THE COMPARATIVE EFFECTIVENESS OF ADJUSTMENTS VERSUS MOBILISATION IN TREATING MECHANICAL NECK CONDITIONS

A dissertation presented to the faculty of Health Services, Technikon Natal in partial fulfilment of the requirements for the Master's Degree in Technology: Chiropractic

by

Craig Anthony Scott-Dawkins

March 1996

I, Craig Anthony Scott-Dawkins, do hereby declare that this dissertation represents my own work.

Approved for final submission

Dr C. Penter M. Dip. C (S.A) M.C.A.S.A

Supervisor

ACKNOWLEDGEMENTS

I would personally like to thank the following people for their assistance in the performance and completion of this study:

Dr. C. Penter for taking over as my supervisor and the many hours spent working on suggestions to improve the study.

Dr. A.G. Till for his supervision in the early stages of this study and his suggestions.

Mr J. de Klerk for his assistance, guidance and expertise in the performance of the statistical analyses.

To Technikon Natal, particularly, the library and radiography departments for their assistance.

To the many patients who participated in the study and without whom this would not have been possible.

To Dr Elga Drews for her support, guidance and assistance with proof reading.

Finally, to my parents for their encouragement and understanding during the completion of this study and for providing me with the opportunity to become a chiropractor.

ABSTRACT

The aim of this study was to determine the effectiveness of adjustments versus mobilisation in the treatment of mechanical neck pain. It was hypothesized that treatment with adjustments over a three week period, with a further three week follow-up period, would be more effective than mobilisation in terms of improving the patients' cervical ranges of motion and their perceptions of pain and disability.

Thirty consecutive patients suffering from predominantly chronic mechanical neck pain were randomly assigned to either the adjustment or mobilisation group (Muscle Energy Technique). An experimental design was employed, whereby both groups received treatment twice a week for three weeks. After a follow-up period of three weeks the patients were re-assessed. Measurements of the cervical spine ranges of motion with the CROM goniometer and the completion of the Numerical Rating Scale-101, CMCC Neck Disability Index and the Short Form McGill Pain questionnaires were performed before the first treatment, after the first treatment, after the three weeks treatment and after the follow-up period.

The data was then transferred to spreadsheets and underwent statistical analysis. Analysis within each group was performed using the Wilcoxon Signed Ranks test comparing the readings before the first treatment to; after the first treatment, to after the three weeks of treatment and to after the follow-up period.

Comparison between the two groups was performed using the Mann Whitney test at the four measurement stages. The alpha value was set at the 0.05 level of significance.

The results indicated that the mobilisation group achieved significant improvements with regard to mobility of the cervical spine after the first treatment and the three weeks of treatment ($p<0.05$). The adjustment group achieved significant improvements with regard to left and right lateral flexion after the three weeks of treatment ($p<0.05$). The mobilisation group had a greater improvement with regard to disability after the three weeks of treatment and follow-up period. The adjustment group had a greater reduction in pain after the first treatment, whereas the mobilisation group appeared to improve over the three week treatment period. Both groups tended to deteriorate during the follow-up period. No statistically significant difference was noted between the two groups after the three weeks of treatment or after the follow-up period. A significant difference with regard to pain reduction was noted between the groups after the first treatment.

From the results, it is apparent that mobilisation, in the form of Muscle Energy Technique, is just as effective in treating chronic mechanical neck pain as are adjustments. Further research in this field is required to refute or validate this finding.

Table of Contents

APPENDICES:

List of Tables

List of Abbreviations

ADJ - Adjustment

MOB - Mobilisation

M.E.T - Muscle Energy Technique

CMCC - Canadian Memorial Chiropractic College

NRS-101 - Numerical Pain Rating Scale-101

ROM - Range of Motion

INTRODUCTION

Cailliet (1964: iii) describes pain and disability originating from the neck as one of the most common neuromuscular conditions affecting man. He is of the opinion that it is only exceeded by low back pain. Bland (1987: vii) considers neck syndromes as being the fourth most common cause of pain in man. Neck pain can be the result of many different causes i.e. cardiovascular disease, meningitis, osteo-arthritis, hypertension, temporal arteritis, polymyalgia rheumatica, different neurological and metabolic diseases, primary or secondary cancer, infection, lymphoma and myeloma (Bland, 1987: 2). It can also result from less serious causes such as mechanical factors i.e. postural stresses and trauma.

Adjustments and mobilisation procedures are just two forms of manual therapy (Cassidy et.al., 1992b). Manipulative therapy involves the application of specific, accurately determined forces to the body. Its objective is to improve mobility in areas where mobility is restricted, whether the restrictions are within the joints, connective tissues or skeletal muscles. The result may be an improvement in posture or locomotion and the relief of pain and discomfort. Improvement in the functioning of systems elsewhere in the body and a greater sense of well-being may also be evident. (Korr, 1978: xv.)

Sandoz (1976) defines an adjustment as a passive, manual maneuver during which an articular element is suddenly carried beyond the usual limit of movement without exceeding the integrity of the anatomical boundary.

The usual characteristic of an adjustment is the thrust which is a brief, sudden and carefully dosed impulse delivered at the end of the normal passive range of movement. It is often accompanied by a cracking sound (cavitation). Once this has occurred, the joint has been taken into what is called the paraphysiological space. (Sandoz, 1976.) In some texts this is referred to as Thrust Manipulation (Basmajian, 1985: 28).

Grieve (1991: 177) classifies mobilisation as a gentle, persuasive pressure performed within the available accessory range of motion or at the end of the passive range. Mobilisation does not take the joint into the paraphysiological space and there is no accompanied cracking sound (Sandoz, 1976). Basmajian (1985: 28) describes mobilisation as Non-Thrust Manipulation.

There is, however, much controversy related to manipulation, not only concerning its definition and what types of procedures it entails but also its mechanism of action. Research relating to manual therapy for mechanical neck pain, as well as low back pain, is also controversial. Numerous authors (Brunarski,1984 and Koes et.al., 1991a) have criticized many studies involving manual therapy, using meta-analysis, because of poor methodological design and bias.

Koes et.al. (1991a) describes the most common methodological problems as: a lack of adequate description of drop outs, the small sizes of study populations, the lack of placebo groups and the lack of blinding of both the patient and the person performing the measurements.

Brunarski (1984) in his review of the literature related to studies involving manipulation, observed that randomized, controlled, clinical trials appeared to meet the criteria of a good methodological study better than the other studies related to manual therapy.

In his presentation at LACC's 8th Annual Interdisciplinary Symposium on The Cervical Spine, Aker (1995) reviewed the related literature on the conservative management of neck pain. This was conducted via research with teams at McMaster University in Canada and through the RAND Corporation in California. Only randomized clinical trials were included in this search. Five studies were found to have been done involving manipulation and four studies involving mobilisation. These studies will be discussed further in Chapter Two. Other studies have been performed with regards to adjustments and mobilisation but they were not randomized clinical trials and presumably were therefore not included (Cassidy et. al., 1992a ; Hviid, 1971; Parker et. al., 1979).

Cassidy (et. al., 1992b) claims to have been the first to compare mobilisation to adjustment in the treatment of mechanical neck pain. A single treatment was performed and no follow up period was included.

No studies appear to have been performed comparing adjustments to mobilisation on a longer term basis. Clinically, it has been shown that many patients with mechanical neck pain do not recover fully after a single treatment and that most require a series of treatments (Cassidy et.al., 1992b). It is therefore important that a study involving a longer treatment period be performed (Cassidy et.al., 1992b).

The longer the treatment period necessary for satisfactory recovery, the greater financial burden on the patient, medical aids and society. Therefore it is necessary to determine if any one procedure is more successful in producing a faster recovery in terms of pain, disability or range of motion and which procedure has a superior long term benefit.

This study was carried out at a chiropractic teaching clinic and consequently certain limitations were placed on the nature of the study. As a result of time and financial constraints and lack of qualified personnel a large sample size and blinded outcomes were not possible.

1.0 The Problem and its Setting

1.1 The Statement of the Problem

The purpose of this investigation was to evaluate the relative effectiveness of adjustments and mobilisation on the range of motion and the patient's experience of pain and disability in the cervical spine, in order to establish under which circumstances each of these interventions was most effective in treating mechanical neck conditions.

1.2 Statement of the Subproblems

1.2.1 The First Subproblem

The first subproblem was to evaluate the effectiveness of adjustments on the patients' ranges of motion in the cervical spine in order to determine how motion was affected by an adjustment.

1.2.2 The Second Subproblem

The second subproblem was to evaluate the effectiveness of an adjustment with reference to the patients' experiences of pain and disability in the cervical spine in order to determine how patients perceived the changes in the quality of their lives after treatment.

1.2.3 The Third Subproblem

The third subproblem was to evaluate the effectiveness of mobilisation on the patients' ranges of motion in the cervical spine in order to determine how motion was affected by mobilisation.

1.2.4 The Fourth Subproblem

The fourth subproblem was to evaluate the effectiveness of mobilisation with reference to the patients' experiences of pain and disability in the cervical spine in order to determine how patients perceived the changes in the quality of their lives after treatment.

1.2.5 The Fifth Subproblem

The fifth subproblem was to integrate the knowledge on the effectiveness of an adjustment and mobilisation on the ranges of motion and the patients' pain and disability in order to determine under which conditions each of these therapies was the most effective in treating mechanical neck conditions .

1.3 The Hypotheses

1.3.1 The First Hypothesis .

It was hypothesized that the range of motion in the cervical spine would be improved by the application of an adjustment.

1.3.2 The Second Hypothesis.

It was hypothesized that the patients' perceptions of pain and disability in the cervical spine would be improved as result of an adjustment.

1.3.3 The Third Hypothesis.

It was hypothesized that mobilisation would be beneficial in increasing the range of motion in the cervical spine.

1.3.4 The Fourth Hypothesis.

It was hypothesized that as a result of mobilisation, the patients' perceptions of pain and disability in the cervical spine would improve.

1.3.5 The Fifth Hypothesis.

It was hypothesized that over a treatment period of six weeks adjustments would be of greater benefit than mobilisation in increasing the ranges of motion and decreasing the patients' perceptions of pain and disability in the cervical spine.

1.4 The Delimitations.

1.4.1 This study was limited to patients presenting to the Technikon Natal Chiropractic Day Clinic with mechanical neck pain. It included patients with shoulder pain / stiffness, sub-occipital headaches and patients with evidence of Myofascial Pain and Dysfunction Syndrome in the cervical or shoulder musculature provided their main complaint was neck pain .

1.4.2 Patients with hard neurological signs were excluded from the study.

1.4.3 Patients presenting with evidence of vascular insufficiency of the neck or cranial structures were not accepted into the study .

1.4.4 No patients with evidence of cervical instability, a history of previous neck surgery or malignancy, bone disease or recent fractures or severe strains were accepted into the study.

1.5 The Assumptions.

1.5.1 The First Assumption.

It was assumed that measuring pain, disability and range of motion would provide accurate and reliable information concerning the effectiveness of the treatments performed on the cervical spine over the six week period as demonstrated in a similar previous study. (Cassidy et.al. , 1992b)

1.5.2 The Second Assumption .

It was assumed that the patients accepted into the study would be honest and truthful in completing the pain and disability rating questionnaires and would be compliant with all instructions given to them.

1.6 DEFINITIONS

1.6.1 Cervical Spine - This is the area of the spine extending from the occiput to and including the seventh cervical vertebra (C7). (Moore, 1985: 570)

1.6.2 Disability - This is the inability to perform normal day to day activities which one can normally perform or a decrease in the ability to perform these functions.

1.6.3 Joint Release (cavitation) - When a joint is taken past the elastic barrier of the physiological range of motion, into the paraphysiological range of motion with the production of gases, (mainly CO_2) in the joint space, usually producing an audible crack and resulting in increased movement in all directions of the joint for up to twenty minutes. (Sandoz ,1976.)

1.6.4 Adjustment - This consists of a high velocity, low amplitude thrust directed beyond the passive range of motion of the joint and associated with an audible crack, caused by cavitation of the underlying facet joint. (Mierau et.al. , 1988)

1.6.5 Mobilisation -This consists of assisted passive and active manoeuvres applied through the active and passive ranges of motion of the spine.(Grieve, 1991: 177)

1.6.6 Mechanical Neck Conditions - All conditions causing increased neural activity in muscles and ligaments of the cervical joints due to mechanical causes, but excluding conditions causing hard neurological signs and symptoms and gross pathology due to systemic diseases. Mechanical neck conditions include posterior facet syndromes, myofascial pain and dysfunction syndromes, sub-occipital headaches and shoulder pain and stiffness.

