, shoulder and arms (Gatterman, 1990: 232).

When a provoked muscle goes into a fatigue spasm, as a compensatory necessity, the muscle becomes painful because the spasm impinges on the free nerve endings of the neurotendinous and neuromuscular receptors (Ufberg, 1980). If spasm is prolonged the altered local environment will cause further irritation and thus perpetuate the muscle spasm (Basmajian & Wolf, 1990: 301).

2.2.4 Sprains and Strains

Sprains and strains can be subdivided broadly into two categories: Chronic postural sprains and strains and the acute traumatic and 'whiplash' syndromes. Chronic strain produces muscular abnormalities as previously discussed . Chronic sprains are postulated to occur due to postural abnormality, producing increased abnormal stresses on ligamentous structures, when the spinal joints are placed into abnormal, non-neutral, positions for a long time (McKenzie, 1983: 17). .

As stated tonic postural or antigravity muscles become fatigued under prolonged stress and then spasmodic and weakened (Jacobson, 1987). When the central nervous system is presented with this nociceptive input, there is often an increase in control of movement patterns , 'a carefulness', which will restrict available motion and force transference (Porterfield, 1995: 3). The end result is that excessive stress is placed on the osteoarticular system. Microscopic plastic changes that occur under these circumstances are thought to cause pain in the short term, and in the long term irreversible structural changes (Porterfield, 1995: 3, 107).

Acute sprains and strains occur with trauma and in hyperflexion and hyperextension injuries. It has been demonstrated experimentally that in the syndrome suffered as a result of 'whiplash' there can be damage to cervical muscles, ligaments, discs, blood vessels and nerves, as well as to oseous structures. (MacNab, 1964)

Acute sprain may also occur when the cervical disc herniates. The mechanism is thought to be similar in the cervical spine to the lumbar spine. It is postulated that a culmulative series of rotational injuries occur that produce radial and circumferential tears with one final traumatic event when the annulus yields. (Gatterman, 1990: 164)

2.2.5 Subluxation

According to Gatterman (1990: 40,41) the subluxation complex is based on the model that spinal joint fixation will compromise neural elements and produce irritation and/or compression of these structures. Nerve irritation which results in increased neuronal activity through facilitation, is thought to occur in circumstances of hypomobility due to spinal fixations. Structural abnormalities that produce nerve compression, lead to tissue degeneration. It is believed that nerve pressure and facilitation have far reaching effects by chronic and excessive activation of the sensory, motor, and autonomic neurological mechanisms.

Korr (1975) postulated that intersegmental muscle spasms and fixations of joints could be attributed to aberrant muscle spindle activity. If the vertebral attachments of the short spinal muscles are approximated by unguarded movement and silence annulospiral receptor activity, the lack of input to the central nervous system then results in an intensifying of the gamma motor neuron gain increasing the intensity of muscle contraction and thus producing muscle spasm. Due to the contraction, the vertebral attachments cannot resume their normal positions and thus muscle spasm is perpetuated.

Patterns of normal cervical articular mechanoreceptor reflexes are profoundly distorted when cervical, articular, nociceptive afferent activity is added to that derived from normally functioning cervical mechanoreceptors (McRae, 1960). Therefore incorrect basic and important movement patterns occur (Janda, 1974). The post-traumatic soft tissue changes that are secondary to joint derangement or irritability become progressively prominent with age, mild during youth, severe in the elderly. The peri-articular connective tissues adapt by shortening on the one side of the joint and lengthening on the other side thus resulting in a relatively permanent lateral flexion, often accompanied by a degree of rotation. This makes chronic subluxations difficult to restore to a corrected position. (Grieve, 1981: 125 -129)

The spinal fixation not only produces local pain but also referred pain and of greater significance is the finding that segmental hypomobility of C0 - C1, C1 - C2 and C2 - C3 may produce sclerotogenous referral of cranial pain (Vernon, 1988: 174). The role played by subluxation or joint dysfunction in the production of headaches is thought to be widely underestimated (Gatterman, 1990: 253).

2.2.6 Psychology

As has been stated, muscular abnormalities affect the nervous input from the motor system and vice versa as nervous tension affects afferent input to the muscular system. Depression is common in patients with chronic pain, either because of the suffering that has occurred as a result of the syndrome or because of pre-existing traits that magnify the discomfort or its consequences (Porterfield, 1995: 15). This confirms what Kilkaldy-Willis (1988: 52) postulated , concerning the low back, that emotional distress would be further perpetuated by the added influence of pain due to segmental immobility or muscle spasm.
The head, neck and face are musculoskeletal regions in which stressors often manifest themselves, therefore neck pain may be influenced by psychological, emotional, social and cultural factors unique to the patient (Porterfield, 1995: 14,15).

Voluntary muscles classically affected by psychological stress are the levator scapulae with the 'weight-of-the-world-on-my-shoulders' reaction or a tense, hostile, aggressive posture (Caillet, 1984: 97). In the trapezius muscle with habitual elevation of the shoulders may be an expression of anxiety or emotional distress (Travell, 1983: 190).

It has also been noted that chronic pain, chronic disability and chronic illness behaviour become increasingly dissociated from their original physical basis and that there may be little objective evidence of any remaining nociceptive stimulus. Chronic pain becomes increasingly associated with emotional distress, depression, failed treatment and adoption of a sick role (Waddel, 1987).

It seems that pain, as a subjective response, has not served well as a guide to the success of therapeutic intervention due to large influence of psychological and cultural factors on pain (Bond & Hughes, 1987).

2.3 The Effectiveness Of Spinal Manipulative Therapy

One of the primary objectives of chiropractic therapy is to restore normal 'tone' to the nervous system. Such an objective is normally achieved by dynamic manual articular mobilization unless such a technique is contra-indicated in a specific situation. (Schafer, 1989: 33)

Sandoz (1976) states that an 'adjustment' is a passive manual manoeuvre during which the three - joint complex (the intervertebral disc, and apophyseal joints) is suddenly carried beyond the normal physiological range of movement without exceeding the boundaries of anatomical integrity.

The stretch reflex is usually associated with slow stretches such as in postural changes. A dynamic thrust will start a momentary myotatic stretch reflex even faster than a slow stretch, via the low threshold stretch circuit, but if delivered properly, a dynamic thrust will also excite the higher threshold Golgi tendon apparatus that will initiate the inverse myotatic reflex, to cause the contracted muscle to suddenly give way (the clasp knife reflex). (Schafer,1989: 56)

A number of studies have been conducted to indicate the effectiveness of re-establishing motion in fixated segments of the cervical spine with their related pain syndromes. Of specific significance are the long term effects of spinal manipulative therapy (SMT).

In a study done by Vernon et al. (1990) the pain pressure threshold of nine patients was measured five minutes after either mobilization or rotary manipulation of the cervical spine. Of the two methods used, manipulation produced significantly higher increases in the pain pressure threshold.

Yeomans (1992) assessed the cervical intersegmental mobility before and after manipulative therapy. Two systems of mensuration were utilized in fifty-eight case studies. Results revealed

that the post SMT mobility is significantly greater that pre SMT data with the exception of the C1 segment of both male and female treatment groups.

Nansel et al. (1990) studied the initial effectiveness as well as the temporal stability of cervical spine manipulation, with respect to amelioration of cervical lateral flexion passive end-range asymmetry. The end range asymmetry was verified goniometrically. Responses of two groups of pain free subjects were compared:

* those with end-range asymmetries of greater than ten degrees who, in addition, have suffered previous neck trauma and,

* those who happened to exhibit end-range asymmetries of greater than ten degrees who had no history of prior neck trauma.

All subjects received a single lower cervical adjustment delivered to the side of the most restricted end-range. Goniometric reassessments were performed 30 minutes , 4 hours and 48 hours following the adjustments. A dramatic amelioration of asymmetry (or increase in lateral flexion range of motion) was observed in both groups at 30 minutes and 4 hours post-manipulation, furthermore the magnitude of these short term effects was similar for the two groups. By 24 hours a difference in temporal response of the two groups had become readily apparent. By 48 hours the difference was even more striking. Twelve of the sixteen subjects with previous neck trauma had regained asymmetries of greater than ten degrees, whereas fourteen of the sixteen subjects, with no neck trauma, continued to exhibit asymmetries of less than ten degrees.

The researchers propose that traumatized articular, osseous or soft tissue paraspinal structures might have facilitated a set of reflex based guarding responses, most likely asymmetric ones. Chronic pain would produce habitual asymmetric movement characteristically related to pain avoidance. They concluded that further work should be done in order to determine whether it would be possible to therapeutically re-entrain a more permanent symmetric pattern of cervical end-range capability and they emphasize the need to determine the long term temporal effects of spinal adjustments.

The long term effects of cervical spine manipulative therapy were assessed by Turk & Ratkolb

(1987) with respect to the amelioration of symptoms in patients with chronic cervicogenous headaches. In a retrograde analysis, after three weeks of manipulative therapy, it was found that 75% of all patients said that their headaches had diminished. After six months it was found that 25% of the patients, said that they had no headaches anymore and took no more analgesics. Forty percent said that their condition had improved but that they still took analgesics. Thirty-five percent of the patients said that their condition had only improved for about one month after treatment and that the headaches had reappeared again and they had begun to use analgesics again.

From the given information and studies it can be seen that SMT definitely produces a diminishing in symptoms and signs. This response, however, is temporal and is dependent on the pre-injury status of the patient and other factors, which have not been clearly established, but may be encompassed by the etiological factors given.

2.4 The Effectiveness of Exercise

2.4.1 Introduction

The effect of exercises to diminish the recurrence of signs and symptoms, determined by the etiological factors given, needs to be evaluated as this may shed light on which type of intervention to utilise in chronic mechanical cervical spine conditions.

2.4.2 The benefit and principles of strengthening exercises

Physical training increases the bulk of muscle fibres and connective tissue strength (Stone, 1988) and enhances the interstitial blood supply, therefore the physiologic mechanisms necessary to absorb extravasated fluid are more efficient in trained than in untrained muscle (Schafer, 1987: 162). Muscular hypertrophy of postural muscles decreases strain on ligamentous structures during prolonged activity (Zohn, 1988: 128).

Another objective of strengthening exercises is to produce fine muscle co-ordination which is necessary to prevent damage of spinal joints. At the end of fast movement the active inhibition of the antagonist switches into rapid facilitation and contraction in order to slow down movement and prevent injury. If this reciprocal interplay is altered great danger for the joint occurs. (Janda, 1974) Synchrony of motor unit firing can be trained in strengthening exercises. This phenomena was shown in a study by Hakkinen & Komi (1983). Increased strength was initially accompanied by increased integrated electromyographic activity and later followed by muscular hypertrophy. The electromyographic readings decreased during the latter portions of this trial, while mechanical work remained the same as the muscle hypertrophied. It seems, therefore, that as we train we 'learn' to activate muscles more effectively .

Isometric and isotonic exercises produce strength gains, however, isometric exercises are known to produce greater strength gains while isotonic exercises produce strength gains more evenly through all ranges of activity. Isometric exercises also involve no joint movement, they help maintain strength and retard atrophy, they can be performed in a short time and they require no specialized equipment. The proper rhythm for an isometric exercise is contract-hold-relax-rest. For a rule of thumb contraction is held for a count of six and the rest period should not be for less than a count of three. Isometric exercises are normally performed at a low frequency. (Ordet & Grand, 1992: 73) (Zohn, 1988: 130)

2.4.3 The benefits and principles of stretching

Connective tissue reorganises itself responding to stretch with lengthening and to immobilization with shortening and thickening. To overcome progressive shortening of tissue, daily repeated movement through a full and normal range of movement is essential. (Basmajian, 1990: 304)

From a biomechanical viewpoint it appears difficult to produce permanent deformation of connective tissue with the typical stretching manoeuvres applied in the clinical situation. Stretching, however, becomes viable where the micro and macro traumas that the connective tissues are subjected to result in loss of normal range of motion because of degenerative changes. When the tissues become weakened and inert they may be altered by manual and mechanical techniques because they are not as resilient as uninjured tissue. (Porterfield, 1995: 107,108)

Stretching also effects the neuromuscular component. Basmajian (1990: 302) states that treatment of muscle spasm must include a lengthening stretch as lengthening of tissues allows for dilatation of capillaries and results in increased blood flow. Travell (1983: 27) also confirms that in the treatment of myofascial trigger points passive stretching is an essential component.

For stretching to take place more effectively there are neurophysiological means of producing maximum tissue elongation. Proprioceptive neuromuscular facilitation(PNF) affects the neuromuscular mechanism through stimulation of the proprioceptors. (Knott & Voss, in Basmajian, 1990)

Specifically PNF techniques are the source of stimuli that raise the threshold of motor neurons or result in a decrease in number of actively discharging motor neurons (Prentice, 1983). The primary reason for PNF effectiveness lies in manipulation of the stretch reflex (Basmajian, 1990: 305)

Isometric contraction followed by relaxation results in inhibition of the alpha motor neuron, therefore stretching can take place more effectively (Prentice, 1983). According to Sherringtonian's law of reciprocal inhibition, if a tight muscle is not stretched it acts in an inhibitory fashion on its antagonist. By stretching tight muscles the 'stage is set' to optimally focus on weakened muscles. (Janda, 1974)

PNF exercises can be performed isometrically or isotonically and usually have elements of both in them. The slow stretch is best for relaxing a given muscle. In the early stages of stretching one moves to a position of mild stretch for 20 -30 seconds and then to a state of moderate stretch for 20 - 30 seconds. Stretching to the point of pain has a negative effect. (Ordet & Grand, 1992: 81 - 83)

2.4.4 Further benefits of therapeutic exercise

Exercise is stated by authors to have the therapeutic benefit of decreasing pain. Pain generated by chemical inflammatory irritation of nociceptive nerve endings can be reduced by physically reducing chemical irritants. Gentle exercise is one way of reducing inflammation and edema, (Basmajian, 1990: 303) , this is done by stimulation of fluid dynamics which includes both blood flow and lymph drainage. Therapeutic exercise also stimulates afferent input in the central nervous system thus regulating pain and modulating muscle contraction (Porterfield, 1995: 210), this is postulated to occur, in part, through stimulation of joint mechanoreceptors (Wyke in Basmajian, 1990: 301).

The ultimate objective of achieving optimum stretch parameters and muscular strengthening is to prevent the recurrence of subluxation (segmental hypomobility) of the spine (Mennel, 1952).

2.5 Contra-indications to Exercise

From a functional perspective the prescription of exercise to treat pain arising from a joint complex where motion is restricted or impaired is unsound (Zohn, 1988: 128).

Hypomobility may also be due to irreversible contractures which usually involve replacement of normal elastic tissues with relatively inelastic tissues such as bone, fibrotic tissues, adhesive scars and calcific infiltration.

Exercise, especially stretching, is contra-indicated in acute inflammatory conditions and hypermobility. In the case of injury too much motion, too early, can be deleterious to the final patient outcome. (Ordet & Grand, 1991: 110,117)

In chronic disorders vigorous active motion increases intradiscal pressure and can aggravate inelastic degenerated soft tissue, therefore isometric exercises are the preferred treatment modality (Schafer, 1987: 368).

2.6 Exercise in Benign Chronic Axial Pain

2.6.1 Strengthening

Several studies have shown a high correlation between individuals with chronic low back pain and those with trunk muscle weakness and a diminishing of symptoms with a prescription of strengthening exercises.

One cannot deduce that because exercise was effective in the lower back, with regard to objective and subjective clinical findings, it also applies to the neck. The low back, however, is also a spinal structure involving voluntary and involuntary muscles, therefore successful interventions in this area may shed light on and give useful direction for studies focusing on the cervical spine area.

A study done by Chaffine & Kyung (1973) showed that the incidence of low back pain was proportionate to the lifting strength requirement and therefore highlighted the necessity for trunk muscle strengthening.

Manniche et al.(1988) showed that intensive low back extensor strengthening for three months diminished symptoms in chronic low back pain in subjects who had symptoms for at least one year. Comparison groups with isometric or less extensive extensor strengthening did not do as well with regard to symptoms or with a functional impairment scale at the three month follow up.

According to a survey done by Rodriguez et al., (1992), on the effectiveness of exercise, only two studies have evaluated this strength of neck flexor musculature in patients with chronic neck pain. Unfortunately muscle strength assessments, in the first study, were performed manually with no objective verification.

In the second study Silvermann et al. (1991) compared anterior cervical muscle strength in thirty subjects with mechanical neck pain and thirty asymptomatic control subjects. Assessment was made with a MicroFET hand held dynamometer in three positions. This dynamometer had the capacity of integrating three strain gauges (measuring the force vectors from each direction) and reporting the result in force. Patients lay supine and the dynamometer was placed on the forehead to measure forward flexon (headlift). Analysis with the Wilcoxon Scores showed that patients with neck pain had significantly less strength in all three positions. They conclude that the efficiency and effect of cervical muscle strengthening should be further defined.

2.6.2 Flexibility

Research regarding therapeutic exercise and flexibility in the cervical spine could not be found. Once again information from studies done in the low back is the only available material we have on exercise intervention for spinal conditions.

Biering-Sorensen's survey (1983) of over 900 people included an examination and a one year follow up questionnaire. It was found that reduced flexibility of the back and hamstrings were more pronounced in those experiencing recurrence of ongoing low back pain in the following year.

Mellin's study (1989) of 256 subjects with chronic low back pain given three weeks of exercise therapy showed a positive correlation between subjective improvement and improvement in lumbar lateral flexion and rotation and hip extension and straight leg raising. In another study done by Mellin (1986) the pre-treatment back trouble and progress were assessed by subjective ratings in questionnaires before the treatment and at the second, sixth and twelfth month follow up. Physical measurements were taken before the treatment and at the second month follow up. Progress was significantly associated with follow up increases of spinal lateral flexion, rotation and hip flexion and lateral rotation.

As with strength, diminished flexibility is associated with subjective findings (pain) and increased flexibility is associated with decreased pain.

2.6.3 Co-ordination

The importance of appropriate timing and forcefulness of activation of the spinal musculature needs to be established. The effect of exercise on motor unit activation has been shown, but research on the effect of functional exercise, or exercises to improve co-ordination, is lacking. (Rodriguez et al., 1992)

Soderberg & Bar (1980) studied surface electromyographic activation of trunk musculature during activity. Subjects with chronic back pain did not activate the abdominal musculature during valsalva as much as controls, nor did they activate extensor musculature during valsalva or sit-ups as much as controls. This information suggests that trunk musculature which may serve a protective function during activity, may be deficient in subjects with chronic low back pain.

King et al., (1988) showed that chronic low back pain suffers did not respond to suddenly applied external load as much as did controls.
Similar studies involving the cervical spine could not be found.

2.6.4 Endurance

Diminished cardiovascular fitness was shown by Cody (1979) to be associated with a higher incidence of back pain, disability and more frequent recurrences of episodic low back pain. The 120 subjects in the study by Morrison et al. (1988) were taught to incorporate general fitness and back strengthening into their lives as well as general back education and body mechanics in six three hour sessions. Pain report measured by the Oswestry Pain Scale was not different from controls after six sessions, but declined significantly from initial values after the one year follow up. This study is significant in that it not only indicates the effectiveness of general fitness and strengthening but it serves as evidence of the long term benefits of exercise for back pain. Unfortunately, other variables were involved in this study.
Once again similar studies, relating specifically to the cervical spine, could not be found.

2.6.5 Psychological Factors

Pain reduction from exercise in chronic neck and back pain may be influenced by psychological factors such as diminished fear of activity. In a study done by Fordyce et al. (1980) patients with chronic pain were asked to perform certain exercises and their behaviour assessed. Results indicate a negative relationship, ie. the more exercise performed, the fewer the pain behaviours.

The authors feel that ,due to psychological and cultural influences on pain, patients suffering from chronic pain anticipate that free unrestricted movement will result in increased pain, thus a positive correlation exists between exercise or activity and suffering. This 'state of mind' may exist even though the original physical basis, for pain production, no longer exists.

The researchers believe from the results achieved in this and other studies where behavioural modification techniques were used, by encouraging patients to increase activity previously restricted, pain behaviours may be diminished. This occurs because the strong relationship between decreased motion and nociception, because of neurological conditioning during the acute or post injury phase, is altered by motor re-education.

Psychological factors in patients seem to be positively affected in back care programs which include exercises as opposed to patients which are left to their own devices. Hazard et al. (1989) reported an 81% return to work rate after a pain management program in comparison with a 21% of those that did not take part in the program because funding was refused. Despite this marked difference in return to work rate, working and non-working program graduates differed only in trunk flexibility and cycling endurance at the one year follow up. Program graduates who returned to work sighted resolution of fear or re-injury, compensation issues, employment dissatisfaction, family discord and other psychological issues as critical factors for the success of the program.

2.7 Therapeutic Exercise Design for Chronic Neck Pain

Looking in retrospect factors such as strength, flexibility and co-ordination are associated with back pain; the evidence as to their association with neck pain is still scarce. Whether these limitations in the neuromusculoskeletal system are the cause or the effect of long term pain is not yet understood. Exercises have been shown to diminish symptoms, decrease the recurrence of pain and possibly affect the patient's perspective and attitude.

The structure of the neck and back differ due to adaptations for specific functions. The emphasis of function in the low back is that of stability and the ultimate goal is to produce hypertrophy and strength. The emphasis of function in the neck is mobility and the goals are to produce flexibility and the ability to react rapidly and endure prolonged positions. (Porterfield, 1995: 211)

Rehabilitative exercises are given in the post injury phase to promote recovery whereas conditioning exercises are given to improve the physical capability of healthy subjects.

It is needful with rehabilitative or therapeutic exercise to consider the patient's status and the kinetic hazards posed by the exercise as opposed to conditioning exercises (Ordet & Grand, 1992: 88). Therapeutic exercise may be performed by stretching and strengthening with the two forms of exercise usually performed in combination (Zohn, 1988: 128). The approach to be used is to attempt directly to produce normally balanced muscle action, however, a misaligned spine may simply re-instate the imbalance, therefore spinal correction through manipulation, or adjustment, is likely to be needed (Ordet & Grand, 1992: 82).

It is very important that patients perform each exercise exactly as intended. Form is taught by careful explanation, demonstration and pictures. (Ordet & Grand, 1992: 88) The clinician focuses on establishing safe and complete movement patterns (Porterfield, 1995: 211) and the patient begins to appreciate different perceptions of contracture and relaxation (Schafer, 1987: 368).