1.6.7 Physiological Range of Motion -This is the active and passive range of motion between the neutral position and the elastic barrier of the joint. (Sandoz ,1976)

1.6.8 Paraphysiological Range Of Motion - This is the range of motion between the elastic barrier and the anatomical limit of the joint, beyond which ligamentous damage would occur. (Sandoz ,1976)

1.6.9 Vertebrobasilar Arterial Insufficiency Syndrome (VBAIS) - This is a clinical syndrome characterised by anxiety, headaches, nausea, vomiting, nystagmus, transient dizziness, paresis / paralysis, blurred vision, diplopia and dysarthria as a result of altered cerebral blood flow through the vertebral arteries due to osteophytes, subluxation, fractures / dislocations of the cervical vertebrae, congenital anomalies of the vertebral arteries and in rare cases cervical manipulation. (Rotatory-Extension Manipulations) (Leach,1986: 110)

1.6.10 The Wallenberg Test - This is a provocative test to try and reproduce the signs and symptoms of VBAIS. It can be performed sitting or supine. The supine technique is regarded as the better of the two. The cervical spine is placed in a position of rotation and extension and the patient is asked to fix his / her eyes on an object, thereby stressing the visual fields. If any of the symptoms occur or if any nystagmus is evident, then cervical adjustments are contraindicated. (other names for this test are: Hautant, Dekleijn or Underberger Test) (Vernon, 1988: 202)

2.0 The Review Of The Literature

2.1 Incidence, Prevalence and Gender Distribution of Neck Pain.

Neck pain in its many different forms is a common complaint and has been found in 12% of the adult female population and 9% of the adult male population at any one time, while 35% of the population can remember having suffered from an episode of neck pain. (Lawrence J.S., 1969)

In a study by the British Association of Physical Medicine (1966), it was found that approximately 70% of people who consulted their doctors for neck pain had improved or were improving within one month. Clinically it has been found that cervical spine pain normally occurs only slightly less frequently than low back pain, but the level of disability related to neck pain is far less. (Bland, 1987: 4) Studies have indicated that a 25% to 30% incidence of one or more attacks of cervical spine stiffness occurs in working individuals between the ages of 25 to 29 and this incidence increases to about 50% in individuals over the age of 45. (Bland, 1987: 4)

A study by Phillips and Butler (1982) revealed that on average 29.3% of people seen by chiropractors in Dade County, Florida complained of neck pain.

Nyiendo and Haldeman (1984) found that 23.7% of 2000 patients presenting to a chiropractic teaching clinic in the United States complained of neck pain.

In a study conducted at the Technikon Natal Chiropractic Day Clinic comparing the types of conditions seen at a teaching clinic and in private chiropractic clinics in South Africa, it was found that 54.4% of patients presenting to the teaching clinic and 57.4% of patients presenting to private practitioners complained of neck pain (Drews, 1995). It must be noted that this category included patients who had neck pain and associated headaches or arm pain. 14.8% of private practice patients and 16.7% of clinic patients had neck pain only (Drews, 1995).

Although the incidence of neck pain seems to vary according to different authors, the number of patients suffering from this condition cannot be disputed.

2.2 Mechanical Neck Pain

There has been widespread debate relating to the definition of conditions within the neuromusculoskeletal system by different health care professions . Terms commonly used to describe them are joint subluxation / fixation or joint dysfunction (Bergmann et. al. , 1993: 54).

2.2.1 Diagnostic Criteria of Joint Dysfunction

Bergmann has modified the acronym, PARTS from Bourdillon and Day (Bergmann et. al., 1993: 63) which is used in the identification of joint dysfunction. These are:

1) Pain and Tenderness - Pain perception and tenderness on palpation of the bony and soft tissue structures with regards to location, quality and intensity is evaluated. This is done by observation, percussion or palpation.

2) Asymmetry - Either localised to one level or at multiple levels. Asymmetry is assessed by using bony landmarks of the vertebrae as reference points and relating it to other positive findings. This is done via observation, static palpation or radiography.

3) Range of Motion Abnormality - Active, passive and accessory joint motion changes, due to increased, decreased or abnormal movements are identified. Hypomobility is postulated as playing a major role in joint dysfunction (Bergmann et.al., 1993: 63). These changes are identified using motion palpation and if required stress radiography.

4) Tone, Texture and Temperature Abnormality - Changes in the soft tissues such as the skin, fascia, muscles and ligaments around an area of joint dysfunction are known to occur. These are identified by means of observation, palpation and sometimes instrumentation.

5) Special Tests - procedures relating to certain technique systems may be necessary for a final diagnosis.

2.2.2 Models of Spinal Dysfunction

Gillet and Liekens (1969) and Schafer and Faye (1989: 12-17) hypothesized that mechanical joint dysfunction develops as a result of three phases of joint dysfunction : muscular, ligamentous and articular. Segmental muscle spasm and contraction causes muscular fixations which with time causes the ligaments to adapt to the limited range of motion. This adaptation involves contracture formation and shortening of the joint capsule and surrounding ligaments producing ligamentous fixations. Finally, as a result of fibrous adhesions developing between the joint surfaces, as a result of degeneration of the inter-articular soft tissues, articular fixations may develop. The end result is possible bony ankylosis and irreversible fixation.

Kirkaldy-Willis and Burton (1992: 105-119) postulates that spinal degeneration is often initiated by local mechanical derangement and that changes in structure are absent. The development of individual motion segment dysfunction, secondary to changes in the segmental muscle tone and function, is often the causative factor. Joint hypomobility is then thought to start the degenerative cycle, due to changes in the biomechanics in the area and this results in joint instability and finally joint re-stabilization through soft tissue fibrosis and bony exostosis.

Gatterman (1990: 40-47) and Schafer and Faye (1989: xix) describe a subluxation as being a result of kinesiopathologic, neuropathophysiologic, myopathologic and histopathologic changes relating to joints and muscles.

The kinesiopathologic and myopathologic changes include: hypomobility as a result of muscle spasm caused by a joint sprain or increased muscle spindle activity, ligamentous shortening, intra-articular adhesions, intra-articular jamming, due to meniscoid entrapment or disc displacement, and hypermobility as a result of disc degeneration or ligamentous sprain. The neuropathophysiologic changes include: nerve irritation resulting in either increased motor, sensory or autonomic changes and nerve compression which may manifest as weakness, atrophy or sensory loss. (Gatterman, 1990: 40-47)

Mennell (1990) is of the opinion that mechanical joint pain arises from the synovial joints of the spine, due to a lack of mechanical play between the joint surfaces (joint play). This prevents normal movement from taking place and can therefore cause pain.

Lewit (1978: 8-9) hypothesizes that entrapment of the free edge of a meniscoid between the two joint surfaces causes a tractioning effect on the joint capsule. Both the meniscoid and capsule are highly pain sensitive and this results in reflex muscle spasm in the area which only decreases once the meniscoid is freed.

Pain may also be produced by the pinching of synovial folds within the joint cavity (Haldeman, 1992: 206). Two mechanisms can be involved in producing this pain.

1) Pulling on the pain sensitive synovial tissue and capsule (similar to Lewit's hypothesis), due to entrapment, or
2) synovitis caused by the trauma of being entrapped.

This could result in cell destruction and the release of pain producing substances within the joint such as histamine, substance P, bradykinin and potassium ions. The accumulation of metabolic products could therefore cause ischaemic pain.

Wyke (1985: 72) reports a further hypothesized mechanism of spinal dysfunction. He states that all synovial joints of the spinal column are provided with four types of receptor nerve endings. He labels them as Type I to Type IV. Type I to Type III are referred to as mechanoreceptors and their function is to provide information about changes in tension of the tissues in which they are found. Type I and Type II mechanoreceptors are found primarily in joint capsules whereas Type III mechanoreceptors are found only in the in joint ligaments. Type IV receptors, nociceptors, are un-encapsulated free nerve endings. They are normally inactive, but become stimulated when abnormally high tension develops within the articular system or when they are exposed to high concentrations of irritating, chemical substances.

Afferent and efferent impulses from these structures synapse on the spinal cord and transmit information to and from the central nervous system. They also provide information to the surrounding musculature. It is as a result of a loss of mechanoreceptor input from joint movement to the central nervous system and a stimulation of the nociceptive system that pain and reflex muscle spasm at the involved joint level is produced, giving the signs of joint dysfunction. Degenerative, inflammatory or traumatic events have an effect on the joints thereby possibly initiating this process.

2.2.3 Causes of Mechanical Neck Pain.

Any condition or event which results in alteration of joint function or structure is capable of causing mechanical neck pain. Derangement of the articular soft tissues and mechanical joint dysfunction may be produced from acute injury, repetitive use injury, faulty posture or co-ordination, ageing, immobilization, static overstress, congenital or developmental defects. (Bergmann et. al. , 1993: 55)

Gillet and Liekens (1969) report that trauma to the cervical spine can be direct (e.g. blows or falls) or indirect (e.g. micro-trauma), which are the major causes of joint fixations.

White and Punjabi (1978: 278) are of the opinion that traumatic events such as motor vehicle accidents, injuries related to sport and falls are the major causes of biomechanical neck pain. Grieve (1988: 176-177) further postulates that faulty posture due to bad habits, working in confined, awkward spaces or uncoordinated movements during sleep can result in spinal fixation.

Mennell (1990) reports that there are always three factors associated with the onset of mechanical joint dysfunction:

1) Trauma of an intrinsic nature,
2) immobilization with resultant disuse and aging, and
3) remaining symptoms from the healing of a more serious pathological condition.

2.3 Adjustments

2.3.1 Definition

Basmajian (1985: 28-29) reports that manipulation implies different procedures to different health practitioners. There are many different techniques that fall under the umbrella term of manipulation. Techniques can range from general to specific manipulation, direct or indirect manipulation, contact or non-contact techniques or thrust and non-thrust techniques.

He further divides thrust techniques into three categories:

1) Specific thrust techniques, which employ three specific criteria:
   - spinal locking
   - high velocity movement
   - overpressure

2) General thrust techniques which employ high velocity stretching procedures.

3) Surgical thrust manipulation under anaesthesia.

Chiropractic adjustments according to Basmajian's classification would fall under the first category.

Sandoz (1976) defines a spinal adjustment as a passive, manual manoeuvre involving the application of a brief, sudden, small amplitude impulse which is delivered at the end of the normal passive range of motion of a joint (elastic barrier), taking the joint into the paraphysiological range of motion without exceeding the anatomical integrity of the joint.

It is usually accompanied by a cracking sound (cavitation) which is caused by a release of gases (primarily carbon dioxide) within the synovial fluid of the joint.

Haldeman (1992: 448) believes that despite all the different definitions that have been put forth to describe adjustive techniques, three characteristics that most aptly describe a chiropractic adjustment are:

1) A high velocity, carefully delivered force,
2) a specific direction or line of drive (direction of planes of articulation), and
3) a controlled depth and magnitude applied through a specific contact point employing body weight, muscle power and sometimes mechanical devices.

2.3.2 Hypothesized Effects Of Manipulation.

Bergmann et. al. (1993: 139) reports that the specific mechanical and physiological changes that take place to relieve the signs and symptoms of joint dysfunction have not been accurately determined. At this stage in time the mechanisms by which manipulation works are mainly hypothetical.

Wyke (1985: 75) suggests that the mechanoreceptor system has collateral branches of innervation which synapse on the nociceptor system, and that these synapses are inhibitory because of the type of neurotransmiter substance they release.

Therefore, stimulation of the peripheral mechanoreceptor system through manipulation will cause a presynaptic inhibition of nociceptive activity before it can be transmitted up into the central nervous system and be perceived as pain.

Lewit (1978: 8-9) postulates that with an adjustment there is a temporary separation of the two joint surfaces and that this would enable the trapped edge of the meniscoid to slip back into the joint space. This same mechanism can free entrapped synovial tissue to which Haldeman attributes joint fixation (Haldeman, 1992: 206).

Sandoz (1969, 1976) writes on the possible effects of the joint crack associated with an adjustment. After a joint 'crack' there is an increase in the passive range of motion of the joint in all directions and to a lesser extent, he postulates, in the active range of motion. This is as a result of the addition of the paraphysiological range of motion to the available active and passive ranges of motion. It is brought on by the meniscoids no longer being aspirated towards the centre of the joint. As a result of the separation of the joint surfaces, articular derangements may be reduced and proprioceptive elements may be stimulated.

Sandoz (1969) also suggests that the audible 'crack' may have a placebo type effect in that the patient can hear that something has taken place within the joint.

Basmajian (1985: 37) reports that some of the possible roles of an adjustment in restoring normal function to a joint are to restore the flexibility of the joint capsule and surrounding ligaments and muscles by preventing contractures from forming. Adjustments may also help to rupture abnormal cross-links between healing tissues.

Basmajian (1985: 41) hypothesizes that the emotional and stress related aspects which can contribute to a person's pain may be influenced by the simple 'laying on of hands' and by the interest and concern shown by the examiner to the patient's condition. The patients feel a sense of relief and satisfaction that a qualified person has examined them.

These are just some of the many theories relating to the possible mechanisms involved in the effects of adjustments. It is nevertheless possible that not a single mechanism is taking effect, but more likely a combination of one or more.

2.3.3 Studies involving Adjustments

Cassidy et.al. (1992a), in a pre-test, post-test study on fifty consecutive unilateral neck pain sufferers with no neurological deficit, examined the effect that a single adjustment would have on pain and range of motion in the cervical spine. Pain intensity was measured using the Numerical Rating Scale-101 (NRS -101), while range of motion was measured using a cervical goniometer (Rangiometer-Maker, Inc., Flushing, MI).

Thirty-seven of the 50 patients experienced an improvement in their pain, indicated by an average improvement of over 12 points on the NRS-101. (Pre-treatment 43.7, post-treatment 31.1). Ranges of motion were also increased. The largest increases were recorded for rotation towards the painful side (average of 5,2 degrees), and lateral flexion to the opposite side (average of 4.5 degrees). A significant relationship between a decrease in pain and an increase in rotation to the same side was found ($p < 0.05$). (Cassidy et.al., 1992a.) This was not a randomized, controlled clinical trial and no placebo group was utilized. The reliability of the results is therefore questionable (Cassidy et.al., 1992a).