The focus of therapeutic exercises would be to stretch tightened structures and strengthen weakened structures as outlined under 'posture' (Also refer to, App. 12) and patients should continue exercises for at least four weeks due to the motoneuronal adaptations that develop in the first four weeks of training (Hakkinen & Komi, 1983).

It is thought that through the proper application of therapeutic exercises (stretching and strengthening) the occurrence of mechanical cervical spine conditions will be diminished or delayed and that it will be a valuable adjunct in the treatment of these conditions, and as such needs to be researched.

3.0 Materials and Methods

3.1 Study Design and Protocol

To determine the study design a critical analysis of the aim of the project revealed three objectives which were to be incorporated in the methodology:

* To determine the effectiveness of chiropractic manipulation in conjunction with therapeutic exercise in the management of chronic mechanical cervical spine conditions in terms of objective and subjective clinical findings.

* To determine the effectiveness of chiropractic treatment alone in the management of chronic mechanical cervical spine conditions in terms of objective and subjective clinical findings.

* To analyse and interpret the obtained data in order to establish the effectiveness of therapeutic exercise as an adjunct to chiropractic treatment in the management of chronic mechanical cervical spine conditions.

3.1.1 Title

The study design was that of a randomised comparative study of two groups, with both groups receiving chiropractic treatment in the form of spinal manipulative therapy and one group receiving auxiliary therapeutic exercise.

The objectives were met by evaluation of :

A) The primary data ie. subjective and objective findings obtained during the execution of the research program.

B) The secondary data ie. existing data obtained through a literature search of the CD Rom books and articles containing relevant studies.

3.1.2 The Design Protocol

The program consisted of ten appointments over the duration of eight to ten weeks (App. 10). A sample consisting of thirty subjects was recruited through advertising in local newspapers and over the radio.

Subjects who responded were contacted telephonically and questioned to determine whether they would be suitable for evaluation and available for the duration of the program.

At the initial consultation subjects had to sign an informed consent form (App. 11) and were assessed by means of a case history (App. 1), physical (App. 2) and regional examination (App. 3). After this a full radiographic examination was conducted (App. 4).

Subjects accepted were randomly placed into their respective treatment groups. Thirty cards were placed into a bag and fifteen cards were allocated to each group. A card was drawn for each new patient entering one of the study groups. If any of the patients left the program prematurely their card was placed back in the bag.

From the second to ninth appointment each group received chiropractic manipulation of the cervical spine twice a week. In addition to this the exercise group did their exercises daily. (App. 12) All treatment ceased for a month after the ninth appointment.

Subjective evaluations with reference to quality (App. 5) and intensity of pain (App. 6), disability (App. 7) and objective evaluations with reference to flexibility (App. 8) were conducted on the second, fifth, ninth and tenth appointments.
Subjects were also required to keep a diary of daily discomfort (App. 9) from the second to tenth appointments for personal record and to remind the exercise group to do their exercises.

The data obtained was evaluated statistically to determine objective and subjective changes within the two groups and between the two groups. The results obtained from these analyses were used
to discuss the role of adjustments and auxiliary therapeutic exercises in treating chronic mechanical neck pain and to draw up any conclusions and recommendations related to the effectiveness.

3.2. Subjects

The age group of patients accepted ranged from 16 - 60 and included both sexes from any race who had suffered from neck pain for longer than six weeks. The group was old enough to answer the questionnaire with ease and be responsible to fulfil the requirements pertaining to the exercise group and yet young enough not to require adaptations to the exercise parameters given.

Patients were assessed by means of the case history, physical and regional examinations to determine whether there were any general health problems in which spinal manipulation or exercises would be contra-indicated (Gatterman, 1990: 67) ie.

* acute traumatic injuries
* vascular complications
* tumours
* infections
* arthritides
* psychological considerations

Patients also received a radiographic examination to determine whether there were any gross structural abnormalities which could affect the results obtained. Pregnant females were not accepted to avoid radiation to the foetus.

3.3 Ethical Considerations

Treatment in the form of chiropractic manipulation and exercise, for the purpose of this study, was based upon contemporary norms in the scientific management of musculoskeletal conditions.

Complications due to treatment of cervical spine and related structures are avoided by proper examination and careful treatment procedures.

The harmful effects of radiographic examination to the extent required for this study were minimal.

3.4 Interventions

3.4.1 Spinal Manipulative Therapy

Both groups received SMT. Tender structures in the cervical spine were identified using the regional examination (App. 3).

Specific levels of hypomobility were identified using motion palpation. The cervical spine was adjusted with the patient lying in the supine position and the researcher, in the fencers' stance , at the head of the patient on the lesion side. The index finger was used for contact behind the articular pillar while the indifferent hand was placed over the rim of the occiput to apply traction , to laterally deviate the head toward the lesion and rotate the head away from the lesion side if indicated.

A sudden short amplitude pectoral thrust was given at the point of restriction. (Szaraz, 19 : 57)

3.4.2 Exercises

The exercise group received the exercise format after their first treatment of SMT. The exercises were demonstrated with the researcher sitting directly opposite the patient in an upright, relaxed posture, looking straight ahead, with the line joining the eyes perpendicular to the midsagital plane of the body. Each set of exercises was demonstrated using the related pictures. (App. 12)

* Turn stretching: the hand was placed over the mandible with the chin in the hollow of the palm. The head was rotated against resistance for six seconds, without any movement taking place. After relaxation the head was rotated to the opposite side for twenty seconds, by using the same hand to push against the chin. The patient was then allowed to relax for three seconds after which the stretch was repeated. This procedure was repeated on the opposite side.

* Side stretching: the hand was placed over the parietal area of the skull with the elbow perpendicular to the midsagital plane of the body. The head was laterally flexed against resistance for six seconds without any movement taking place. After relaxation the head was laterally flexed to the opposite side for twenty seconds by placing the opposite hand over the vertex of the skull and pulling the head towards the opposite shoulder. After three seconds of relaxation the stretch was repeated. This procedure was repeated on the opposite side.

* Forward stretching: both hands were placed behind the head with the fingers interlacing over the occipital area of the skull and the elbows pointing forward. The head was extended against resistance for six seconds without any movement taking place after relaxation the patient was instructed to allow gravity to pull the head and the arms down forward. This stretch was held for twenty seconds and after three seconds of relaxation it was repeated.

* Forward strengthening: both hands were placed over the mandibles with the chin resting on

the hollows of the palms. The head was flexed forward against resistance for six seconds without any movement taking place. This contraction was repeated three times with three seconds relaxation after the first and second contraction.

* Upper back strengthening: The thoracic and cervical spine were flexed forward in a moderate contracture for six seconds, both arms were folded across the front of the body and the chin tucked in toward the chest to assist in flexon. After relaxation the head and upper back were extended over backward, the shoulders were abducted to ninety degrees and externally rotated and the scapulae pressed together (to assist the extension for twenty seconds). After three seconds of relaxation the stretch was repeated.

Patients were instructed to be gentle with their exercises and not to increase the pressure of contraction or stretch if any pain was detected.

3.5 Measurements

3.5.1 Objective measurements

Objective measurements were obtained by using the CROM goniometer. This device has been shown to produce good intra and inter tester reliability in measuring cervical spine ranges (Youdas et al., 1991).

Cervical spine ranges of motion were measured with the patient sitting in a straight back chair with the low back pressed against the back of the chair. The chair was placed so that the magnetic yoke could face North as indicated. The CROM was fastened in position and measurements, in degrees, were taken for each range. Care was taken to ensure that the shoulders and body of the patient remained stationary and that each motion was purely in the direction of the range being measured.

Results of each of the six ranges were recorded on appendix 8 and transferred to spreadsheets for interpretation.

3.5.2 Subjective measurements

The CMCC Neck Disability Index (NDI) was used to determine the level of disability incurred by the chronic neck pain (App. 7). The CMCC NDI has been shown to have a high degree of validity and internal consistency (Vernon & Mior, 1990).

The questionnaire consists of ten categories each made up of six options . The first option received a score of zero and the sixth a score of five. The total score of all categories was added up and multiplied by two to achieve a percentage disability for the patients at different measuring times. The results were recorded on spreadsheets for the two groups.

The Numerical Rating Scale (NRS-101) was used to determine the severity of pain (App. 6). The validity and practicality of this questionnaire has been demonstrated by Jensen et al. (1985). The responses were recorded on spreadsheets as separate percentages for worst and least pain.

The short- form McGill Pain Questionnaire was used to determine the quality of pain. (App. 5) The validity and practicality of this questionnaire has been demonstrated by Melzack

(1987). The quality of pain responses was scored depending on the severity of each type of pain and graded as: zero for no pain, one for mild pain, two for moderate pain or three for severe pain. A total out of 45 for the fifteen types of pain listed was calculated and converted into a percentage. The results were recorded onto spreadsheets.

The responses in questionnaires were relative to the 24 hours preceeding the measurement.

3.6 Statistical Analysis

5Data, relating to the group receiving auxiliary therapeutic exercises, which had been accumulated and tabulated on spreadsheets, was statistically analysed and interpreted by means of the Wilcoxon Signed Rank tests to compare the objective (flexibility) and subjective (pain intensity, pain quality and disability) measurements, before treatment, to those taken at the fifth, ninth and tenth follow up appointments. This was done to determine the effectiveness of SMT together with therapeutic exercises over the allocated time.

The alpha value of significance was set at 0,05 (5% level of significance). The null hypothesis was that no change in flexibility or in the patients' perception of disability, pain intensity or severity, would occur at any stage of comparison (Steyn et al., 1994: 405 - 411).

This method of statistical analysis was also used in the group receiving SMT alone.

Data, relating to both groups, was also statistically analysed and interpreted by means of the Mann -Whitney U test to compare objective and subjective measurements taken at the pre-treatment, fifth, ninth and tenth appointments of the group receiving auxiliary therapeutic exercises, to those of the group receiving SMT alone.

The alpha value of significance was set at 0,05. The null hypothesis was that there would be no difference in flexibility or in the patients' perception of disability, pain intensity or severity, at any stage of comparison.

The groups were also assessed to be compared with respect to age, chronicity of pain and any history of injury.

4.0 Results

4.1 Criteria Governing Admissibility of the Data

Only the data obtained from the case history, physical and regional examinations (App. 1,2 and 3) and from the pain quality, pain intensity and disability questionnaires (App. 5, 6 and 7) completed under the researchers supervision, were used.

Only measurements, pertaining to the active ranges of motion (flexion, extension, lateral flexion and rotation) (App. 8), performed by the researcher, were recorded.

4.2 Demographic Data

Table 4.1 Demographi data related to the Spinal Manipulative Therapy group

Px	Age	Sex	Chronicity	Trauma
1	54	F	30 yrs	Y - MVA
2	41	F	2 yrs	N
3	49	F	2 yrs	Y - MVA
4	32	M	1 yr	Y - MVA
5	33	F	8.5 yrs	Y - MVA
6	49	F	2 yrs	Y - MVA
7	37	F	13 yrs	N
8	22	F	2 yrs	N
9	50	M	6 mths	N
10	19	F	1.5 yrs	Y - MVA
11	39	F	3 mths	N
12	19	F	1 yr	N
13	50	M	20 yrs	Y - FALL
14	46	F	10 yrs	Y - MVA
15	38	M	1.5 yrs	Y - MVA
TOTAL	MEAN AGE	M : F	MEAN CHRONIC - ICITY	Y : N
15	38.5	4 : 11	6,35 yrs	9 : 6

Table 4.2 Demographic data related to the exercise group.