Howe et.al. (1983) in a randomized, controlled study involving 52 patients, studied the effects of manipulation on acute neck pain (< 4 wks) and / or stiffness with pain referred to the head, shoulder or arm compared to treatment with azapropazone (anti-inflammatory).

Seventeen patients received 1 manipulation, 4 received 2 manipulations, 2 received 3 manipulations, 1 received manipulation of the neck and lumbar spine while only 2 patients received manipulation and injection. No mention was made of how many times the 2 patients who received manipulation and injection were treated nor was the number of injections the control group received.

Significant improvements in neck pain and stiffness and shoulder pain and stiffness were found in the manipulative group immediately after the initial treatment, whereas the control group showed no significant improvement. This significant difference between the two groups' symptoms was no longer evident after the first or third weeks. Significant improvements of the cervical ranges of motion were found in the manipulated group, particularly rotation (average of 5 degrees) and to a smaller degree lateral flexion (average of 2 degrees). These improvements were still evident for rotation after one and three weeks, but not for lateral flexion after the first week. The control group did not exhibit any improvement in either rotation or lateral flexion during the course of the investigation.

Hviid (1971) found a similar increase in the rotary mobility of the cervical spine in 92 symptomatic patients treated with five sessions of adjustments. The greatest increase took place in the beginning of the study (a total increase in mobility of 13.3 degrees as a result of the first treatment) and to a lesser extent after the fifth treatment (total mobility was 12.0 degrees greater than before the first treatment). It can therefore be seen that with time the gain in mobility appears to decline. This is evidenced by the fact that the percentage of patients with unchanged or decreased mobility had increased by almost 10% after the fifth treatment compared to after the first treatment.

The reliability and validity of the goniometers used in Howe et.al. (1983) and Hviid (1971) studies can be questioned.

Both were " home made". The goniometer in Howe et.al. (1983) study consisted of an ENT band placed around the patients head with a pointer attached to it, a perspex sheet attached to the upper end of a rod which could be strapped to the patients back either vertically or horizontally. Hviid (1971) used a "Cervicorotometer" which consisted of a circular disc with two scales going from 0 to 120 degrees to the left and right. Another perspex arm attached to the disc and resting on the patient's nose was used to mark off the amount of rotation as the patient turned to the left and to the right as the disc was held with 0 pointing straight forward.

Mennell (1990) conducted a study involving patients suffering from mechanical neck pain which he diagnosed as "joint dysfunction". Eighty three patients received manipulative therapy, 32 of these under anaesthesia using sodium pentothal. Of the 83 patients treated, 25 reported having no more neck pain, 29 patients reported to have experienced a marked improvement in their neck pain and 24 patients reported a moderate improvement in their pain after a two year follow-up period. The author does state though, that a fair proportion of the 83 patients did experience minor recurrences of their neck pain during the two year follow-up, mostly as a result of an unguarded strain to their necks, but in all cases these were relieved by manipulation.

Sloop et. al. (1982) conducted a double blind, randomized, controlled study on the effect of manipulation on patients suffering from chronic neck pain (mean duration of six years). Thirty-seven of the patients also complained of arm pain.

Eighteen patients were assigned to a control group and received an amnesic dose of diazepam intravenously, while 21 patients were assigned to the manipulation group and also received an amnesic dose of diazepam.

Results indicated no significant difference between the two groups as a result of the treatment. However, 57% of the manipulated group compared to 28% of the control group, at three weeks, remarked that the treatment had helped them. After the twelve week period, it was found that 7 of the 9 patients in the manipulation group felt that the treatment had helped them as compared to only 2 out of the 6 patients in the control group. According to the authors this was, however, not statistically significant. Both groups also showed improvements with regards to their severity of pain after three weeks of treatment, but there was no significant difference between the two groups. No improvement was found with regards to ranges of motion or visual analogue scales related to activities. The authors concluded that although a larger percentage of patients in the manipulated group had improved compared to the control group, these improvements were not statistically significant and that the value of a single adjustment in patients with chronic neck pain had therefore not been established.

Nansel et.al. (1990) studied the effects of a single, unilateral, lower cervical adjustment on the relief of passive end-range, lateral flexion cervical range of motion differences of more than ten degrees in asymptomatic patients. The Cybex EDI 320 Electronic Goniometer was utilized to measure ranges of motion. Two groups, one having had a previous history of neck trauma (group A), and the other having had no history of neck trauma (group B) were utilized.

A significant decrease in the lateral flexion end range asymmetry in the cervical spine was noted in both groups thirty minutes after the adjustment had been performed (group A: average decrease in asymmetry 15.2 to 2.7 ; group B: average decrease in asymmetry from 13.7 to 1.6). This was also evident after four hours. The effect was less marked in group A, but the difference was not statistically significant ($p > 0.05$). By the twenty four hour follow-up measurement, a significant difference had appeared in the two groups (group A: increase from 3.5 to 8.4 ; group B: increase from 1.7 to 2.5). This appeared because 7 of the patients in group A regained end-range lateral flexion differences of greater than 10 degrees by this stage while none of the patients in group B regained these differences. After forty eight hours the difference between the two groups was even more apparent (group A: increased from 8.4 to 11.4 ; group B: increased from 2.5 to 3.8). All but 4 patients in group A had regained their differences of greater than 10 degrees, whereas 14 patients in group B continued to exhibit differences of less than 10 degrees. Noted by the authors was the fact that the post-treatment mean differences in group A were actually no longer significantly different from those recorded before treatment and that in every case the re-established lateral flexion difference was always on the same side.

The results produced in this study do not support the findings of other studies on spinal adjustments, namely those of Howe et.al. (1983), particularly for follow-up periods of longer than 30 minutes but it must be kept in mind that the patients in Nansel et.al. (1990) study were asymptomatic with respect to pain.

The affect on symptomatic patients in conjunction with end range differences still needs to be studied .

The authors hypothesized that this temporary improvement was as a result of the adjustment merely interfering with the "normal oscillating physiological patterns of asymmetric cervical paraspinal muscle spasm" (Nansel et. al. , 1990). A second hypothesis put forth was that facilitation of certain spinal reflex pathways via afferent nociceptor input from injured articular joints caused increased gamma and/or alphamotor efferent activity which resulted in increased paraspinal muscle spasm causing a decrease in movement of the affected joints. This is to protect the joint from any further injury. After a few days, weeks or even years, the pain and muscle stiffness, according to Nansel et.al. (1990) might have decreased to such a level that the patient no longer perceives it, but when movement to the painful side is attempted, reinforcement of these aberrant spinal reflexes causes asymmetric movement to avoid the painful movement. Nansel et.al. (1990) postulated that the spinal cord might not only have "learned" this aberrant reflex pattern, but that it might now attempt to maintain this preferred pattern despite normal afferent input via a spinal adjustment. In essence, these authors are stating that the reflex patterns have to be re-trained in order to restore functioning.

Koes et.al. (1991a), in his review of spinal manipulation and mobilisation for back and neck pain critisized Howe et.al.'s (1983) investigation and gave it a total score of twenty nine out of one hundred for its quality of methods.

This score was based on four main categories namely: study population, interventions, measurement of effect, and data presentation and analysis. Criteria regarded by the authors as important for the development of a sound methodological study were examined in each of the main categories. According to the authors, where Howe et.al.'s (1983) study failed to earn any points in some of the categories were due to: (1) a lack of information regarding drop outs or lack thereof, (2) no loss to follow-up was calculated, (3) too small group sizes were used after randomization, (4) during the study other medical or physical treatment interventions were not avoided, (5) no placebo group was used and (6) the manipulative therapists' qualifications or experience were not stated.

2.4 Mobilisation

2.4.1 Definition

Grieve (1988: 534) defines mobilisation as a passive technique employing rhythmic, repetitive movements to patient tolerance in the active and/or passive ranges of motion in an attempt to restore full painless joint function. It is normally graded according to examination findings and is directly under the control of the patient at all times.

Gatterman (1990: 50) describes three essential differences between adjustments and mobilisation.

1) There is no dramatic separation of the joint surfaces during mobilisation because the elastic barrier of the joint is not overcome,
2) there is no cavitation heard as a result, and
3) no radiolucent space occurs between the joint surfaces as is the case with an adjustment.

Again, as is the case with manipulation, mobilisation can take on many different forms. Basmajian (1985: 29-31) categorizes mobilisation into six different techniques:

1) Graded Oscillation Mobilisation,
2) Progressive Stretch Mobilisation,
3) Continuous Stretch Mobilisation,
4) Functional Mobilisation,
5) Counterstrain Mobilisation and
6) Muscle Energy Mobilisation (Muscle Energy Technique).

All are mobilising techniques, but each has a different method of application and slightly different therapeutic effect. For the purpose of this study, Muscle Energy Techniques where chosen because they were the technique used in a previous study (Cassidy et. al., 1992b) on which this study is based. This technique was also chosen because the likelihood of achieving a joint cavitation is minimal (Bourdillon et. al. , 1992: 128).

2.5 Muscle Energy Technique. (M.E.T.)

Greenman (1989: 88-91) defines M.E.T as a manual medicine procedure whereby voluntary muscle contraction by a patient at varying strength levels, in carefully determined directions, is used against a counterforce provided by the operator.

Bourdillon et. al. (1992: 122-128) describe M.E.T as a direct technique, like high velocity thrust techniques, in that the barrier of restriction is directly located and addressed. It is, however, different to high velocity thrust techniques in that the activating force is intrinsic, i.e. it is achieved by the patient pushing against the doctor. The force used is controlled by the patient and the doctor only applies a counteracting force. Breathing techniques are also employed by the patient. Because the patient controls the amount of force used, Bourdillon et. al. (1992: 123) suggest that it is a technique which is very useful in treating elderly patients who may have weakened bones, due to osteoporosis or disease, or in acute episodes where high velocity thrusting may aggravate the condition.

2.5.1 Indications

Greenman (1989: 88) report that M.E.T.'s have many different uses:

- They can be used to stretch a muscle in spasm or in a state of contracture,
- to strengthen a weak muscle or group of muscles,
- to decrease oedema in a localized area or reduce passive congestion by the muscle's pumping action, and

- mobilize a joint which is exhibiting a restricted range of motion.

Any joint which is under the control of voluntary muscle contraction can be influenced by using M.E.T.

2.5.2 Types of Muscular Contractions.

According to Greenman (1989: 89) there are four different types of muscular contractions which can be employed when using M.E.T.:

1) Isometric Muscular contractions, whereby the length of the muscle does not change during the contraction phase; i.e. there is no shortening of the muscle and the origin and insertion of the muscle do not approximate. As a result, a fixed tension develops within the muscle. This is achieved by the doctor applying an equal but opposite counterforce to the effort of the patient.

2) Concentric Isotonic Muscular contractions, whereby the muscles origin and insertion approximate as a result of the tension developed within the muscle.

3) Eccentric Isotonic Muscular contractions, whereby the origin and insertion of the muscle actually separates as a result of the tension applied to the muscle.

4) ' Isolytic ' Muscular contractions, whereby the patient attempts a concentric contraction to approximate origin and insertion but the external force applied by the doctor is in the opposite direction and actually results in lengthening of the muscle.

2.5.3 Principles of M.E.T.

Isometric Muscle Energy Techniques help restore hypertonic muscles back to their normal resting lengths by reducing the tone in the muscle (Greenman, 1989: 89).

These hypertonic muscles are often thought to be the major cause of restricted joint mobility (Lee, 1994: 721 ; Greenman, 1989: 89). The fusimotor system controls primarily the length and tone of a muscle through the intrafusal fibres of a muscle tendon. Neural control of this fusimotor system is brought about by regulation through the gamma system. Korr (1975: 123-135) is of the opinion that muscle hypertonicity is from gamma gain. Afferent impulses from the golgi tendon organs and spindle receptors feed information to the spinal cord. Efferent impulses from the spinal cord then influence the intrafusal fibres which change their length and this in turn changes the length of the extrafusal fibre and the muscle as a whole (Greenman, 1989: 89). Dysfunction occurs when abnormally high afferent inputs to the spinal cord are maintained, and this therefore results in what is called a facilitated segment (Lee, 1994: 722).

The M.E.T uses two fundamental physiological principles: that of reciprocal innervation and autogenic inhibition (Lee, 1994: 722).

1) Reciprocal innervation implies that when an agonist muscle is contracted it will reflexively relax the antagonist muscle. The contraction of a specific antagonist muscle can decrease the gamma motorneuron discharge to its facilitated agonist muscle.

Therefore, the stronger the contraction of an antagonist muscle, to a certain extent, the more the spastic agonist muscle will relax. (Lee, 1994: 722.)

2) Autogenic inhibition implies that contracting a facilitated muscle from a lengthened position will stimulate the golgi tendon organ, which will in turn cause a reflex inhibition of both alpha and gamma motorneurons, i.e. resetting the gamma gain. This causes lengthening of the muscle on relaxation. (Lee, 1994: 722.)

Hence, using isometric muscle contractions at low intensities will help to reduce hypertonic muscle spasms and can consequently help to restore mobility to affected joints. The muscle contractions will also influence the surrounding connective tissues and fascia. As a result of the muscular effort applied by the patient and the resultant energy consumption and metabolic by-products of muscle contraction, it is not uncommon for the patient to experience some post treatment muscle stiffness for up to 36 hours. (Greenman, 1989: 88.)

Graham (1985: 1) outlines eight steps that he describes as essential to the performance of any M.E.T. He describes them as follows:

1) There must be an accurate structural diagnosis,

2) the barrier of restriction must be engaged in all three planes of joint motion,

3) the doctor must apply an unyielding counterforce,

4) the patient must supply the correct isometric force in terms of:

- strength
- direction (away from restriction)
- duration (3-5 seconds)

5) the patient and doctor must both relax completely after their muscle contractions at the same time,
6) the joint must be moved to the new barrier of restriction in all three planes,
7) the above steps must be repeated between three to five times, and
8) the patient must be retested for the structural diagnosis.

Graham (1985: 1) goes on further to describe some of the common mistakes made when performing M.E.T.:

- not checking the movement of the joint by palpation,
- allowing the patient to contract too forcefully,
- not letting the patient maintain the contraction for a sufficient length of time,
- not allowing the patient to relax fully before repositioning the joint to the new barrier of restriction and
- not retesting the patient after completing the procedure.

Greenman (1989: 88) reports that a contraction in the wrong direction by the patient and not giving the patient proper instructions as how to perform the technique can influence the success of the treatment.

Bourdillon et.al. (1992: 127) reiterate the importance of engaging the barrier of restriction. They state that if the barrier is not reached the technique will not be as effective, and if the barrier is engaged too strongly no effect may be noticed. Contraction in any direction, as long as it is away from the barrier of restriction is vital.

Greenman (1989: 89) is of the opinion that M.E.T. is one of the most effective forms of manual therapy which can help restore or increase joint mobility, normalize muscle strength and stretch shortened connective tissues.
It is a physiologically and anatomically safe procedure. This is supported by Bourdillon et.al. (1992: 257) who state that there have been no recorded incidents of vertebrobasilar artery damage occurring as a result of this procedure.

2.5.4 Studies involving Mobilisation

Brodin (1984) conducted a study on the effectiveness of cervical mobilisation in the treatment of 63 mechanical neck pain patients. The patients were randomly divided into three groups. One group acted as a control and received no treatment. The second group received massage, gentle traction and electrical stimulation. The third group received passive mobilisation without any thrusting. All treatments were performed three times a week for three weeks, and all three groups were advised to take a salicylate preparation during this period. Cervical ranges of motion and pain intensity were measured before the treatment, weekly during the treatment period and after a one week follow-up period.

Results indicated that one week after the treatment had ended 48% of the mobilised group, 22% of the control group and 12% of the massage group had no neck pain. Overall 78% of the mobilised group experienced a decrease in their pain as compared to 39% in the control group and 35% in the massage group. This difference was found to be statistically significant ($p<0.05$).

A significant increase in the cervical range of motion was evident in the mobilised group as compared to the other groups after the third week of treatment ($p < 0.001$), but this difference was not as significant after the fourth week ($p < 0.1$).

Brodin (1984) concluded that mobilisation was an effective form of treatment for mechanical neck pain, and although cervical range of motion increased initially, it tended to decrease again once treatment had ended. He further remarked that a relationship between increased mobility of the cervical spine and a decrease in pain could not be made in the outcome of patients suffering with mechanical neck pain.

Nordemar and Thorner (1981) performed a randomized study involving 30 patients suffering from acute cervical pain of less than three days duration. Patients were placed in one of three groups. The first group received a neck collar and analgesics. The second group received a neck collar, analgesics and transcutaneous nerve stimulation three times a week. The third group received a neck collar, analgesics and were asked to rest. In addition, the third group also received soft tissue treatment, gentle traction and mobilisation in the form of Muscle Energy Technique. They were also treated three times a week. Treatment was initially designed to last for two weeks but because the majority of patients had significant improvements within one week, the second week of treatment was not performed. The patients were followed-up at six weeks and three months.

Results indicated an increase in the total mobility range for both the TENS group and the mobilisation group. The neck collar group did not improve as well as the other two groups. The authors report that the increase in the total mobility range was significant between the TENS group and the neck collar group only and not between any of the other groups. The mobilisation group did have the greatest improvement in total mobility range in the first week, however, which the authors failed to recognise (increase of 132 deg.).

The severity of neck pain decreased in all the groups during the first week of treatment, but none were significant. The mobilisation group had the greatest reduction in pain severity. At the six week and three month follow-up, all patients except one, had full mobility and were pain free. This patient was in the neck collar group and experienced continued episodes of neck pain and stiffness. It is interesting to note that the mobilisation group consumed the least amount of analgesics (2.1 g/week), followed by the TENS group (2.5 g/week).

Mealy et.al. (1986) and Mc Kinney (1989) conducted studies involving acute whiplash injuries to determine the effectiveness of early mobilisation in their treatment. It was found that early mobilisation produced a significant decrease in pain intensity and that a significant improvement in the cervical mobility had been achieved after four weeks of treatment which was maintained after eight weeks.

2.6 Studies involving Adjustments and Mobilisation

In a randomized controlled study, Cassidy et.al. (1992b) compared the immediate effects of an adjustment to mobilisation on 100 consecutive patients suffering from unilateral neck pain of mechanical origin with referral into the trapezius muscle. Sixteen patients had neck pain for less than one week, 34 had neck pain for between one week and six months, and the other 50 had neck pain of longer than six months duration.

Fifty-two patients were adjusted using a single rotary adjustment and 48 were mobilised using the Muscle Energy Technique on the involved side. Before treatment the patients filled out a pain disability index, a pain intensity questionnaire (NRS-101) and their cervical ranges of motion in all three planes were measured using the Rangiometer by Maker Inc.

The results indicated that the pain intensity decreased in both groups and that their ROM increased within the five minute post-treatment period. Of the manipulated group, 85 percent (44 out of 52) experienced a decrease in their neck pain (NRS-101 decreased by 17.3 points from 37.7 to 20.4), while in the mobilised group 69 percent (33 out of 48), experienced a similar response (NRS-101 decreased by 10.5 points from 31.0 to 20.5). It was found that in 10 percent of the manipulated group and 25 percent of the mobilised group no improvement was experienced, while in 6 percent of cases increased pain was experienced in both groups. The ROM was increased in all three planes in both groups, but the manipulated group experienced greater improvements in all directions, particularly in ipsilateral rotation, then forward flexion and contralateral flexion. These improvements did not meet statistical levels of significance.

Cassidy et.al. (1992b) therefore concluded that the results indicated that both treatments were effective in decreasing pain and increasing ROM. They reported that a single adjustment was more effective than mobilisation in decreasing mechanical neck pain because the manipulated group experienced a nearly one and half times greater improvement in their NRS-101 scores. To the authors' knowledge this was the first time such a phenomenon had been shown to take to place.

Koes et. al. (1991b, 1992a, 1993) conducted a randomized clinical trial on the effectiveness of manual therapy, physiotherapy and treatment by a general practitioner on chronic non-specific back and neck complaints of not less than six weeks duration. One hundred patients suffering with neck pain were treated in the four groups and their mean duration of complaint was one year. Treatments consisted of exercises, massage and physical therapeutic modalities (electrotherapy, heat, ultrasound and shortwave diathermy) for the physiotherapy group. The manual therapy group received manipulation or mobilisation. The patients treated by their general practitioners received medication and advice related to posture and exercise, while a fourth group acted as a control group and received detuned ultrasound or shortwave diathermy. The treatments were performed for a maximum period of three months and follow-up measurements were taken at three, six and twelve weeks.

Results for patients with chronic neck and low back pain indicated that at three and six weeks the manual therapy group and the physiotherapy group had a much greater improvement in their main complaints and global perceived effect compared to the general practitioner and control groups. At twelve weeks however, the difference between the groups was minimal. No statistically significant difference was found between any of the groups with regards to pain severity or daily functioning, and all groups tended to improve equally. The manual therapy group had a greater improvement in physical functioning at all three measurements compared to the other groups.

This was statistically significant at three weeks but not at twelve weeks. Spinal mobility did not seem to change significantly in any of the groups, and its suitability for measuring progress in patients with chronic neck and low back pain was questionned. It is of interest to note that the manual therapy group received the least number of treatments (5.4) as compared to the physiotherapy group (14.7), but no other significant differences were noted between the manual therapy or physiotherapy groups at any of the follow-up measurements.

The authors also performed a one year follow-up on the above study (Koes <u>et.al.</u>,1992b, 1993), but due to dropouts and change over patients only analysis with regards to the manual therapy and physiotherapy groups was made. After the twelve month follow-up period manual therapy appeared to be slightly more effective than physiotherapy. This was evident by a greater mean improvement of the manual therapy patients' neck pain as compared to the physiotherapy group. Unfortunately, not a clear enough distinction was made between neck pain and low back pain patients.

Vernon et. al. (1990) conducted a study on patients suffering from chronic mechanical neck pain (majority < 3 mths) to determine the effect that an adjustment would have on the pressure pain thresholds in the paraspinal areas of joint dysfunction. A control group (4 patients) received an oscillating, rotary mobilisation, while the manipulation group (5 patients) received a rotary adjustment to the involved level. Pressure pain thresholds were measured by blinded examiners using a pressure threshold meter.

The results indicated that a 40%-55% increase in pressure pain thresholds was obtained in the manipulated group which was not evident in the mobilisation group. The differences between the two groups were found to be highly significant statistically. It must be noted, though, that none of the patients in the mobilised group felt that they had received a proper treatment and therefore patient bias may have affected the results.

In a study carried out by Parker et.al. (1979) over a period of six months, the effect of manipulation versus mobilisation (control group) of the cervical spine amongst other parameters was investigated in the treatment of migraine sufferers. Treatment was performed by chiropractors, medical practitioners and physiotherapists. Eighty-five patients were divided into three, randomly selected treatment groups. The first group received adjustments from experienced chiropractors (4), the second group received adjustments from medical practitioners (2) and physiotherapists (4) and the third group received mobilisation from medical practitioners (1) and physiotherapists (6) for a period of two months.

Although this trial was not specifically designed to compare adjustments and mobilisation, during the course of the trial it was found that the mobilised group had actually experienced an improvement in their migraine attacks and that the decision to use them as a control was a mistake.

2.7 Complications arising from Manual Therapy

Haldeman (1992: 585-586) and Jaskoviak (1980) report that pathological processes, such as atherosclerosis, osteophytosis or abnormal vascular flow patterns within one or both arteries can result in ischaemia to the brain and surrounding areas. Trauma to the arterial wall resulting in vasospasm or direct damage, due to unduly forceful rotation and extension type adjustments causing emboli to be formed, have been known to cause complications in some instances. These complications are usually synonymous with those of the vertebrobasilar artery insufficiency syndrome.

Aker (1995) believes that the incidence of vertebrobasilar artery insufficiency or major complications such as cardiac arrest, fracture of the vertebral column or trachea, compression of the spinal cord or haematoma formation in the internal carotid artery is approximately 5-10 per 10 million manipulations, while neurological deficit, paralysis or permanent impairment is approximately 3-6 per 10 million manipulations. He further estimates that death as a result of manipulation occurs in less than 3 per 10 million manipulations.

Michaeli (1993) in a study analysing the occurrence and nature of complications arising from manipulative physiotherapy in South Africa, found that between

1971 and 1989, approximately 228, 050 manipulations had been performed by 153 physiotherapists. The number of mobilising procedures performed in the same period, however, were not known.

It was found that during this period 25 patients reported complications arising from manipulation ranging from dizziness, nausea, headaches, vomiting, nystagmus, blurred vision, loss of consciousness to brachialgia with and without neurological symptoms. Of these, 72% were as a result of general rotary type adjustments, and 28% were due to localised adjustments. All these patients had a full recovery from their complications within an average of 6.3 days. Fifty-eight patients who received mobilisation complained about complications including dizziness, headaches, nausea, vomiting, blurred vision, nystagmus, brachialgia with or without neurological symptoms, increased pain and one incident of cerebral vascular accident. Not all patients recovered fully. It was not apparent, according to the author which particular type/s of mobilisation were employed when these complications resulted, but it is speculated that they involved end range techniques and not gentle grades. No such study involving chiropractors has been performed in South Africa to date.

Bourdillon et.al. (1992: 257) report that no incidents of vertebrobasilar artery insufficiency have been known to occur as a result of Muscle Energy Techniques.

2.8 Conclusion

The information in this chapter is presented in order to reveal some of the current knowledge relating to manual therapy. Mobilisation is a form of manual therapy, as is an adjustment. The only difference is the extent to which the joints are put through their ranges of motion.

It is evident from the above studies (Cassidy et.al., 1992b ; Brodin, 1984 ; Nordemar et.al., 1981) that mobilisation does indeed have an effect on pain producing structures and the cervical ranges of motion. The important point is to establish what long term effects both therapies have on mechanical neck pain.

The study by Cassidy et.al. (1992b) is well designed and has a sound methodology. Both outcome measures used have been shown to be reliable and valid in previous studies by Jensen et.al. (1986) and Cassidy et.al. (1992a). The two groups were similar with respect to history of neck pain and disability, while the sample sizes were adequate (average of fifty patients after randomization).

Complications arising from mobilisation are less likely to occur because of the lesser force imparted to the joint and also, because the joints are not taken into the paraphysiological ROM. Mobilisation is more gentle in its application and, therefore, if found to be as effective as manipulation for mechanical neck pain it may be the treatment of choice in patients suffering from this condition who have identifiable risk factors associated with adjustments.

3.0 MATERIALS AND METHODS

3.1 THE DATA

The data of this research was of two specific types, namely primary and secondary data.