Px	Age	Sex	Chronicicity	Trauma
1	26	F	3,5 yrs	N
2	50	M	1,5 yrs	N
3	37	F	1 yr	Y - MVA
4	30	F	1 yr	Y - MVA
5	22	F	1,5 yrs	N
6	44	M	1,5 mths	N
7	40	F	2 yrs	Y - MVA
8	31	M	10 yrs	Y - MVA
9	40	M	9 yrs	N
10	56	M	3 yrs	Y - FALL
11	46	F	20 yrs	N
12	32	F	7 yrs	Y - MVA
13	21	F	8 yrs	Y - MVA
14	29	M	8 yrs	Y - MVA
15	54	F	38 yrs	Y - FALL
TOTAL	MEAN AGE	M : F	MEAN CHRONIC - ICITY	Y : N
15	37.2	6 : 9	7.58 yrs	9 : 6

4.3 Range of Motion

4.3.1 Flexion

Table 4.3 Mean Flexion Readings (n=30)

GROUP	PRE Tx	5TH FU	9TH FU	10TH FU
SMT	49.40°	49.13°	47.73°	49.53°
EXER	49.53°	52.73°	54.73°	53.67°

4.3.1.1 Results of the Wilcoxon Signed Rank Test

Statistical Analysis at the 5% level of significance revealed:

1. No significant increases in flexion in the spinal manipulative therapy (SMT) group.
2. Significant increases in flexion at the 5th (p=0.0306842) and 9th (p=0.0306842) follow up measurements in the exercise group.

4.3.1.2 Results of the Man Whitney Unpaired Test

Statistical analysis, comparing the two groups, revealed:

A significantly greater increase in flexion (p=0.0093455) at the 9th follow up measurement in the exercise group.

4.3.2 Extension

Table 4.4 Mean Extension Readings (n=30)

GROUP	PRE Tx	5TH FU	9TH FU	10TH FU
SMT	69.93°	68.00°	71.27°	64.07°
EXER	73.40°	69.53°	72.53°	73.93°

4.3.2.1 Results of the Wilcoxon Signed Rank Test

Statistical analysis at the 5% level of significance revealed:
No significant increases in extension in either group.

4.3.2.2 Results of the Man Whitney Unpaired Test

Statistical analysis, comparing the two groups, revealed:
A significant difference in extension (p=0.0208838) at the 10th follow up measurement, in favor of the exercise group. The exercise group had gained a slight increase in extension after the month follow up, whereas the SMT group had lost any gain in extension and showed a greater limitation in flexibility after the month follow-up than before treatment had commenced.

4.3.3. Right Rotation

Table 4.5 Mean Right rotation readings (n=30)

GROUP	PRE Tx	5TH FU	9TH FU	10TH FU
SMT	65.73°	65.40°	66.53°	65.46°
EXER	65.93°	68.00°	69.87°	69.53°

4.3.3.1 Results of the Wilcoxon Signed Rank Test

Statistical analysis revealed:

1. No significant increases in right rotation in the spinal manipulative therapy (SMT) group.
2. A statistically significant increase in right rotation (p=0.0080784) at the 10th follow up in the exercise group.

4.3.3.2 Results of the Man Whitney Unpaired Test

Statistical analysis comparing the two groups revealed:
No significant differences, despite the improvements in flexibility in the exercise group.

4.3.4 Left Rotation

Table 4.6 Mean Left Rotation Readings (n=30)

GROUP	PRE Tx	5TH FU	9TH FU	10TH FU
SMT	61.20°	63.53°	64.40°	64.00°
EXER	65.93°	67.73°	70.00°	68.80°

4.3.4.1 Results of the Wilcoxon Signed Rank Test

Statistical analysis revealed:
No significant increase in left rotation in either group despite improvements seen in flexibility in both groups.

4.3.4.2 Results of the Man Whitney Unpaired Test

Statistical analysis comparing the two groups revealed:
No significant differences between the groups.

4.3.5 Right Lateral Flexion

Table 4.7 Mean Right Lateral Flexion Readings (n=30)

GROUP	PRE Tx	5TH FU	9TH FU	10TH FU
SMT	38.60°	39.13°	39.40°	37.80°
EXER	42.26°	39.60°	41.40°	41.06°

4.3.5.1 Results of the Wilcoxon Signed Rank Test

Statistical analysis revealed:
No significant change in right lateral flexion in either group.

4.3.5.2 Results of the Man Whitney Unpaired Test

Statistical analysis comparing the two groups revealed:
No significant difference between the two groups.

4.3.6 Left Lateral Flexion

Table 4.8 Mean Left Lateral Flexion Readings (n=30)

GROUP	PRE Tx	5TH FU	9TH FU	10TH FU
SMT	37.60°	34.73°	36.13°	36.13°
EXER	40.30°	39.20°	41.46°	40.80°

4.3.6.1 Results of the Wilcoxon Signed Rank Test

Statistical analysis revealed:
No significant change in left lateral flexion in either group.

4.3.5.2 Results of the Man Whitney Unpaired Test

Statistical analysis comparing the two groups revealed:
No significant difference between the two groups.

4.4 McGill Pain Questionnaire

Table 4.9 Mean McGill scores (n=30)

GROUP	PRE Tx	5TH FU	9TH FU	10TH FU
SMT	22.93%	19.60%	15.60%	15.86%
EXER	16.13%	12.26%	10.53%	9.60%

4.4.1 Results of the Wilcoxon Signed Rank Test

Statistical Analysis at the 5% level of significance revealed:

1. No significant changes within the spinal manipulative therapy (SMT) group.
2. A significant decrease in the quality of pain, at the 5th (p=0.0216539) and 10th '(p=0.0079306) follow up measurements, in the exercise group.

4..2 Results of the Man Whitney Unpaired Test

Statistical analysis comparing the two groups revealed:
No significant change in the quality of pain responses, despite the marked changes within the exercise group.

4.5 Numerical Rating Scale

4.5.1 Worst Pain Experienced

Table 4.10 Mean NRS (worst) scores

GROUP	PRE Tx	5TH FU	9TH FU	10TH FU
SMT	56.60%	41.40%	45.53%	44.73%
EXER	53.60%	50.60%	32.40%	33.60%

4.5.1.1 Results of the Wilcoxon Signed Rank Test

Statistical Analysis at the 5% level of significance revealed:

1. No significant changes within the spinal manipulative therapy (SMT) group.
2. A significant decrease in the intensity of pain (worst), at the 9th (p=0.0049116) and at the 10th (p=0.0080784) follow up measurements, in the exercise group.

4.5.1.2 Results of the Man Whitney Unpaired Test

Statistical analysis comparing the two groups revealed:
No significant change in the intensity of pain (worst), despite the marked changes within the exercise group.

4.5.2 Least Pain Experienced

Table 4.11 Mean NRS (least) scores

GROUP	PRE Tx	5TH FU	9TH FU	10TH FU
SMT	20.60%	25.46%	18.13%	17.73%
EXER	21.20%	20.20%	12.86%	16.60%

4.5.2.1 Results of the Wilcoxon Signed Rank Test

Statistical analysis revealed:

1. No significant changes in the spinal manipulative therapy (SMT) group.
2. A significant decrease in the intensity of pain (least) ($p=0.0385497$) at the 10th follow up treatment in the exercise group.

4.5.2.2 Results of the Man Whitney Unpaired Test

Statistical analysis comparing the two groups revealed:
No significant change in the intensity of pain (least).

4.6 CMCC - Neck Disability Index

Table 4.12 Mean CMCC scores (n=30)

GROUP	PRE Tx	5TH FU	9TH FU	10TH FU
SMT	24.00%	21.20%	18.00%	20.93%
EXER	20.93%	18.13%	11.30%	11.46%

4.6.1 Results of the Wilcoxon Signed Rank Test

Statistical analysis at the 5% level of significance revealed:

1. A significant improvement in the disability scores (p=0.048046), at the 9th follow up measurement, in the spinal manipulative therapy (SMT) group.
2. A significant improvement in the disability scores at the 9th (p=0.0016417) and 10th (p=0.0016417) follow up measurements, in the exercise group.

4.6.2 Results of the Man Whitney Unpaired Test

Statistical analysis comparing the two groups revealed:

A significantly greater improvement in disability scores (p=0.0094383) at the 10th follow up measurement, in the exercise group.

5.0 Discussion

5.1 Objective Measurements - Flexibility

Tables 4.3 - 4.8 contain the mean values determined to demonstrate changes in flexibility (ranges of motion) over a two month period. The Wilcoxon Signed Ranks Test revealed statistically significant increases in flexion (at the 5th and 9th follow up measurements) and in right rotation (at the 10th follow up) in the exercise group.

The SMT group showed no statistically significant increases in flexibility over the study period.

The Mann Whitney Unpaired Test revealed statistically significant differences in flexion and extension, in favour of the exercise group, when compared with the SMT group.

In a literature review several references were made to studies in which the object was to improve flexibility.

The studies of Yeomans (1992) and Nansel et al (1990) assessed the effect of SMT on flexibility, however, measurements were taken shortly after manipulation. Nansel found that a large proportion of his subjects (especially those having suffered previous trauma) had regained a-symmetries after 48 hours. The fact that there were no statistically significant increases in flexibility in the SMT group in the present study does not contradict the aforementioned studies as the period between treatment and when measurements were taken to assess flexibility was far longer.

Unfortunately no studies could be found assessing the effectiveness of exercises to increase flexibility specifically in the cervical spine. With regards to therapeutic exercise,however, similar principles for stretching and strengthening apply to the musculoskeletal system as a whole. Adaptations would need to be made for the muscle fibre type (type 1 & 2A, B) and for the specific structures involved. These parameters, unfortunately, have not yet been defined.

Research has shown that PNF stretching is effective in increasing the flexibility around a single joint (Prentice, 1983) and that stretching techniques have also been effective in increasing flexibility in the low back (Mellin, 1989).

In the study done by Prentice it was found that both static and PNF stretching were capable of producing increased flexibility in the hip joint. Subjects were required to participate in flexibility training for 30 sessions over 10 weeks. PNF stretching (10 seconds contraction, followed by 10 seconds of stretching ; repeated 3 times) proved to be more successful than static stretching (10 seconds of stretching, followed by 10 seconds of relaxation ; repeated 3 times) in increasing the range of motion.

In Mellin's study subjects received general back care with the emphasis on exercise. Patients received between 20 and 30 treatments and after three months follow up continued to show significant increases in rotation, hip flexion and hip extension.

The present study supports findings that PNF exercises increase flexibility and that when these principles are applied to the cervical spine successful results are obtained. The sample size in this study was very small, however viewing the demographic data (tables 4.1 & 4.2) shows that for randomised grouping, the groups were surprisingly well matched, with equal distribution of cases involving previous trauma and with chronicity of pain being only slightly in favour of the SMT group. These factors enhance the credibility of the results obtained, as previous trauma and chronicity of pain would affect the outcome of flexibility studies and make spontaneous recovery less likely. (Nansel et al., 1990)

The available knowledge on the effectiveness of exercises to enhance mobility and flexibility, especially concerning specific structures is limited and the current exercise design was largely based on assumptions and deductions made from the information gathered from the related literature. The results however support the first aspect of the hypothesis that therapeutic exercise, utilising the principles of PNF, is effective as an adjunct to chiropractic treatment, in terms of objective clinical findings.