3.1.1 The Primary Data

Five types of primary data were required :

A : The patients' responses to the CMCC Neck Disability Index Questionnaire. (Appendix A)

B : The patients' responses to the Numerical Rating Scale-101 Questionnaire for pain intensity. (Appendix B)

C : The patients' responses to the McGill Short Form Pain Questionnaire. (Appendix C)

D : The patients' ranges of motion for flexion, extension, rotation and lateral flexion in the cervical spine. (Appendix D)

E : Demographic data obtained from the Case History (Appendix E), Physical Examination (Appendix F) and Regional Cervical Examination (Appendix G).

3.1.2 The Secondary Data

The secondary data was obtained by conducting citation searches of any studies or books related to the use of manual therapy in patients presenting with mechanical neck pain. The Mediline CD ROM was also used to find relevant articles. Meta-analyses on manual therapy for the cervical spine were included.

3.2 THE CRITERIA GOVERNING THE ADMISSIBILITY OF THE DATA

Only the data obtained from the disability, pain intensity and pain quality questionnaires (Appendices A, B and C) and the case history, physical examination and regional examination (Appendices E, F and G), completed under the researchers supervision or clinician were used once the patients had been instructed on how to complete them correctly.

Active ranges of motion for flexion, extension, rotation and lateral flexion were measured (Appendix D). Only measurements performed by the author, or someone with experience in using the CROM goniometer were recorded .

There was a minimum age restriction of fifteen to ensure that the patients understood what was required of them in the completion of the questionnaires. There was no restriction as to the duration of the complaint. A minimum of thirty patients were treated in the study at the Technikon Natal Chiropractic Clinic, once they had given informed consent.

3.3 THE RESEARCH METHODOLOGY

This was a randomized, consecutive, comparative study involving both experimental and analytical survey methods. All patients who responded to the advertisements placed in the local newspapers were evaluated to determine if they suffered from mechanical neck pain. Once the case history (Appendix E), general physical examination (Appendix F), and regional examination of the cervical spine (Appendix G) had been completed, the patients were then randomly placed in one of two groups, either the adjustment or mobilisation group.

This was accomplished by placing thirty possibilities into a hat, fifteen of adjustment and fifteen of mobilisation. Before the first patient was treated all thirty cards were drawn from the hat. This determined the order as to what group each patient was assigned to, as and when they arrived at the clinic for treatment. The position of any patient that dropped out was then replaced by the next new patient joining the study.

A radiological study of the cervical spine was carried out at the Technikon Natal Radiography Department when clinically indicated and was reported on by a radiologist before any treatment was performed. The prescribed views were: an A-P, a Lateral, a right and left Oblique and an Open Mouth View. This was to ensure that no contraindication to manual therapy existed.

Once the patients had given written consent for their participation in the study, the initial part of the study began. This entailed the completion of the disability (Appendix A), pain intensity (Appendix B) and pain quality (Appendix C) questionnaires by the patients. These questionnaires were chosen, as they had been demonstrated to exhibit good reliability and validity in measuring neck pain(Vernon and Mior, 1991 and Jenson et. al., 1986).

Ranges of motion of the cervical spine were measured using the CROM goniometer (Performance Attainment Associates, St. Paul, MN). The CROM goniometer was chosen, because it has been demonstrated to produce good to excellent intra-tester and inter-tester reliability in measuring cervical ranges of motion (Capuano-Pucci et. al., 1991 and Rheault et. al., 1992). The CROM goniometer has also been shown to be highly reliable when comparing cervical range of motion measurements using different techniques, i.e. universal goniometer or visual estimation (Youdas et. al., 1991).

Cervical ranges of motion were measured with the patient sitting in a straight-backed chair with their arms resting at their sides and their feet flat on the ground. The CROM instrument was placed on the patient as if he/she was putting on a pair of glasses and the velcro straps were fastened. All measurements were made using the same type of chair. When measuring rotation the patient sat so the magnetic yoke pointed in the direction of north.

Measurements were made in the following manner:

1) Cervical Flexion and Extension - The patient was instructed to firstly tuck in his chin to include sub-occipital flexion, and then to attempt to put his chin on his chest. Cervical extension was measured by first getting the patient to tilt his head back (sub-occipital extension) and then to try and get his forehead parallel to the ceiling. These readings were taken off the sagittal plane meter and recorded on appendix D. Only one reading for each direction was taken.

2) Lateral Flexion - The patient was instructed to laterally flex his neck as far as possible to the left and right without elevating the shoulders or rotating the head. The two measurements were then read off the lateral flexion meter and recorded on appendix D.

3) Rotation - For rotation the magnetic yoke and rotation arm were used. The sagital plane and lateral flexion meters were checked to ensure that they were at zero, while the rotation meter was set at zero by turning the dial on the rotation meter. The patient was instructed to turn his head as far as he could to the right and then to the left, keeping his eyes moving along a horizontal line and avoiding any shoulder rotation. The two readings were read off the rotation meter and recorded on appendix D. (Modified from CROM Procedure Manual, 1988: 4-6.)

Immediately thereafter, the affected joint/s were identified using motion palpation and other signs such as muscle hypertonicity, local tenderness, the texture and tone of the underlying tissues, any anatomical asymmetry, "subluxation"or any lasting soreness (Bergmann et. al., 1993: 63).

Once the affected area/s had been identified, the patients were treated according to the group to which they had been assigned. Both groups did receive soft tissue therapy to the upper back and cervical musculature before each treatment was performed.

The adjustment group received adjustments involving minimal rotation (Diversified Technique), whereby skin slack was removed in the direction of thrust until the contact was firmly secured over the posterior articular pillar of the cervical spine. The indifferent hand was then placed over the contra-lateral temporal area of the skull, cupping the patient's ear and was used to laterally flex the patient's head and neck towards the contact hand, while at the same time, rotating the patient's head and neck slightly away from the contact hand until all the joint slack under the contact finger had been removed. Once this had been achieved, a high velocity, short amplitude thrust was applied in the direction of the planes of articulation of the posterior facet joints. This procedure was repeated at any other levels where fixations were found.

The mobilisation group received a mobilisation procedure known as Muscle Energy Technique. The affected level/s were first isolated, and the direction in which the loss of motion had occurred, determined the position in which the head and neck were placed. The forefinger and thumb of one hand were utilized to stabilise the involved level, while the other hand provided the counterforce. The patient was then instructed to produce the opposite movement while the therapist applied the counterforce.

This isometric contraction was held for between 3-5 seconds with mild to moderate forces imparted by both the therapist and patient. The patient was also instructed to move his eyes so that he was looking in the direction in which he was trying to obtain movement. This served as an activating force. Additionally, the patient was instructed to breathe in while doing this. The patient was allowed to relax and 'let go', and then the procedure was repeated once the new barrier of restriction to joint movement had been engaged. This was repeated 3-5 times for each level identified.

After the first treatment the same questionnaires were completed as before, and the ranges of motion in the cervical spine were measured again. Patients received two treatments per week for a maximum of three weeks, but if any of the patients had experienced a full recovery in less than three weeks the second phase of the study began straight away.

The second phase entailed completion of the questionnaires for a third time and measurement of the cervical ranges of motion after the three week treatment period had ended. After a further three weeks of no treatment the third phase of the study was completed. The questionnaires and ranges of motion were again completed and the patients were then released from the study.

The data that had been collected was then scored. The neck disability index (Appendix A) was scored from zero to five for each of the ten categories, depending on the option the patient chose.

The first option in the category received a score of zero, while the sixth option received a score of five. The total score for all the categories was added up and multiplied by two to achieve a percentage disability for the patient at the different measuring times. These were recorded on spreadsheets for the two different groups.

The numerical rating scale responses (Appendix B) were recorded on spreadsheets as separate averages for "worst" and "least" pain for the two groups over the study period. The quality of pain responses (Appendix C) were scored depending on their severity and were graded as: zero for no pain; one for mild pain; two for moderate pain or three for severe pain. A total out of forty-five for the fifteen types of pain listed, was calculated and converted into a percentage. This was recorded on a spreadsheet for each patient at the different measurement times. The ranges of motion were not scored and were used as raw scores.

The information contained on the spreadsheets was fed into a computer with the assistance of a statistician and underwent statistical analysis using the computer program, Statsgraphics Plus-Version 6.0. The tests performed were the Wilcoxon Signed-Ranks test for comparing data within the two groups and the Mann-Whitney test for comparing data between the two groups (Daniel , 1978: 31-34; 82-85). The results obtained from these analyses were used to discuss the role of adjustments and mobilisation in treating mechanical neck pain and to draw up any conclusions and recommendations related to their effectiveness.

3.4 THE SPECIFIC TREATMENT OF EACH SUBPROBLEM

In this section the treatment of subproblem one to four was identical.

3.4.1 Subproblem One

The first subproblem was to evaluate the effectiveness of adjustments on the patients' ranges of motion of the cervical spine in order to determine how motion was affected after an adjustment .

The Data Required

The data required for testing the hypothesis of subproblem one were the flexion, extension, left and right lateral flexion and left and right rotation range of motion measurements.

The Location of the Data

The data was obtained from the fifteen patients who comprised the adjustment group. All patients were treated at the Technikon Natal Chiropractic Day Clinic.

The Means of Obtaining the Data

The data required was obtained by means of the CROM goniometer.

It is a combination of two gravity meters which measure, flexion/extension and left and right lateral flexion, and a magnetic meter which measures rotation. The measurements were obtained on the four occasions as stated in the methodology.

The Treatment of the Data

One reading for each direction of motion was measured on each occasion and this was recorded on the range of motion result sheet (Appendix D). The data was transferred to spreadsheets and used to construct tables for the different measurement times.

Interpretation of the Data

The data was interpreted by calculating Wilcoxon Signed-Ranks tests comparing ranges of motion before the first treatment to those after the first treatment, before the first treatment to those after the third week of treatment, as well as to those after the three week follow-up period.

The alpha value of significance was set at 0.05 (5% level of significance). The null hypothesis was that no change in the range of motion occurred after an adjustment. If the statistical value was greater than the tabled value the null hypothesis was to be rejected and the alternative hypothesis, that an adjustment increased the range of motion in the cervical spine, was to be accepted. (Steyn et. al., 1994: 405-411)

3.4.2 The Second Subproblem

The second subproblem was to evaluate the effectiveness of an adjustment with reference to the patients' experiences of pain and disability in the cervical spine in order to determine how patients perceived the change in the quality of their lives after treatment.

The Data Required

The data required for testing the hypothesis of subproblem two were the responses of the patients' levels of disability, pain intensity and severity.

The Location of the Data

The data was obtained from the fifteen patients belonging to the adjustment group. The study was confined to patients who presented to the Technikon Natal Chiropractic Day Clinic.

The Means of Obtaining the Data

All the data required was obtained by means of questionnaires. These comprised of :

- CMCC Neck Disability Questionnaire (Appendix A),
- Numerical Pain Rating Scale-101 Questionnaire (Appendix B),

- McGill Short Form Pain Questionnaire (Appendix C)

The questionnaires were completed on four separate occasions as outlined in the research methodology.

The Treatment of the Data

Screening of the questionnaires was carried out to ensure that all the questionnaires had been completed correctly. They were scored and the results transferred to spreadsheets.

The Interpretation of the Data

The data was interpreted by calculating Wilcoxon Signed-Ranks tests comparing the responses to the three questionnaires before the first treatment to those after the first treatment, before the first treatment to those after the third week of treatment, as well as to those after the three week follow-up period.

The alpha value of significance was set at 0.05 (5% level of significance). The null hypothesis was that no change in the patients' perceptions of disability, pain intensity or severity would occur after a treatment. If the statistical values were greater than the tabled values the null hypothesis was to be rejected and the alternative hypothesis accepted. (Steyn et. al., 1994: 405-411.)

3.4.3 The Third Subproblem

The third subproblem was to evaluate the effectiveness of mobilisation (Muscle Energy Technique) on the patients' ranges of motion of the cervical spine in order to determine how motion was affected after such therapy .

The Data Required

See Data Required for Subproblem One.

The Location of the Data

See Location of Data for Subproblem One.

The Means of Obtaining the Data

See Subproblem One - Means of Obtaining the data.

The Treatment of the Data

See Treatment of Data for Subproblem One.

Interpretation of the Data

See Interpretation of Data for Subproblem One.

3.4.4 The Fourth Subproblem

The fourth subproblem was to evaluate the effectiveness of mobilisation (Muscle Energy Technique) with reference to the patients' experiences of pain and disability in the cervical spine, in order to determine how patients perceived the change in the quality of their lives after treatment.

The Data Required

As for Subproblem Two.

The Location of the Data

As for Subproblem Two.

The Means of obtaining the Data

As for Subproblem Two.

The Treatment of the Data

As for Subproblem Two.

The Interpretation of the Data

As for Subproblem Two.

3.4.5 The Fifth Subproblem

The fifth subproblem was to integrate the knowledge of the relative effectiveness of an adjustment and Muscle Energy Technique on the range of motion and patients' perceptions of pain and disability in order to determine under which conditions an adjustment was more beneficial to Muscle Energy Technique in treating mechanical neck pain .

The Data Required

The data required, consisted of the answers to the disability, pain intensity and pain severity questionnaires and the measured ranges of cervical motion.

The Location of the Data

The data was obtained from the fifteen patients in the adjustment group and the fifteen patients in the mobilisation group.

Means of Obtaining the Data

The data was obtained by means of the CMCC Neck Disability Questionnaire (Appendix A), Numerical Pain Rating Scale-101 (Appendix B), McGill Short Form Pain Questionnaire (Appendix C) and the CROM goniometer.

The Treatment of the Data

The data relating to the different outcome measures was used to make comparisons between the adjustment and mobilisation group over the study period. This was tabulated.