5.2 Subjective Clinical Findings

5.2.1 Disability

The CMCC Neck Disability Index (NDI) was designed to assess the effect of cervical spine pain syndromes on the activities of daily living. The authors of this questionnaire sought to find the most relevant activities affected by neck pain and based their search on other questionnaires, including the PDI (pain disability index) and the Oswestry Low Back Pain Index. Ten items which broadly outline the neck pain sufferer's "quality of life" were identified. (Vernon and Mior, 1990) (App. 7)

Table 4.12 contains the mean scores obtained from the CMCC NDI over the two month period. In both groups an improvement in the levels of disability was noted. The Wilcoxon Signed Ranks Test revealed statistically significant improvements in the SMT group at the 9th follow up measurement and in the exercise group at the 9th and 10th follow up measurements.

A Mann Whitney Unpaired Test also revealed a statistically significant improvement in the level of disability in the exercise group when compared to the SMT group.

These findings support the hypothesis that exercise will serve as a valuable adjunct to chiropractic management of chronic mechanical cervical spine conditions in terms of subjective findings, specifically in terms of disability.

5.2.2 Pain

Tables 4.9 - 4.11 contain the mean scores obtained from the McGill and NRS - 101 Questionnaires over the two month period.

The McGill Questionnaire scores (Table 4.9) reveal a diminishing in the quality of pain in both groups. The Wilcoxon Signed Rank Test only revealed statistically significant changes in the exercise group at the 5th and 10th follow up measurements. No statistically significant changes were seen in the spinal manipulative therapy group.

The NRS - 101 Questionnaire scores revealed a diminishing in the intensity of pain in both groups, for "worst" and "least" scores.

The NRS - 101 "worst" scores (Table 4.10) only reached statistically significant levels in the exercise group at the 9th and 10th follow up measurements.

The NRS - 101 "least" scores also only reach statistically significant levels in the exercise group at the 10th follow up.

The Mann Whitney Unpaired Test revealed no statistically significant changes, when comparing the two groups, with regard to quality and intensity of pain.

These findings indicate that SMT together with therapeutic exercise is effective in treating chronic mechanical cervical spine conditions with regards to the subjective pain responses. The findings do not provide irrefutable proof of the effectiveness of therapeutic exercise as a pain treatment modality, as the Mann Whitney Unpaired Test comparison did not show statistically significant differences between the groups. The effects seen in pain control may, therefore, have been due to spinal manipulative therapy.

A high likelihood, however, of exercise being effective as a pain treatment modality exists, due to the significant changes in pain response that occurred specifically in the exercise group. These changes, which to a large extent occurred over the time period involving the 9th and 10th follow up appointment, also correspond with improved flexibility and levels of disability in the exercise group.

No studies have been done to assess the effectiveness of neck exercises in pain control. Studies of low back exercise can not be extrapolated to the neck, however, because they are the only spinal studies that exist, it is worth mentioning that improved flexibility (Mellin, 1989) and strengthening (Manniche, 1988) in the low back region have been associated with decreased pain. It has also been shown that manipulation, in the short term (Vernon, 1990) and in the long term, with regards to cervicogenous headaches (Turk & Ratkolb, 1987), is an effective form of intervention for pain control.

More research needs to be done in the spheres of exercise and spinal manipulative therapy with regards to pain control, to determine the long term effectiveness of each, specifically in the treatment of chronic mechanical cervical spine conditions. Preferably this should be done using a larger sample size, as this could be one of the reasons why the outcome in pain control was not as clear cut in the present study.

In hindsight it may be beneficial, for further research, to state that the program of intervention in this study did not contain the optimum design for a chronic pain management program. The mean pain chronicity was 6.9 years and to expect statistically significant responses in pain levels after one month of treatment followed by one month of rest may be idealistic due to the adaptations that occur in chronic pain syndromes. Traumatised spinal structures may facilitate reflex based guarding responses which may become established and produce complications in therapeutic intervention (Nansel et al, 1990). Chronic spinal subluxations (segmental hypomobility) may even produce permanent deformation in the spine (Grieve, 1981 : 125 - 129). Psychological factors may also be a strong influence in the chronic pain syndrome (Waddel, 1987) and should be taken into consideration in the design of a pain management program.

6.0 Conclusions and Recommendations

The results of this study suggest that exercise serves as a valuable adjunct in the management of chronic mechanical cervical spine conditions.

Statistically significant improvements in flexibility were noted in the exercise group. This provides valuable information, in the form of an exercise program design, for chiropractors and other conservative therapists who are seeking ways to physically reintroduce lasting flexibility. Diminished flexibility and fascial tightness have been postulated by many authors to produce pain syndromes and the recurrence of spinal subluxation (Mennel, 1952) (Dorpat, 1955) (Janda, 1974) (Ufberg, 1980) (Grieve, 1981 : 125-129) (Nansel, 1990).

Statistically significant improvements in the levels of disability were seen in both groups, thus reflecting a rapid, general, improved state of well-being with minimal intervention. This proved to be more lasting in the exercise group, when the follow up assessment was done. Exercise together with spinal manipulative therapy also proved to be effective in pain control, however, the gains were not statistically significant when compared to the SMT group.

This result indicates that exercise, as an entity is not necessarily effective in pain control, as the lessening in pain may have been due to spinal manipulative therapy. Evidence in this and in other studies, however, suggests a high likelihood of exercise being valauble in pain control.

For the results of this study to be confirmed the use of a larger sample size would be beneficial. The effect of spinal manipulation and e5xercise for pain intervention may be better established if intervention could take place over a long period. Follow up measurements could be done at later time intervals so that the temporal effects of treatment can be established. The effects of spinal manipulation have been shown to last for six months in some cases (Turk & Ratkolb, 1987). The effectiveness of therapeutic exercise for the cervical spine has not been established, however, exercise has been shown to produce long term effects in the low back region (Mellin, 1989). Long term methods of mensuration would be valuable to determine these effects.

It is also advisable, in a program similar to this, to make use of a double blind study to avoid bias on the behalf of the researcher. The researcher (or person providing treatment) should be experienced in the art of spinal manipulative therapy, including grade five manipulation.

Research concerning proprioceptive neuromuscular facilitation and the effects of different parameters (for this form of therapy) for differing structures and muscle fibre types, would also be a benefit to anyone doing research in the field of exercise.
Further research concerning the effectiveness of strengthening and exercises to improve co-ordination may also be valuable to determine the specific benefits of each form of therapy.

Overall there seems to be a lack of standardization in the prescription of exercises for different conditions and this is probably the greatest need which still needs to be addressed.

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TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

CASE HISTORY

Patient:______________________________ Date # ____________

File #:____________

X-ray #:____________

Age: __________ Sex:_______ Occupation: ____________

Intern: __________________________ Signature: ________________

FOR CLINICIAN'S USE ONLY

Initial visit clinician: Signature:

Case History:

Examination:

Previous: TN Other

Current: TN Other

X-ray Studies:

Previous: TN Other

Current: TN Other

Clinical path. lab.:

Previous: TN Other

Current: TN Other

Case status:

PTT: Conditional: Signed off: Final sign out:

Recommendations:

Intern's case history

1. Source of history:

2. Chief complaint: (patient's own words)

3. Present illness:

Location

Onset

Duration

Frequency

Pain (character)

Progression

Aggravating factors

Relieving factors

Associated S & S

Previous occurrences

Past treatment and outcome

4. Other complaints:

5. Past history:

General health status

Childhood illnesses

Adult illnesses

Psychiatric illnesses

Accidents/injuries

Surgery

Hospitalizations

6. Current health status and life-style:
   - Allergies
   - Immunizations
   - Screening tests
   - Environmental hazards (home, school, work)
   - Safety measures (seat belts, condoms)
   - Exercise and leisure
   - Sleep patterns
   - Diet
   - Current medication
   - Tobacco
   - Alcohol
   - Social drugs

7. Family history:
   - Immediate family:
     - Age
     - Health
     - Cause of death
     - DM
     - Heart disease
     - TB
     - HBP
     - Stroke
     - Kidney disease
     - CA
     - Arthritis
     - Anaemia
     - Headaches
     - Thyroid disease
     - Epilepsy
     - Mental illness
     - Alcoholism
     - Drug addiction
     - Other

8. Psychosocial history:

Home situation

Daily life

Important experiences

Religious beliefs

9. Review of systems:

General

Skin

Head

Eyes

Ears

Nose/sinuses

Mouth/throat

Neck

Breasts

Respiratory

Cardiac

Gastro-intestinal

Urinary

Genital

Vascular

Musculoskeletal

Neurologic

Haematologic

Endocrine

Psychiatric.

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

Underline abnormal findings in RED and elaborate on back of relevant page, if necessary.
Mark "NAD" if normal.

Patient:______________________________ File #______

Last name First name

Clinician:________________ Signature:______________

Intern:__________________ Signature:______________

Date:______________

Height:__________ Weight:__________ Temp:__________

Rates: Heart:______ Pulse:______ Respiration:__________

Blood pressure: Arms: L / R /

Legs: L / R /

General appearance:

STANDING EXAMINATION.

Minor's sign
Skin changes
Posture
erect
Adam's
Ranges of motion:

T/L spine: Flexion: 90 Fingers to floor
Extension: 50
R.lat.flex.: 30 Fingers down leg
L.lat.flex.: 30 Fingers down leg
Rot.to R.: 35
Rot.to L.: 35

Flex.

L.Rot. R.Rot.

L.lat flex. R.lat. flex.

Ext.

/ = pain-free limitation; // = painful limitation.

Romberg's sign.
Pronator ~~drift~~.
Trendelenburg's sign.
Gait.
rhythm
balance
pendulousness
on toes
on heels
tandem
Half squat.
Scapular winging.
Muscle tone.
Spasticity/Rigidity.

Shoulder:
- skin
- symmetry
- ROM - glenohumeral
  - scapulo-thoracic
  - acromioclavicular
  - elbow
  - wrist

Chest measurement
- inspiration
- expiration

Visual acuity

Breast examination:
- Inspection:
  - skin
  - size
  - contour
  - nipples
  - arms overhead
  - hands against hips
  - leaning forward.
- Palpation:
  - axillary lymph nodes.

SEATED EXAMINATION.

- Spinal posture
- Head
  - scalp
  - skull
  - face
  - skin
- Eyes
  - conjunctiva
  - sclera
  - eyebrows
  - eyelids
  - lacrimal gland
  - nasolacrimal duct
  - alignment
  - corneal reflex
  - ocular movement

	L			R	
III	IV	VI	III	IV	VI

  - visual fields
  - accommodation
  - iris
  - pupils
  - red reflex
  - optic disc

- vessels
- general background
- macula
- vitreous
- lens

Ears:
- auricle
- ear canal
- drum
- auditory acuity
- Weber test
- Rinne test

Nose:
- external
- internal
  - septum
  - turbinates
  - olfaction

Sinuses (frontal & maxillary):
- tenderness
- transillumination

Mouth and pharynx:
- lips
- buccal mucosa
- gums and teeth
- roof
- tongue
  - inspection
  - movement
  - taste
  - palpation
- pharynx
  - inspection
  - CN X

-Neck:
- posture
- size
- swelling
- scars
- discoloration
- hair line

ROM:

Flexion:	45	chin to larynx chin to sternum
Extension:	55	forehead parallel to floor
L.lat.flex:	40	
R.lat.flex:	40	
L.rot.:	70	
R.rot.:	70	

Flex.