The Interpretation of the Data

The data from the questionnaires and the ranges of motion of the cervical spine were interpreted using the Mann-Whitney test for comparison of data between the two sample groups before the first treatment, after the first treatment, after the three week treatment period and after the three week follow-up period.

The alpha value of significance was set at 0.05. The null hypothesis was that there would be no difference in the patients' perception of disability, pain intensity, pain severity or ranges of motion between the two groups at the different measurement times.

If the statistical values were, however, greater than the tabled values the null hypothesis would be rejected and the alternative hypothesis accepted, i.e. that a significant difference existed between the two groups. (Daniel, 1978: 82-84)

It must be noted that the two groups were also compared with regard to age, sex and duration of complaint to determine if any differences existed.

4.0 RESULTS

4.1 INTRODUCTION

Forty-eight patients were examined during the period of this study. Of these, 12 patients were excluded from the study for the following reasons:

- 6 patient's were suffering from Myofascial Pain and Dysfunction Syndrome only.
- 1 patient had hard neurological signs.
- 1 patient had a positive Wallenberg's Test with associated vomiting.
- 1 patient had a Type II odontoid peg fracture.
- 1 patient had signs of underlying pathology (vomiting and bloody stools).
- 1 patient was a habitual self adjuster.
- 1 patient had cervical and thoracic spine pain.

Out of the remaining patients, 3 did not return after the initial examination, while 3 patients were non-compliant during the course of the study. Therefore, the results in this chapter reflect the treatment of 30 patients, 15 in each group.

Note: The range of motion scores are in degrees, while the disability and pain scores are in percentages. Refer to appendices I-R for raw data related to results.

4.2 RANGE OF MOTION

4.2.1 Flexion

4.2.1.1 Results of Wilcoxon Signed Ranks Test

Table 4.1 Comparison of mean flexion ranges of motion for the adjustment and mobilisation group over the study period. (*n* = 30)

GROUP/FLEXION	PRE.TX	POST.TX	3WKS.TX	3WKS.F-UP
ADJUSTMENT	50.07	50.47	50.13	52.80
MOBILISATION	49.47	55.33	54.27	50.27

Comparison of the flexion range of motion readings showed a significant statistical increase within the mobilisation group after the first treatment. The mean gain was 5.86 degrees (p=0.0079532). This had decreased slightly after the three weeks of treatment. Mean decrease of 1 degree was noticed, but there was still a significant improvement compared to before treatment had started (p=0.0177322).

This was no longer evident after the three week follow-up period (p=0.3948355). No statistically significant increases were found in the adjustment group at any stage in the study, which is explained by the relatively small increases in the mean flexion readings.

4.2.1.2 Results of Mann Whitney Test

Despite the differences in the flexion ranges of motion of the cervical spine between the two groups, especially after the first and the three weeks of treatment (Table 4.1), these differences did not reach statistical levels of significance. None of the other measurements reached statistical levels of significance during the study period. (5% level of significance)

4.2.2 Extension

4.2.2.1 Results of Wilcoxon Signed Ranks Test

Table 4.2 Comparison of mean extension ranges of motion of the adjustment and mobilisation group over the study period. (*n*=30)

GROUP/EXTENSION	PRE.TX	POST.TX	3WKS.TX	3WKS.F-UP
ADJUSTMENT	72.93	74.80	75.07	73.07
MOBILISATION	71.00	76.60	79.13	69.33

Comparison of the extension range of motion readings showed a significant statistical increase within the mobilisation group after the first treatment (p=0.0206633), and after the three weeks of treatment (p=0.0075111). This was represented by a mean increase in extension of 5.6 degrees and a further 2.53 degrees respectively. After the three week follow-up period the mobilisation group had actually lost all its gained extension and had 1.67 degrees less extension than before the first treatment (p=0.376803).

No statistically significant increases were found in the adjustment group at any stage in the study, despite the overall small increase in extension.

4.2.2.2 Results of Mann Whitney Test

No statistically significant differences were noted between the two groups at any stage during the study period, despite the statistical differences experienced within the mobilisation group (Table 4.2).

4.2.3 Right Rotation

4.2.3.1 Results of Wilcoxon Signed Ranks Test

Table 4.3 Comparison of mean right rotation ranges of motion of the adjustment and mobilisation group over the study period. (*n*=30)

GROUP/RIGHT ROTATION	PRE.TX	POST.TX	3WKS.TX	3WKS.F-UP
ADJUSTMENT	66.47	69.00	68.00	68.27
MOBILISATION	62.27	66.53	67.00	66.00

Statistical analysis at a 5% level of significance revealed statistically significant increases in right rotation in the mobilisation group at all measurement times. Mean gain in right rotation after the first treatment was 4.26 degrees (p=0.0115648). Mean overall gain in right rotation after the three weeks of treatment was 4.73 degrees (p=0.0320149). After the three week follow-up period it had decreased slightly to a 3.73 degree mean gain (p=0.0222765).

The overall increases within the adjustment group failed to reach statistical levels of significance at any of the measurement stages.

4.2.3.2 Results of Mann Whitney Test

No statistically significant differences were found between the two groups at any stage in the study, despite the statistically significant changes within the mobilisation group over the whole course of the study.

4.2.4 Left Rotation

4.2.4.1 Results of Wilcoxon Signed Ranks Test

Table 4.4 Comparison of mean left rotation ranges of motion of the adjustment and mobilisation group over the study period. (*n*=30)

GROUP/LEFT ROTATION	PRE.TX	POST.TX	3WKS.TX	3WKS.F-UP
ADJUSTMENT	70.27	71.20	71.67	70.53
MOBILISATION	66.80	70.93	71.87	68.73

A statistically significant increase in left rotation was noted in the mobilisation group after the first treatment (Mean gain of 4.13 degrees; p=0.0188163), which was further increased by nearly 1 degree after the three weeks of treatment (p=0.0206633). After the three week follow-up period this was no longer evident. No statistically significant increases were noted in the adjustment group at any stage during the study.

4.2.4.2 Results of the Mann Whitney Test

Despite the significant changes within the mobilisation group during the study (Table 4.4), no statistically significant differences between the two groups were noted during the study.

4.2.5 Right Lateral Flexion

4.2.5.1 Results of Wilcoxon Signed Ranks Test

Table 4.5 Comparison of the mean right lateral flexion ranges of motion of the adjustment and mobilisation group over the study period. (*n*=30)

GROUP/RIGHT LATERAL FLEXION	PRE.TX	POST.TX	3WKS.TX	3WKS.F-UP
ADJUSTMENT	41.47	44.07	44.00	41.67
MOBILISATION	41.00	42.93	45.07	38.60

Comparison of the results within each group showed a statistically significant increase in right lateral flexion in the adjustment group after the three weeks of treatment (p=0.0355944), and a non significant increase after the first treatment (p=0.05).

The mobilisation group had a non significant increase after the three week treatment period ($p=0.0711065$). No other statistically significant increases were found in either group at any other stage in the study.

4.2.5.2 Results of the Mann Whitney Test

No statistically significant difference was found between either group over the length of the study period ($p>0.1$).

4.2.6 Left Lateral Flexion

4.2.6.1 Results of Wilcoxon Signed Ranks Test

Table 4.6 Comparison of the mean left lateral flexion ranges of motion of the adjustment and mobilisation group. (*n*=30)

GROUP/LEFT LATERAL FLEXION	PRE.TX	POST.TX	3WKS.TX	3WKS.F-UP
ADJUSTMENT	44.40	46.73	47.07	44.93
MOBILISATION	44.00	46.53	48.07	44.80

Statistical analysis within each group revealed statistically significant increases in left lateral flexion in both the adjustment (mean gain of 2.67 degrees; p=0.0196215) and mobilisation groups (mean gain of 4.07 degrees; p=0.0019403) after the three weeks of treatment. This was not evident in either group after the first or follow-up visit.

4.2.6.2 Results of the Mann Whitney Test

As was the case with right lateral flexion, no statistically significant differences were noted between either groups over the study period (p>0.1).

4.3 Disability Questionnaire

4.3.1 Results of Wilcoxon Signed Ranks Test

Table 4.7 Comparison of mean neck disability scores of the adjustment and mobilisation group over the treatment period. (*n*=30)

GROUP/DISABILITY	PRE.TX	POST.TX	3WKS.TX	3WKS.F-UP
ADJUSTMENT	28.40	19.00	13.47	17.33
MOBILISATION	31.80	25.60	15.27	18.07

Statistical analysis of the disability scores within each group indicated significant improvements regarding the levels of disability.

After the first treatment the adjustment group had a 9.4% improvement in their pain ($p=0.00206408$), while the mobilisation group had a 6.2% improvement ($p=0.0083643$). After the three weeks of treatment the adjustment group had had an overall improvement of 14.93% ($p=0.000438745$), while the mobilisation group had improved by 16.53% ($p=0.000438745$). Even though both groups deteriorated slightly after the three week follow-up period, patients were still significantly better than before the study had started. (ADJ: $p=0.0026928$; MOB: $p=0.0045907$).

4.3.2 Results of Mann Whitney Test

No statistically significant differences were noted between the two groups at any stage during the study period. There was a near statistically significant difference between the two groups after the first treatment ($p=0.078606$) when considering the improvement of the disability scores at that stage (Table 4.7).

4.4 McGill Pain Questionnaire

4.4.1 Results of Wilcoxon Signed Ranks Test

Table 4.8 Comparison of mean McGill Pain scores of the adjustment and mobilisation group over the study period. (*n*=30)

GROUP/McGILL PAIN	PRE.TX	POST.TX	3WKS.TX	3WKS.F-UP
ADJUSTMENT	19.93	6.00	3.80	10.40
MOBILISATION	19.60	9.33	8.33	13.27

Comparison of results obtained within each group revealed significant statistical decreases at all measurement times. After the first treatment both groups had improved significantly (ADJ: mean decrease of 13.93%; p=0.0019403 and MOB: mean decrease of 10.27%; p=0.000438745). This was further decreased in both groups after the three week treatment period (ADJ: further mean decrease of 2.2%; p=0.000438745 and MOB: further mean decrease of 1%; p=0.00089275).

Both groups had deteriorated after the three week follow-up period (ADJ: mean increase of 6.6% and MOB: mean increase of 4.94%) This was still significantly better than before the first treatment (ADJ: p=0.002083 ; MOB: p=0.0129213).

4.4.2 Results of Mann Whitney Test

A statistically significant difference with regards to the decrease in pain experienced in the adjustment and mobilisation group was noted after the first treatment (p=0.0178856). The adjustment group had a far superior improvement (See Table 4.8). After the three weeks of treatment (p=0.063043) and the three week follow-up period (p=0.060304), no significant difference was apparent.

4.5 Numerical Pain Rating Scale-101

4.5.1 Worst Pain Experienced

4.5.1.1 Results of Wilcoxon Signed Ranks Test

Table 4.9 Comparison of mean 'Worst Pain Experienced' of Numerical Rating Scale-101 of the adjustment and mobilisation group over the study period. (*n*=30)

GROUP/NRS-101 WORST PAIN	PRE.TX	POST.TX	3WKS.TX	3WKS.F-UP
ADJUSTMENT	75.00	45.33	47.00	44.00
MOBILISATION	80.67	69.00	42.67	57.67

Comparison of the results within each group indicated statistically significant improvements with regards to the NRS-101 Pain Questionnaire in both the groups. After the first treatment (ADJ: mean decrease of 29.67%; p=0.00321702 and MOB: mean decrease of 11.67%; p=0.0180157).

After the three weeks of treatment the adjustment group had 1.67% increase in pain (p=0.00048581), while the mobilisation group had a further 26.33% decrease in pain (p=0.000438745). At the three week follow-up period the adjustment group had a 3% decrease in pain (p=0.0019403), where as the mobilisation group had a 15% increase in their pain levels (p=0.00356624). These were, however, still significantly better than before the first treatment. (See table 4.9.)

4.5.1.2 Results of the Mann Whitney Test

Comparison of results between the two groups showed a statistically significant difference after the first treatment (p=0.0289712). This is as a result of the adjustment group's pain improving by almost 30%, whereas the mobilisation group improved by almost 11% after the first treatment (See table 4.9). No other statistically significant differences were noted between either group (p>0.1). If the changes between the groups after the first treatment and the three weeks of treatment are analyzed, and then again after the three weeks of treatment and the follow-up period, it is evident that the mobilisation group improved more over the treatment period, but lost some of this improvement over the three-week follow up period. The adjustment group was far more stable.

4.5.2 Least Pain Experienced

4.5.2.1 Results of Wilcoxon Signed Ranks Test

Table 4.10 Comparison of mean 'Least Pain Experienced' of Numerical Rating Scale-101 of adjustment and mobilisation group over the study period. (*n*=30)

GROUP/NRS-101 LEAST PAIN	PRE.TX	POST.TX	3WKS.TX	3WKS.F-UP
ADJUSTMENT	17.33	11.67	11.00	10.87
MOBILISATION	33.33	27.67	13.33	15.33

Analysing the results obtained within each group, it was found that the mobilisation group had experienced statistically significant decreases in its pain. This was represented by a mean decrease in pain of 5.66% after the first treatment (p=0.0180157), which was further decreased by 14.34% after the three weeks of treatment (p=0.000438745).