L.Rot. R.Rot.

L.Lat. flex. R.lat. flex.

Ext.

lymph nodes
trachea
thyroid
carotid arteries (thrills, bruit)
CN V
CN VII
CN VIII (nystagmus)
CN IX
CN XI
TMJ --
Inspection
ROM
deviation
Palpation
crepitus
tenderness

Neurological:
  Dermatomes
    C5
    C6
    C7
    C8
    T1
  Tendon reflexes
    biceps
    triceps
    brachioradialis
  Muscle strength
    C5
    C6
    C7
    C8
    T1
  Coordination:
    point-to-point
    dysdiadochokinesia
Thorax:
  Chest:
    Inspection:
      skin
      shape
      respiratory distress
      rhythm (respiratory)
      depth
      effort
      intercostal/supraclavicular retraction
    Palpation:
      tenderness
      masses
      respiratory expansion
      tactile fremitus
    Percussion:
      lungs (posterior)
      diaphragmatic excursion
      kidney punch
    Auscultation:
      breath sounds
        vesicular
        bronchial
      adventitious sounds
        crackles (rales)
        wheezes (rhonchi)
      voice sounds
        bronchophony
        whispered pectoriloquy
        egophony

Cardiovascular:
auscultation (aortic murmurs)
Allen's test

SUPINE EXAMINATION

JVP
PMI
auscultation heart (L.lat.recumbent)
respiratory excursion
percussion chest (anterior)
breast palpation
The abdomen:
Inspection:
skin
umbilicus
contour
peristalsis
pulsations
hernias (umbilical/incisional)
Auscultation:
bowel sounds
bruit
Percussion:
general
liver
spleen
Palpation:
superficial reflexes
cough
light
rebound tenderness
deep
liver
spleen
kidneys
aorta
intra-/retro-abdominal wall mass
shifting dullness
fluid wave
Acute abdomen:
where pain began and now
cough
tenderness
guarding/rigidity
rebound tenderness
Rovsing's sign
psoas sign
obturator sign
cutaneous hyperaesthesia
rectal exam
Murphy's sign.

Male genitals and hernias.
Inspection:
skin
prepuce
glans
meatus
nits/lice
scrotum
inguinal/femoral bulges
Palpation:
penis (tenderness/induration)
testes
epididymis
inguinal canal
femoral canal
cremasteric reflex
Auscultation:
scrotal mass.
Peripheral vasculature:
Inspection:
skin
nail beds
pigmentation
hair loss
Palpation:
pulses - radial, brachial, femoral, poplitoal, post.tibial, dorsalis pedis
lymph nodes - epitrochlear, femoral (horizontal & vertical)
temperature (foot & legs)
Manual compression test
Retrograde filling (Trendelenburg) test
Arterial insufficiency test

Musculoskeletal:
ROM
hip
flex. 90/120
ext. 15
abd. 45
add. 30
int rot 40
ext rot 45
knee
flex. 130
ext. 0/15
ankle
plantar flex 45
dorsiflex 20
inversion 30
eversion 20
leg length

Neurological:
- dermatomes
  - L1
  - L2
  - L3
  - L4
  - L5
  - S1
- muscle strength
  - hip flexion
  - knee extension
  - ankle dorsiflexion
  - plantar flexion
- tendon reflexes
  - patellar
  - Achilles
- plantar reflex

Rectal examination:
- Inspection
  - sacrococcygeal & perianal areas
- Palpation
  - sphincter tone
  - tenderness
  - induration
  - nodules
  - prostate
  - seminal vesicles

<u>Mental status</u>

- Appearance and behaviour:
  - level of consciousness
  - posture and motor behaviour
  - dress, grooming, personal hygiene
  - facial expression
  - affect
- Speech and language:
  - quantity
  - rate
  - volume
  - fluency
  - aphasia (prn)
- Mood
- Thought processes (logical, relevant, organized)
- Memory and attention:
  - orientation (time, place, person)
  - remote memory
  - recent memory
  - new learning ability
- Higher cognitive functions:
  - information and vocabulary (general & specialized knowledge)
  - abstract thinking

APPENDIX 3

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC.

REGIONAL EXAMINATION -- CERVICAL SPINE.

PATIENT: ____

FILE # : ____________________ DATE: ____________________

INTERN/RESIDENT: ____________________________________

SUPERVISING CLINICIAN : ______________________________

OBSERVATION :

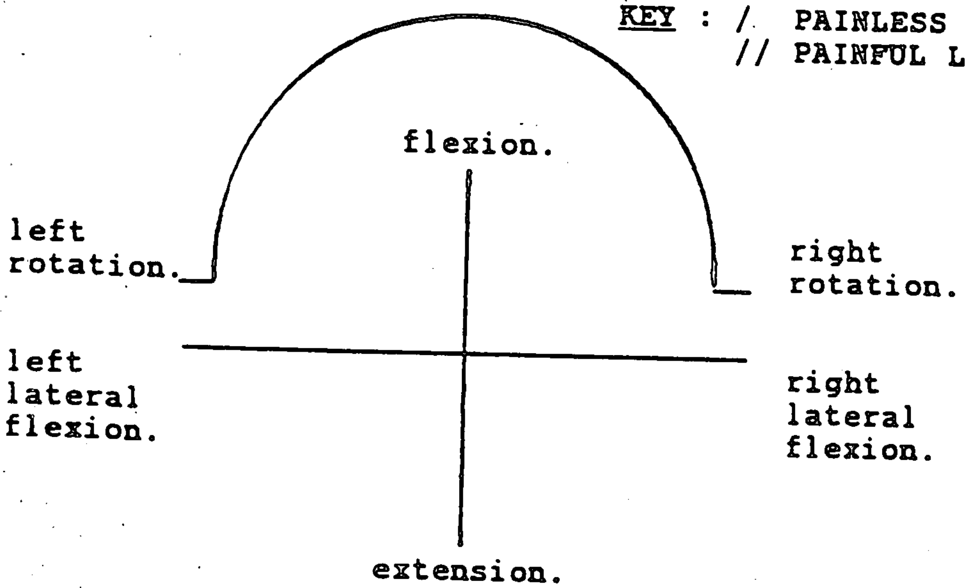
Posture
Swellings
Scars
Discoloration
Hair Line
Bony and soft tissue contours

Shoulder position:
Left =
Right =
Muscle spasm
Facial expression

RANGE OF MOTION:

Flexion = 45 degrees.
Extension = 70 degrees.
L/R Rotation = 70 degrees.
L/R Lateral flexion = 45 degrees.

KEY : / PAINLESS LIMITATION.
// PAINFUL LIMITATION.



PALPATION : lymph nodes.
trachea.
thyroid gland.

ORTHOPAEDIC EXAMINATION :

Tenderness
Active MF Trigger Points :
SCM.
Trapezius.
Scaleni.
Levator Scapulae.
Posterior Cervical musculature.

Doorbell Sign
Kemp's Test
Cervical Distraction
Halstead's Test
Hyperabduction Test (Wright's)
Shoulder abduction Test
Dizziness rotation Test
Brachial Plexus Tension

Cervical Compression
Lateral Compression
Adson's Test
Costoclavicular Test
Eden's (traction) Test
Shoulder depression Test
Lhermitte's Sign
O'Donoghue Manoeuvre

Remarks : ____________________

____

____

____

NEUROLOGICAL EXAMINATION :

DERMATOMES: Left	Right.	MYOTOMES: Left	Right.	REFLEXES: Left	Right
C2		C1		C5	
C3		C2		C6	
C4		C3		C7	
C5		C4			
C6		C5			
C7		C6			
C8		C7			
T1		C8			
		T1			

VASCULAR :

	LEFT.	RIGHT.
BLOOD PRESSURE.		
CAROTIDS.		
SUBCLAVIAN ARTERIES.		
WALLENBERG'S TEST.		

COMMENTS: ____

____

____

____

____

____

MOTION PALPATION :

t.play		Left						Right					Jt.play	
A	Lat	Fle	Ext	LF	AR	PR		Fle	Ext	LF	AR	PR	P/A	Lat
							C0							
							C1							
							C2							
							C3							
							C4							
							C5							
							C6							
							C7							
							T1							
							T2							
							T3							
							T4							

REQUISITION FOR RADIOGRAPHIC EXAMINATION

APPENDIX 4

Radiograophic Laboratory 1
Technikon Natal
Ritson Rd,
Durban.

DATE: ______

NAME (block letters) ______ | ID number ______ | x-ray number ______

Age: ______ | Race: ______ | Sex: ______ | Date LMP ______

TRANSPORT TO RADIOGRAPHIC LABORATORY
walking.......chair......stretcher.........

Previous x-rays.............

Patient's history and clinical findings: ______

Radiographic examination required: ______
Information required: ______
Referring Doctor (name & signature) ______

FOR OFFICIAL USE OF RADIOGRAPHIC LABORATORY ONLY

Radiographic Factors

Part	kV	mA	time	bucky	room

Time of arrival:.........
Time of x-ray:...........
Time of departure:.......

FILMS

No.	size	code	Passed by

PATIENT NAME : ____________________________

FILE # : __________ DATE : ______________

	NONE	MILD	MODERATE	SEVERE
1 THROBBING	0) ____	1) ____	2) ____	3) ____
2 SHOOTING	0) ____	1) ____	2) ____	3) ____
3 STABBING	0) ____	1) ____	2) ____	3) ____
4 SHARP	0) ____	1) ____	2) ____	3) ____
5 CRAMPING	0) ____	1) ____	2) ____	3) ____
6 GNAWING	0) ____	1) ____	2) ____	3) ____
7 HOT-BURNING	0) ____	1) ____	2) ____	3) ____
8 ACHING	0) ____	1) ____	2) ____	3) ____
9 HEAVY	0) ____	1) ____	2) ____	3) ____
10 TENDER	0) ____	1) ____	2) ____	3) ____
11 SPLITTING	0) ____	1) ____	2) ____	3) ____
12 TIRING-EXHAUSTING	0) ____	1) ____	2) ____	3) ____
13 SICKENING	0) ____	1) ____	2) ____	3) ____
14 FEARFUL	0) ____	1) ____	2) ____	3) ____
15 PUNISHING-CRUEL	0) ____	1) ____	2) ____	3) ____

McGILL PAIN QUESTIONNAIRE

NUMERICAL RATING SCALE - 101

Name: Date:

Please indicate on the line below the number between 0 and 100 that best describes the pain of your major problem at this point, <u>when it is at its worst.</u> A zero (0) would mean "no pain at all" and a hundred (100) would mean "pain as bad as it could be." Please write only one number.

Please indicate on the line below the number between 0 and 100 that best describes the pain of your major problem at this point, <u>when it is at its least.</u> A zero (0) would mean "no pain at all" and a hundred (100) would mean "pain as bad as it could be". Please write only one number.

CMCC NECK DISABILITY INDEX

PATIENT NAME:____ FILE #:______ DATE:________

This questionnaire has been designed to give the doctor information as to how your neck pain has affected your ability to manage in everyday life. Please answer every section and mark in each section only the ONE box which applies to you. We realize you may consider that two of the statements in any one section relate to you, but please just mark the box which most closely describes your problem.