After the three week follow-up period a slight increase in pain was noted (2%), but it was still significantly better than before the first treatment (p=0.00185093). In the adjustment group a decrease of 6.46% after the three week follow-up period was the only measurement to reach statistical levels of significance (p=0,0341763). The values after the first treatment (p=0.064095) and three weeks of treatment (p=0.068485), were not of statistical significance.

4.5.2.2 Results of Mann Whitney Test

A statistically significant difference between the groups before the first treatment was noted (p=0.0067746), indicating that the mobilisation group had a higher 'Least Pain' score initially. This was also evident after the first treatment (p=0.00191768). From table 4.10 it can be seen that this is as a result of the differences in baseline values and that both groups had exactly the same decrease in 'Least" pain scores after the first treatment (decrease of 5.66%). No significant difference was noted between either groups after the three weeks of treatment, or after the three week follow-up period. If table 4.10 is consulted, it can be seen that overall the mobilisation group had a much larger mean percentage decrease in pain than the adjustment group over the study period.

4.6 DEMOGRAPHIC DATA

Table 4.11 Demographic data related to the adjustment group. (n=15)

PATIENTS ADJ. GROUP	AGE	SEX	CHRONICITY	TRAUMA	NECK ONLY	NECK + HEAD ACHE	NECK + SHOULDER
1	24	M	5 years	Y-MVA		Y	
2	56	M	8.5 years	N	Y		
3	44	M	16 years	Y-MVA			Y
4	59	F	2 months	Y-FALL			Y
5	50	M	4 years	N		Y	
6	34	M	14.5 years	Y-MVA			Y
7	38	F	3 years	Y-MVA		Y	
8	56	F	1 year	N			Y
9	35	F	18 years	Y-MVA		Y	
10	60	M	5 years	Y-MVA	Y		
11	30	M	12 years	Y-MVA			Y
12	25	F	10 years	N		Y	
13	30	M	7 months	Y-FALL		Y	
14	21	F	3 years	Y-FALL		Y	
15	25	F	5 years	Y-MVA		Y	
TOTAL	MEAN AGE	M:F	MEAN CHRONICITY	Y:N	TOTAL	TOTAL	TOTAL
15	**39.13**	**8:7**	**7.05 years**	**11:4**	**2**	**8**	**5**

Table 4.12 Demographic data related to the mobilisation group. (*n*=15)

PATIENTS MOB. GROUP	AGE	SEX	CHRONICITY	TRAUMA	NECK ONLY	NECK + HEAD ACHE	NECK + SHOUL DER
1	25	M	2 years	N			Y
2	58	F	34 years	Y-FALL	Y		
3	22	F	13 years	Y-MVA	Y		
4	22	F	6 years	Y-FALL	Y		
5	24	F	1 year	Y-MVA		Y	
6	34	F	1.5 years	Y-MVA		Y	
7	20	F	10 months	Y-MVA		Y	
8	48	M	3 months	Y-FALL	Y		
9	49	F	20 years	Y-MVA		Y	
10	57	F	10 years	N		Y	
11	40	F	35 years	Y-FALL			Y
12	44	F	2 years	N			Y
13	62	M	4 years	Y-MVA	Y		
14	32	M	6 years	Y-MVA			Y
15	24	M	1.5 years	Y-MVA		Y	
TOTAL	MEAN AGE	M:F	MEAN CHRONICITY	Y:N	TOTAL	TOTAL	TOTAL
15	**37.4**	**5:10**	**9.13 years**	**12:3**	**5**	**6**	**4**

5.0 DISCUSSION

5.1 RANGE OF MOTION

5.1.1 Discussion of Wilcoxon Signed Ranks Tests

Viewing the results presented in tables 4.1 to 4.6 it is apparent that both the adjustment and the mobilisation groups had increases in their ranges of motion as a result of the treatment. This supports hypotheses one and three.

The mobilisation group had significant increases in their ranges of motion after the first treatment with regards to flexion, extension, right rotation and left rotation ($p<0.05$), whereas the increases in the adjustment group did not reach statistical levels of significance.

Cassidy et. al. (1992b) found increases in the cervical ranges of motion for both the adjustment and mobilisation groups after the first treatment, but none of the measurements met statistical levels of significance. It was also found that the adjustment group experienced greater gains in ranges of motion as compared to the mobilisation group, which was not the case in this study. The small sample sizes used in this study or possibly the use of a different goniometer may account for this. Cassidy et. al. (1992b) used the Rangiometer by Maker, Inc. This goniometer is claimed by the authors to have shown good intra-examiner reliability.

The CROM goniometer was used in this study and has been shown by Rheault et. al. (1992), Capuano-Pucci et. al. (1991) and Youdas et.al. (1991) to have a high intra-examiner and inter-examiner reliability.

A small difference with regards to patient demographics may have played a role in producing the differences noted. Patients in this study had neck pain of a more chronic nature and 17% more patients had experienced some form of previous trauma to their necks, as compared to Cassidy et.al. (1992b) study.
(76% with a previous history of trauma to their cervical spine, as compared to 59%)

Over the three week treatment period both groups tended to increase their respective ranges of motion or maintain approximately the same range of motion they had obtained as a result of the first treatment. The mobilisation group appeared to respond better over the three week treatment period, maintaining significant improvements in flexion, extension, right rotation, left rotation and left lateral flexion as compared to before the first treatment. This was only evident in right and left lateral flexion in the adjustment group.

As no studies have previously involved both adjustments and mobilisation over more than one treatment, the results obtained in this study will be compared to related studies which involved either adjustments or mobilisation. Brodin (1984) found significant improvements in the mobility of patients suffering from mechanical neck pain ($p< 0.001$), when they had been treated over a period of three weeks with mobilisation.

Nordemar et.al. (1980) found dramatic increases in the total mobility range of patients suffering from acute neck pain, after they had received three mobilisation treatments over one week. Both these studies support the findings of this study but it must be noted that Nordemar et.al. (1980) study involved acute neck pain.

Howe et.al. (1983) and Hviid (1971) both found significant increases in the cervical ranges of motion following adjustments to the cervical spine over treatment periods of between three and five weeks. This was especially evident in rotation. This was not found in this study, despite the general overall increase in range of motion in the adjustment group.

These differences may be influenced by the larger sample sizes used in the above two studies or the questionable reliability of the goniometers employed. Both were designed by the authors who performed the studies, and no reliability studies had been performed on them by independent individuals. In a double-blind study involving the use of adjustments on chronic neck pain sufferers Sloop et.al. (1982) found no significant improvement with regards to range of motion over a three week treatment period. It is therefore evident that different authors have found conflicting results when measuring the effect of adjustments on increasing range of motion, especially related to chronic complaints.

In this study it was evident that both groups had lost some of their increased mobility after the three week follow-up period. In most cases the ranges of motion were still slightly greater than before the first treatment.

This was not the case, though, for extension and right lateral flexion in the mobilisation group, which completed the course of treatment having slightly less mobility than prior to the start of the study. From tables 4.1 to 4.6 it is evident that the mobilisation group tended to lose the gain in mobility more rapidly than the adjustment group. None of the ranges of motion were still significantly improved after the three week follow-up period.

This trend towards regaining limited mobility after the final treatment is supported by a number of authors. Brodin (1984), Hviid (1971) and Nansel et.al. (1990) all found decreases in the increased mobility during follow-up periods.

Nansel et.al.'s (1990) study was confined to asymptomatic patients with regards to pain. It was found that in the group with a previous history of trauma to the cervical spine, 12 out of the 16 patients regained their limited lateral flexion ranges within 48 hours after a single adjustment. In each case the restricted movement was found to return to the same side as before the adjustment. This was not found in the group with no history of previous trauma to their cervical spines.

When the demographic data of the patients in the adjustment and mobilisation groups of this study is analyzed (tables 4.11 and 4.12), it is evident that 73% of the adjustment group and 80% of the mobilised group had a previous history of trauma to the cervical spine. Therefore the trend towards losing their increased mobility is supported by the findings of Nansel et.al. (1990).

The greater loss of initially gained mobility by the mobilisation group over the follow-up period may be due to the fact that a higher percentage of patients within this group had a previous history of neck trauma.

Nansel et.al. (1990) reported that this loss could be attributed to the nervous system becoming used to the "dysfunctional reflex pattern" created by the original trauma. It therefore tried to restore the pattern, despite an attempt to correct it by stimulating the articular afferent neurological system via adjustments or mobilisation.

The chronicity of the patients' complaints may play a role in the relative differences in results occurring between the adjustment and mobilisation groups. The majority of both groups' complaints were of a chronic nature (see tables 4.11 and 4.12). If one considers the type of joint dysfunction or pathology most likely occurring in and around the joint at that stage, it is possible that many patients may have presented with ligamentous fixations (Gillet and Liekens, 1969; Schafer and Faye, 1989). This involves shortening of the ligaments and contracture formation of the joint capsules.

Gillet and Liekens (1969) suggested that in order to restore the ligaments and capsules back to their normal lengths, a slow, repeated pull-type of procedure would be beneficial. They further reported that although the increase in range of motion after an adjustment to muscular fixations is quite apparent, this increase is not as dramatic in adjustments to ligament fixations.

This may be a reason why mobilisation, in the form of Muscle Energy Technique, may have had a more dramatic effect on increasing the range of motion in the cervical spine.

5.1.2 Discussion of Mann Whitney Test

No statistically significant differences were noted between the two groups at any stage in the study despite the significant increases within the mobilisation group at the stages mentioned above. This may be due to the small sample sizes used. It, therefore, infers that mobilisation was not overall significantly superior to adjustments in increasing the patients' ranges of motion. These results are similar to those found by Cassidy et. al. (1992b) for the effect of a single treatment of adjustment or mobilisation on the ranges of motion of the cervical spine.

5.2 DISABILITY

5.2.1 Discussion of Wilcoxon Signed Ranks Tests results.

The CMCC Neck Disability Index Questionnaire proved to be an inappropriate questionnaire to detect differences experienced by the patients after the first treatment, despite the significant statistical improvements experienced in both groups at this stage. The reason for this is that patients had to give responses to questions regarding their levels of disability related to personal care, lifting, work, driving and sleeping which they had not performed again in the short time following the first treatment.

The results relating to after the first treatment are hence questionable and will not be discussed. Cassidy et.al. (1992b) only measured levels of disability before the first treatment to see if both groups had similar levels of disability prior to the study.

After the three weeks of treatment both groups had experienced significant improvements with regards to their levels of disability (table 4.7). The mobilisation group had experienced approximately 2% greater improvement than the adjustment group. After the three week follow-up period both groups experienced a slight deterioration with regards to disability (table 4.7), which is similar to the range of motion findings. Overall, patients were still significantly improved, compared to before the first treatment. The approximate 2% greater improvement in the mobilisation group was still evident after the three week follow-up period.

These findings support hypotheses two and four, namely that adjustments and mobilisation would improve the patients' perceptions of disability related to mechanical neck pain.

5.2.2 Discussion of the results of the Mann Whitney Tests

No significant differences were noted between the two groups at any stage during the study, implying that both forms of treatment were just as effective in decreasing the patients' perceptions of disability related to mechanical neck pain. These results, therefore, do not support hypothesis five.

In addition, both groups were found to be experiencing similar levels of disability before the first treatment as a result of their neck pain. This was also the case in Cassidy et.al.'s study (1992b).

5.3 PAIN

5.3.1 Discussion of results of Wilcoxon Signed Ranks test.

The McGill Pain Questionnaire was utilized to analyze the patient's severity of neck pain, but not the ' type' of neck pain the patient was suffering from. Within each group a significant decrease in pain was experienced after the first treatment, which was further decreased over the three week treatment period in the adjustment group. This further decrease was not noted in the mobilisation group. After the three week follow-up period a similar increase in pain severity was observed in both groups (Table 4.8). It must be noted that according to the McGill Pain Questionnaire the severity of the patient's pain before the treatment commenced was not very high (20%). No studies appear to have used the McGill Pain Questionnaire as a subjective measure for evaluating mechanical neck pain.

Both the adjustment and mobilisation groups experienced decreases in pain with regards to the NRS-101 Questionnaire. For the measurements relating to the 'worst' pain ever experienced, the adjustment group appears to have responded better with a nearly 3 times greater reduction in pain after the first treatment compared to the mobilisation group (Table 4.8).

This may be explained by the rapid separation of the joint surfaces, that has been shown to occur during an adjustment, and the freeing of trapped pain-sensitive tissues i.e. meniscoid (Lewit, 1978) or synovial fold (Haldemann, 1992). The mobilisation group appears to have had a greater decrease in pain over the three week treatment period, while the adjustment group maintained a similar level to that after the first treatment.

This decrease in pain over the treatment period may be contributed to by the fact that mobilisation might take longer to free a trapped pain sensitive structure, as there is no joint cavitation involved and, therefore, no dramatic separation of the joint surfaces (Mierau et.al., 1988). With prolonged treatment, however, the joint may be mobilised further and further until finally the trapped structure may be released.

After the three week follow-up period the adjustment group maintained its decreased pain levels, while the mobilised group had regained some of its pain. This may be explained by the incomplete freeing of pain sensitive structures over the treatment period with mobilisation. It does not explain why the patients in the adjustment group still had pain after the three week follow-up period.

Similar findings were detected with regards to the 'least' pain experienced in both groups. The mobilisation group tended to respond slower, but it must be noted that the two groups did not have similar pain levels before the treatment started (Table 4.10).

Over the whole study the mobilisation group had a greater decrease in pain with regards to 'least' pain but they had a much higher 'least' pain level initially.