Section 1 - Pain Intensity

- ☐ I have no pain at the moment.
- ☐ The pain is very mild at the moment.
- ☐ The pain is moderate at the moment.
- ☐ The pain is fairly severe at the moment.
- ☐ The pain is very severe at the moment.
- ☐ The pain is the worst imaginable at the moment.

Section 2 - Personal Care (Washing, Dressing etc.)

- ☐ I can look after myself normally without causing extra pain.
- ☐ I can look after myself normally but it causes extra pain.
- ☐ It is painful to look after myself and I am slow and careful.
- ☐ I need some help but manage most of my personal care.
- ☐ I need help every day in most aspects of self care.
- ☐ I do not get dressed, I wash with difficulty and stay in bed.

Section 3 - Lifting

- ☐ I can lift heavy weights without extra pain.
- ☐ I can lift heavy weights but it gives extra pain.
- ☐ Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently positioned, for example on a table.
- ☐ Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned.
- ☐ I can lift very light weights.
- ☐ I cannot lift or carry anything at all.

Section 4 - Reading

- ☐ I can read as much as I want to with no pain in my neck.
- ☐ I can read as much as I want to with slight pain in my neck.
- ☐ I can read as much as I want with moderate pain in my neck.
- ☐ I can't read as much as I want because of moderate pain in my neck.
- ☐ I can hardly read at all because of severe pain in my neck.
- ☐ I cannot read at all.

Section 5 - Headaches

- ☐ I have no headaches at all.
- ☐ I have slight headaches which come in-frequently.
- ☐ I have moderate headaches which come in-frequently.
- ☐ I have moderate headaches which come frequently.
- ☐ I have severe headaches which come frequently.
- ☐ I have headaches almost all the time.

Section 6 - Concentration

- ☐ I can concentrate fully when I want to with no difficulty.
- ☐ I can concentrate fully when I want to with slight difficulty.
- ☐ I have a fair degree of difficulty in concentrating when I want to.
- ☐ I have a lot of difficulty in concentrating when I want to.
- ☐ I have a great deal of difficulty in concentrating when I want to.
- ☐ I cannot concentrate at all.

Section 7 - Work

- ☐ I can do as much work as I want to.
- ☐ I can only do my usual work, but no more.
- ☐ I can do most of my usual work, but no more.
- ☐ I cannot do my usual work.
- ☐ I can hardly do any work at all.
- ☐ I can't do any work at all.

Section 8 - Driving

- ☐ I can drive my car without any neck pain.
- ☐ I can drive my car as long as I want with slight pain in my neck.
- ☐ I can drive my car as long as I want with moderate pain in my neck.
- ☐ I can't drive my car as long as I want because of moderate pain in my neck.
- ☐ I can hardly drive at all because of severe pain in my neck.
- ☐ I can't drive my car at all.

Section 9 - Sleeping

- ☐ I have no trouble sleeping.
- ☐ My sleep is slightly disturbed (less than 1 hr. sleepless).
- ☐ My sleep is mildly disturbed (1-2 hrs. sleepless).
- ☐ My sleep is moderately disturbed (2-3 hrs. sleepless).
- ☐ My sleep is greatly disturbed (3-5 hrs. sleepless).
- ☐ My sleep is completely disturbed (5-7 hrs. sleepless).

Section 10 - Recreation

- ☐ I am able to engage in all my recreation activities with no neck pain at all.
- ☐ I am able to engage in all my recreation activities, with some pain in my neck.
- ☐ I am able to engage in most, but not all of my usual recreation activities because of pain in my neck.
- ☐ I am able to engage in a few of my usual recreation activities because of pain in my neck.
- ☐ I can hardly do any recreation activities because of pain in my neck.
- ☐ I can't do any recreation activities at all.

GONIOMETER READINGS

NAME	DATE	FLEX.	EXT.	LR.	RR.	LLF.	RLF.

DAILY DIARY

WEEK:

DAYS	1	2	3	4	5	6	7
Severe Pain							
Moderate Pain							
Mild Pain							
No Pain							

DAILY DIARY

WEEK:

DAYS	1	2	3	4	5	6	7
Severe Pain							
Moderate Pain							
Mild Pain							
No Pain							

DAILY DIARY

WEEK:

DAYS	1	2	3	4	5	6	7
Severe Pain							
Moderate Pain							
Mild Pain							
No Pain							

DAILY DIARY

WEEK:

DAYS	1	2	3	4	5	6	7
Severe Pain							
Moderate Pain							
Mild Pain							
No Pain							

The total duration of your involvement will be a maximum of 2½ months.

<u>Programme Layout:</u>

Week 1	Week 2	Week 3	Week 4	Week 5	1 Month	Week 10
App. 1	App. 2,3	App. 4,5	App. 6,7	App. 8,9		App. 10
Examine History X-Ray Questions	Treatment	Treatment Questions	Treatment	Treatment Questions	Rest	Question

During the first week the physical and radiographic examination will be done and the history taken. During the next four weeks treatment will be given and questionaires will be completed at the fifth and ninth appointment. A rest period of one month will occur and during the final week questionaires will be completed once again. You will be required to fill in your pain diary everyday for the entire duration of the programme.

Thank-you for your interest and participation in this programme.

PATIENT CONSENT FORM

Name: ______________________________

Date: ______________________________

Treatment is based upon contemporary norms in chiropractic and physiotherapeutic paradigms and attempts, as far as possible, not to be injurious to patients. Complications such as strokes, disc, ligamentous and muscular injuries are minimised by proper examination and careful treatment procedures.

The harmful effects of radiographic examination, to the extent required for this study, are minimal.

I realise that I may withdraw from this study at any time by notifying Theo Fourie. I give my consent to be radiographically and otherwise examined and treated at the Technikon Natal Chiropractic Day Clinic and will comply with the instructions of this study.

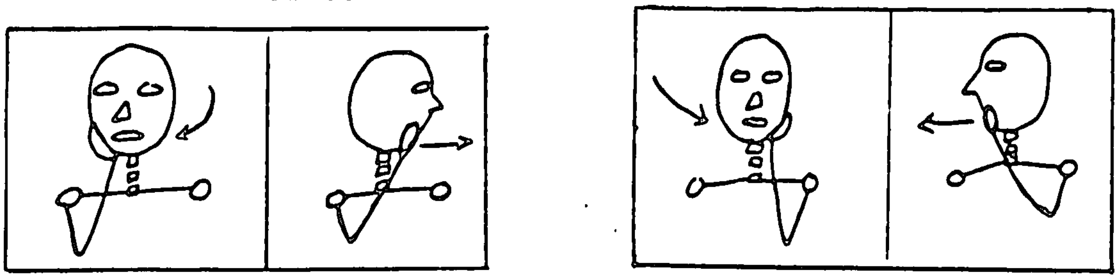
____

SIGNATURE

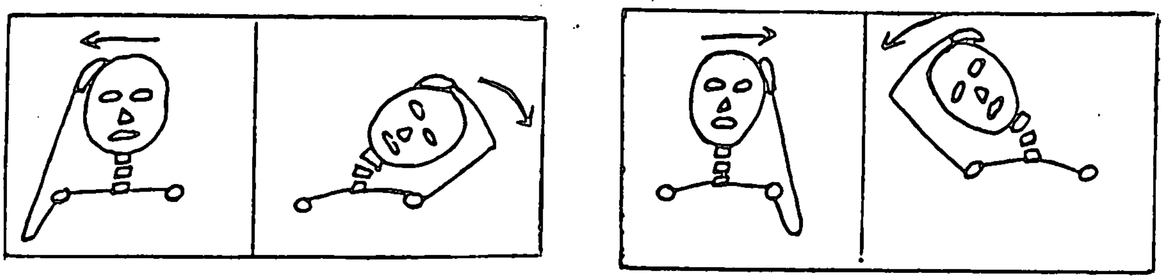
APPENDIX 12

EXERCISE PROGRAMME

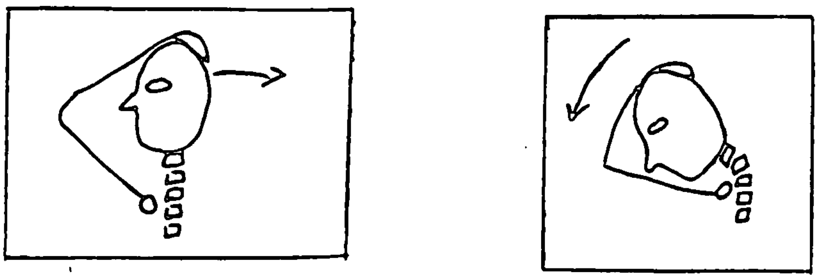
Turn Stretching: Hold 6 seconds. Stretch 2 X 20 seconds. Both sides.



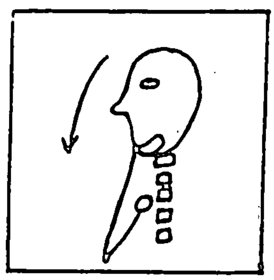
Side Stretching: Hold 6 seconds. Stretch 2 X 20 seconds. Both sides.



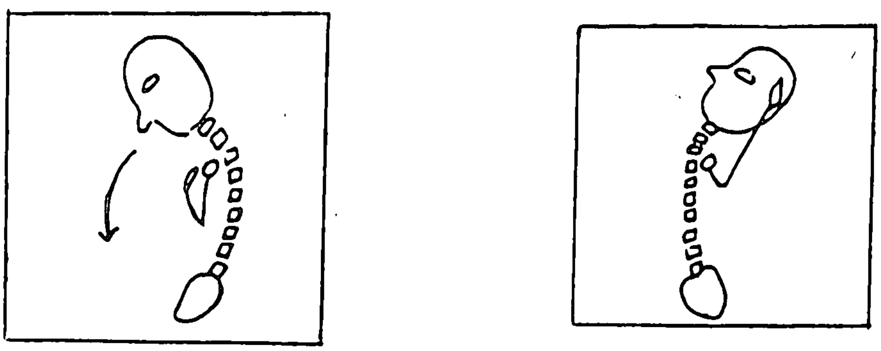
Forward Stretching: Hold 6 seconds. Stretch 2 X 20 seconds.



Forward Strengthening: 6 seconds contract, 3 seconds relax. 3x's



Upper Back Strengthening: Forward hunch 6 seconds. Cat stretch 2 X 20 seconds.



ROM FLEX S.M.T.	PRE Tx	5TH FU	9TH FU	10TH FU
1	65°	56°	50°	46°
2	43°	48°	50°	55°
3	43°	45°	44°	47°
4	50°	60°	64°	51°
5	49°	57°	54°	65°
6	33°	37°	46°	40°
7	70°	61°	40°	64°
8	50°	38°	52°	50°
9	40°	38°	40°	40°
10	53°	60°	42°	49°
11	46°	45°	42°	49°
12	62°	50°	48°	54°
13	50°	47°	37°	41°
14	29°	42°	44°	34°
15	58°	53°	53°	55°

ROM FLEX EXER	PRE Tx	5TH FU	9TH FU	10TH FU
1	64°	64°	54°	50°
2	54°	60°	60°	53°
3	58°	54°	50°	52°
4	47°	60°	54°	52°
5	62°	70°	64°	72°
6	38°	43°	38°	29°
7	52°	41°	60°	50°
8	70°	50°	68°	60°
9	39°	40°	44°	48°
10	40°	43°	44°	49°
11	42°	47°	50°	47°
12	42°	51°	56°	55°
13	48°	56°	62°	68°
14	43°	60°	60°	61°
15	44°	52°	57°	58°

ROM EXT. S.M.T.	PRE Tx	5TH FU	9TH FU	10TH FU
1	80°	85°	90°	80°
2	70°	83°	84°	57°
3	57°	60°	88°	70°
4	85°	82°	61°	62°
5	60°	65°	67°	76°
6	85°	66°	70°	80°
7	78°	82°	89°	71°
8	65°	50°	60°	70°
9	65°	50°	48°	48°
10	90°	82°	78°	50°
11	58°	55°	62°	57°
12	69°	70°	70°	71°
13	53°	48°	50°	43°
14	76°	72°	72°	66°
15	58°	70°	80°	60°

ROM EXT. EXER.	PRE Tx	5TH FU	9TH FU	10TH FU
1	63°	59°	68°	68°
2	80°	65°	63°	68°
3	80°	74°	67°	74°
4	66°	68°	70°	71°
5	80°	75°	82°	88°
6	82°	72°	65°	70°
7	63°	55°	60°	64°
8	73°	50°	69°	72°
9	79°	80°	70°	62°
10	86°	73°	77°	79°
11	56°	58°	80°	66°
12	72°	78°	82°	79°
13	76°	90°	85°	98°
14	79°	73°	74°	78°
15	66°	73°	76°	72°

ROM R.ROT S.M.T.	PRE Tx	5TH FU	9TH FU	10TH FU
1	74°	75°	66°	62°
2	70°	73°	69°	65°
3	74°	54°	79°	71°
4	74°	80°	73°	70°
5	62°	64°	67°	76°
6	58°	54°	63°	58°
7	75°	79°	72°	72°
8	56°	60°	70°	63°
9	44°	32°	46°	52°
10	73°	72°	70°	76°
11	75°	80°	72°	64°
12	65°	65°	66°	61°
13	56°	50°	47°	54°
14	66°	63°	58°	68°
15	64°	80°	80°	70°

ROM R.ROT EXER	PRE Tx	5TH FU	9TH FU	10TH FU
1	68°	62°	70°	76°
2	69°	63°	68°	70°
3	68°	73°	73°	74°
4	70°	65°	69°	70°
5	78°	78°	78°	80°
6	58°	66°	57°	49°
7	53°	60°	69°	56°
8	72°	55°	60°	70°
9	75°	77°	86°	76°
10	60°	73°	60°	63°
11	62°	64°	70°	73°
12	65°	75°	80°	73°
13	72°	80°	82°	80°
14	62°	70°	72°	73°
15	57°	59°	60°	60°

APPENDIX 16

ROM L.ROT S.M.T.	PRE Tx	5TH FU	9TH FU	10TH FU
1	67°	70°	62°	62°
2	75°	72°	72°	65°
3	57°	56°	74°	67°
4	72°	72°	69°	72°
5	34°	64°	68°	63°
6	58°	62°	66°	58°
7	67°	66°	70°	66°
8	56°	58°	60°	61°
9	48°	32°	41°	40°
10	73°	80°	76°	70°
11	54°	66°	64°	71°
12	70°	75°	69°	75°
13	52°	45°	42°	52°
14	60°	55°	53°	58°
15	75°	80°	80°	80°

ROM L.ROT EXER.	PRE Tx	5TH FU	9TH FU	10TH FU
1	76°	76°	70°	68°
2	66°	72°	72°	64°
3	62°	59°	62°	68°
4	66°	72°	63°	59°
5	78°	85°	88°	85°
6	58°	53°	56°	65°
7	60°	62°	64°	65°
8	70°	48°	62°	65°
9	76°	74°	72°	65°
10	70°	52°	60°	60°
11	45°	70°	70°	75°
12	60°	75°	82°	80°
13	72°	80°	83°	83°
14	70°	70°	70°	65°
15	60°	68°	76°	65°

ROM R.LF S.M.T.	PRE Tx	5TH FU	9TH FU	10TH FU
1	43°	43°	40°	36°
2	43°	49°	55°	50°
3	46°	32°	42°	47°
4	35°	40°	35°	35°
5	23°	32°	33°	29°
6	34°	24°	30°	33°
7	47°	47°	40°	45°
8	33°	35°	52°	44°
9	34°	28°	28°	28°
10	53°	58°	50°	50°
11	45°	43°	40°	35°
12	50°	55°	53°	55°
13	20°	23°	28°	19°
14	32°	30°	30°	31°
15	42°	48°	35°	30°

ROM R.LF EXER.	PRE Tx	5TH FU	9TH FU	10TH FU
1	48°	40°	40°	41°
2	47°	48°	47°	50°
3	47°	42°	43°	44°
4	38°	37°	40°	35°
5	50°	45°	40°	52°
6	35°	29°	30°	32°
7	40°	36°	38°	25°
8	53°	45°	50°	45°
9	47°	43°	46°	46°
10	35°	30°	39°	36°
11	42°	38°	43°	35°
12	45°	40°	46°	48°
13	45°	52°	59°	50°
14	32°	37°	40°	41°
15	30°	32°	30°	36°

ROM L.LF. S.M.T.	PRE Tx	5TH FU	9TH FU	10TH FU
1	50°	38°	32°	40°
2	34°	38°	40°	40°
3	34°	30°	33°	35°
4	34°	38°	40°	40°
5	33°	32°	39°	35°
6	35°	35°	40°	34°
7	49°	41°	42°	50°
8	27°	33°	39°	36°
9	30°	15°	18°	20°
10	53°	54°	48°	54°
11	40°	34°	37°	39°
12	30°	30°	36°	30°
13	36°	30°	20°	22°
14	30°	30°	30°	30°
15	50°	43°	50°	40°

ROM L.LF. EXER	PRE Tx	5TH FU	9TH FU	10TH FU
1	38°	40°	42°	38°
2	48°	46°	47°	44°
3	39°	33°	36°	41°
4	38°	44°	44°	45°
5	50°	50°	48°	58°
6	34°	27°	27°	25°
7	30°	36°	40°	33°
8	50°	40°	44°	40°
9	48°	48°	50°	44°
10	34°	30°	33°	30°
11	33°	34°	39°	42°
12	40°	35°	43°	43°
13	50°	50°	49°	52°
14	35°	40°	40°	42°
15	38°	35°	40°	35°

Mc GILL PAIN ADJ.	PRE Tx	5TH FU	9TH FU	10TH FU
1	11%	7%	2%	9%
2	2%	2%	2%	2%
3	33%	16%	2%	7%
4	11%	13%	7%	20%
5	22%	11%	4%	4%
6	38%	13%	42%	4%
7	9%	16%	16%	7%
8	73%	76%	27%	29%
9	7%	58%	13%	2%
10	11%	16%	9%	22%
11	2%	2%	2%	4%
12	64%	29%	84%	73%
13	22%	22%	9%	4%
14	18%	7%	2%	4%
15	16%	7%	13%	7%

Mc GILL PAIN EXER	PRE Tx	5TH FU	9TH FU	10TH FU
1	16%	7%	4%	4%
2	2%	2%	2%	2%
3	9%	4%	16%	2%
4	29%	20%	18%	40%
5	7%	2%	7%	2%
6	4%	4%	7%	2%
7	4%	9%	7%	4%
8	29%	13%	0%	0%
9	20%	36%	31%	20%
10	13%	7%	2%	4%
11	40%	27%	20%	13%
12	42%	40%	36%	40%
13	16%	7%	4%	7%
14	4%	4%	4%	4%
15	7%	2%	0%	0%

APPENDIX 20

NRS 101 WORST S.M.T.	PRE Tx	5TH FU	9TH FU	10TH FU
1	80%	18%	80%	75%
2	30%	10%	10%	20%
3	100%	68%	45%	40%
4	25%	25%	20%	28%
5	70%	60%	40%	10%
6	70%	50%	80%	80%
7	10%	15%	15%	10%
8	90%	90%	90%	80%
9	60%	90%	30%	10%
10	50%	60%	70%	80%
11	30%	40%	10%	20%
12	60%	30%	90%	70%
13	75%	50%	18%	85%
14	70%	0%	65%	50%
15	30%	15%	20%	15%

MRS 101 WORST EXER.	PRE Tx	5TH FU	9TH FU	10TH FU
1	55%	37%	45%	35%
2	20%	18%	18%	20%
3	40%	40%	15%	15%
4	60%	60%	50%	80%
5	45%	55%	30%	20%
6	55%	55%	60%	10%
7	25%	15%	8%	10%
8	30%	70%	0%	0%
9	80%	80%	50%	50%
10	100%	90%	50%	90%
11	70%	70%	30%	40%
12	90%	80%	60%	70%
13	80%	70%	40%	35%
14	5%	20%	30%	30%
15	50%	10%	0%	0%

NRS 101 LEAST S.M.T.	PRE Tx	5TH FU	9TH FU	10TH FU
1	18%	18%	5%	5%
2	10%	0%	0%	10%
3	60%	68%	45%	40%
4	4%	6%	4%	6%
5	40%	30%	10%	0%
6	20%	20%	40%	30%
7	3%	10%	10%	5%
8	80%	75%	75%	75%
9	0%	40%	0%	0%
10	25%	15%	20%	40%
11	10%	10%	5%	5%
12	10%	0%	10%	0%
13	10%	50%	8%	25%
14	10%	0%	35%	15%
15	10%	5%	5%	10%

NRS 101 LEAST EXER.	PRE Tx	5TH FU	9TH FU	10TH FU
1	8%	1%	5%	0%
2	0%	0%	2%	0%
3	40%	30%	15%	5%
4	20%	15%	5%	60%
5	0%	20%	5%	0%
6	0%	0%	22%	0%
7	0%	6%	4%	0%
8	5%	6%	0%	0%
9	50%	50%	40%	20%
10	100%	90%	25%	90%
11	30%	30%	20%	20%
12	60%	50%	45%	50%
13	5%	5%	5%	5%
14	0%	0%	0%	0%
15	0%	0%	0%	0%

DISABILITY S.M.T.	PRE Tx	5TH FU	9TH FU	10TH FU
1	24%	16%	22%	20%
2	16%	12%	8%	26%
3	42%	46%	30%	32%
4	12%	10%	4%	16%
5	40%	22%	6%	2%
6	44%	34%	52%	36%
7	6%	6%	14%	12%
8	34%	30%	16%	32%
9	14%	60%	18%	8%
10	12%	16%	12%	26%
11	26%	18%	12%	14%
12	24%	8%	24%	28%
13	12%	16%	10%	20%
14	36%	6%	28%	24%
15	18%	18%	14%	18%

DISABILITY EXER	PRE Tx	5TH FU	9TH FU	10TH FU
1	28%	14%	20%	22%
2	12%	10%	10%	2%
3	12%	8%	8%	6%
4	24%	20%	12%	30%
5	16%	8%	8%	4%
6	14%	6%	16%	12%
7	24%	26%	14%	6%
8	12%	28%	0%	0%
9	24%	26%	22%	12%
10	44%	30%	16%	22%
11	26%	26%	20%	18%
12	42%	46%	18%	28%
13	20%	12%	8%	4%
14	6%	6%	6%	6%
15	10%	6%	0%	0%