Cassidy et.al.'s (1992b) study was similar. After the first treatment the adjustment group had experienced a much greater decrease in pain intensity than the mobilisation group. In his study it was approximately 1.5 times greater in the adjustment group. This comparatively smaller increase may be attributed to the larger population sizes used in his study. A similar trend is, nevertheless, evident.

Howe et. al. (1983) and Sloop et.al. (1982) both found significant improvements with regards to neck pain in patients treated with adjustments over a period of three weeks. Howe et.al. (1983) also mentioned that the greatest decrease in pain in the adjustment group appeared after the first treatment, and that with further treatments the pain levels did not change dramatically.

Brodin (1984) and Nordemar et.al. (1981) also found decreases in pain levels after mobilisation over treatment periods of between four and six weeks. Seventy eight percent of patients experienced a decrease in pain after mobilisation in Brodin's study.

The above studies, therefore, support the findings of this study with regards to the effect of adjustments and mobilisation on patients' perceptions of pain levels. The findings support hypotheses two and four.

5.3.2 Discussion of the results related to the Mann Whitney tests.

A significant difference between the two groups was noted after the first treatment. The adjustment group had a much greater reduction in pain than the mobilisation group. To a certain extent this is supported by the findings of Cassidy et.al. (1992) although their results did not meet statistical levels of significance (p=0.05). The differences in sample sizes may have played a role here. No other statistically significant differences were noted between the two groups after the three weeks of treatment, or after the three week follow-up period. This indicates that, although the mobilisation group took slightly longer to improve, they had just as an effective improvement over the study period as the adjustment group.

The different biomechanical effects that adjustments and mobilisation exert on the joints and surrounding soft tissues may account for this. The high velocity thrusts employed in adjustments may exert a greater and quicker effect on the joint mechanoreceptors and nociceptors, which in turn affects reflex responses on pain inhibition. Many of the mechanoreceptors and nociceptors involved with pain inhibition are high threshold receptors (Wyke, 1985). The levels of stimulation produced from a slow and gentle procedure, such as Muscle Energy Technique, may not have a dramatic effect initially. With a series of treatments, however, sufficient afferent input may be achieved to stimulate these pain inhibiting pathways. This is an area which needs further investigating.

<u>Note:</u> If the raw data of appendices I-R are considered, it can be seen that measurements from three patients in the adjustment group, and one patient in the mobilisation group tended to be quite different from most of the other patients' measurements for the follow-up period. Patients one and three in the adjustment group, and patient four in the mobilisation group were suffering from influenza at the follow-up stage, while patient six in the adjustment group suffered an epileptic attack during the follow-up period. This may have influenced their pain scoring, and due to the small sample sizes of the groups in this study, may have influenced the results for the follow-up measurement time. If one views the nature of the patients' complaints in table 4.11 and 4.12, it is evident that the two groups varied in the number of patients who had neck pain only. The mobilisation group had a greater proportion of these patients. It is interesting to note the high incidence of neck pain and associated headaches in both groups. It can also be seen that the majority of these patients had experienced some form of trauma previously. This is a finding which needs to be investigated further.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The results of this study over the three week treatment period and three week follow-up period indicate that adjustments do not appear to be more beneficial than mobilisation (Muscle Energy Technique) in the treatment of chronic mechanical neck pain. No statistically significant difference was noted between the two treatment groups for any of the outcome measures after the three weeks treatment or after the follow-up period.

Several outcome measures within each group, however, had significant improvements at certain stages of the study when compared to pre-treatment values. The mobilisation group appeared to have more improvement with regards to mobility and disability, especially after the first treatment and the three week treatment period. This was not as obvious in the adjustment group. The adjustment group tended to have a much quicker response with regards to reduction in pain, particularly after the first treatment. The mobilisation group experienced a similar reduction in pain, but over a longer treatment period.

Both groups appear to have deteriorated slightly after treatment was completed. In many instances patients were still improved compared to before treatment. The three patients who experienced influenza, and the one patient who suffered an epileptic attack during the follow-up period may have influenced this result, because of the small population sizes used in the study.

It is, therefore, recommended that a much larger sample size and double blind measures be utilised if this study is repeated. The small numbers of patients used in this study makes accurate statistical analysis difficult.

The limited experience of any undergraduate researcher in the field of manual therapy may bias the results and it is suggested that more experienced manual therapists repeat this study in order to further substantiate the role of adjustments and mobilisation in the treatment of mechanical neck pain.

It is recommended that passive ranges of motion be analysed instead of active ranges of motion. Wong and Nansel (1992) have shown that measuring passive ranges of motion demonstrates range of motion asymmetries to a greater extent than active ranges of motion. In measuring passive ranges of motion 'cortical influences' (Wong and Nansel, 1992) are absent and the effects of a certain treatment on the ranges of motion of the joint may, therefore, become more apparent. The use of passive movement would also exclude the influence that muscle can have on reducing mobility and would, hence, be a more reliable indicator of pure joint movement.

In this study range of motion was not a very reliable indicator of progression. This is possibly because of the chronicity of the conditions. It is suggested that pressure pain thresholds rather be used to determine the patients' responses to treatment.

Vernon et.al. (1990) have shown a significant improvement in pressure pain thresholds of patients with chronic mechanical neck pain treated with a single adjustment as compared to mobilisation.

The Short Form McGill Pain Questionnaire used in the study was less reliable than the NRS-101, because it is more difficult to analyse. This is supported by the findings of Jensen et.al. (1986), and it is therefore suggested that it is excluded in future studies. No other studies in the current literature related to mechanical neck pain have utilised this questionnaire.

As the majority of patients in this study suffered from chronic neck pain, it is suggested that the study be repeated on a population suffering from acute neck pain to establish whether the duration of complaint plays any role in the effectiveness of the treatment. In acute neck pain severe limitation of movement is common, normally in rotation and to a lesser extent lateral flexion. In chronic neck pain a more generalised reduction in mobility is evident. The mechanisms and pathological processes producing acute and chronic neck pain are not the same. In acute neck pain inflammation causing pain and reduced mobility is hypothesized to be from entrapped soft tissues and muscle spasm (Lewit,1978; Haldeman, 1992: 205), while chronic neck problems, causing low grade pain and reduced mobility, are hypothesized to be from adhesions, ligament shortening or capsular contracture (Gillet and Liekens, 1969). The different physical and biomechanical effects of adjustments and mobilisation on the joints and surrounding tissues, therefore, needs to be analysed in chronic as well as acute patients.

It is the authors opinion, by considering the results produced in this study, that both forms of treatment are effective in treating chronic mechanical neck pain. In order to decide which treatment is of greater benefit the primary objective of the treatment must be established. If it is to restore mobility, then Muscle Energy Technique appears to be slightly more beneficial. If it is to decrease pain as quickly as possible, it appears that adjustments would be more suitable. Further research is required to refute or validate these findings.

7.0 REFERENCES

Aker, P.D. 1995. Management of Neck Pain: A Literature Review. Paper read at 8th Annual Interdisciplinary Symposium on The Cervical Spine: Hyperflexion-Extension (Whiplash) Injuries, Los Angeles College of Chiropractic, California, 25-26 March, 1995.

Basmajian, V. 1985. Manipulation, Traction and Massage. 3rd Edition. Baltimore: Williams and Wilkens. 333p. ISBN: 0-683-00378-X.

Bergmann, T.F., Peterson, D.H.and Lawrence, D.J. 1993. Chiropractic Technique-Principles and Procedures. New York: Churchill Livingstone Inc. 803p. ISBN: 0-443-08752-0.

Bland, J.H. 1987. Disorders of the Cervical Spine - Diagnosis and Medical Management. Philadelphia: W. B. Saunders Company.377p. ISBN: 0-7216-1187-7.

Bourdillon, J.F., Day, E.A.and Bookhout, M.R. 1992. Spinal Manipulation. 5th Edition. Oxford: Butterworth-Heinemann LtD. 381p. ISBN: 0-7506-0576-6.

British Association of Physical Medicine. 1966. Pain in the Neck and Arm - A Multi-Centre Trial of the Effects of Physical Therapy. British Medical Journal. 1: 253.

Brodin, H. 1984. Cervical Pain and Mobilization. International Journal of Rehabilitation Research. 7: 190-191.

Brunarski, D.J. 1984. Clinical Trials of Spinal Manipulation: A Critical Appraisal and Review of the Literature. Journal of Manipulative and Physiological Therapeutics. 7 (4): 243-249.

Caillet, R. 1964. Neck and Arm Pain. Philadelphia: F.A. Davis Company. 112p.

Capuano-Pucci, D., Rheault, W., Aukai, J., Bracke, M., Day, R.and Pastrick, M. 1991. Intra-tester and Inter-tester Reliability of the Cervical Range of Motion Device. Archives of Physical Medicine and Rehabilitation. 72: 338- 340.

Cassidy , J.D. , Quon , J.A. , Lafrance , L.J. and Yong - Hing , K. 1992a . The Effect of Manipulation on Pain and Range of Motion in the Cervical Spine: A Pilot Study. Journal of Manipulative and Physiological Therapeutics . 15 (8) : 495-500.

Cassidy , J.D. , Lopes , A.A. and Yong-Hing , K. 1992b . The Immediate Effects of Manipulation versus Mobilization on Pain and Range Motion in the Cervical Spine: A Randomized Controlled Trial . Journal of Manipulative and Physiological Therapeutics. 15 (9) :570-575 .

Daniel, W.W. 1978. Applied Nonparametric Statistics. Boston: Houghton Mifflin Company. 503p. ISBN: 0-395-25795-6.

Drews, E.R. 1995. A Study of Demographic and Epidemiological Factors of Private Chiropractic Practices and a Chiropractic Teaching Clinic. M. Dip. C. dissertation, Technikon Natal, Durban.

Gatterman, M.I. 1990. Chiropractic Management of Spine Related Disorders. Baltimore: Williams and Wilkens. 437p. ISBN: 0-683-03438-3.

Gillet, H.and Liekens, M. 1969. A Further Study of Spinal Fixations. Annals of Swiss Chiropractors' Association. Vol. IV: 41-46.

Graham, K.E. 1985. Outline of Muscle Energy Techniques. Oklahoma College of Osteopathic Medicine and Surgery. 61p.

Greenman, P.E. 1989. Principles of Manual Medicine. Baltimore: Williams and Wilkens. 347p. ISBN: 0-683-03556-8.

Grieve, P. 1988. Common Vertebral Joint Problems. 2nd Edition. Hong Kong: Churchill Livingstone. 787p. ISBN: 0-443-03365-X.

Grieve, P. 1991. Mobilisation of the Spine - A Handbook of Clinical Method. Fifth Edition. Singapore: Churchill Livingstone. 426p. ISBN: 0-443-04236-5.

Haldeman, S. 1992. Principles and Practice of Chiropractic. 2nd Edition. Connecticut: Appleton and Lange. 641p. ISBN: 0-8385-6360-0.

Howe, D.H., Newcombe, R.G. and Wade, M.T. 1983. Manipulation of the Cervical Spine - A Pilot Study . Journal of the Royal College of Practitoners . 33: 574-579.

Hviid, H. 1971. The Influence of the Chiropractic Treatment on the Rotary Mobility of the Cervical Spine - A Kinesiometric and Statistical Study. Annals of Swiss Chiropractors' Association. Vol. V: 31-44.

Jaskoviak, P.A. 1980. Complications arising from Manipulation of the Cervical Spine. Journal of Manipulative and Physiological Therapeutics. 3 (4) 213- 219.

Jensen, M.P., Karoly, P.and Braver, S. 1986. The Measurement of Clinical Pain Intensity: A Comparison of Six Methods. Pain. 27: 117-126.

Kirkaldy-Willis, W.H.and Burton, C.V. 1992. Managing Low Back Pain. 3rd Edition. New York: Churchill Livingstone. 419p. ISBN: 0-443-08789-X.

Koes , B.W. , Assendelft , W.J.J. , van der Heijden , G.J.M.G. , Bouter , L.M. and Knipschild , P.G. 1991a . Spinal Manipulation and Mobilization for Back and Neck Pain: A Blinded Review . British Medical Journal . 303 : 1298-1303.

Koes, B.W., Bouter, L.M., Knipshild, P.G., van Mameren, H., Essers, A., Houben, J.P., Verstegen, G.M.J.R. and Hofhuizen, D.M. 1991b. The Effectiveness of Manual Therapy, Physiotherapy and Continued Treatment by the General Practioner for Chronic Nonspecific Back and Neck Complaints: Design of a Randomized Clinical Trial. Journal of Manipulative and Physiological Therapeutics . 14 (9) : 498-502 .

Koes, B.W., Bouter, L.M., van Mameren, H., Essers, A., Verstegen, G.M.J.R., Hofhuizen, D.M., Houben, J.P. and Knipschild, P.G. 1992a. A Blinded Randomized Clinical Trial Of Manual Therapy and Physiotherapy for Chronic Back and Neck Complaints: Physical Outcome Measures. Journal of manipulative and Physiological Therapeutics. 15 (1): 16-23.

Koes, B.W., Bouter, L.M., van Mameren, H., Essers, A., Verstegen, G.M.J.R., Hofhuizen, D.M., Houben, J.P. and Knipschild, P.G. 1992b. Randomized Clinical Trial of Manipulative Therapy and Physiotherapy for Persistent Back and Neck Complaints: Results of one year follow up. British Medical Journal. 304: 601-605.

Koes, B.W., Bouter, L.M., van Mameren, H., Essers, A., Houben, J.P., Verstegen, G.M.J.R., Hofhuizen, D.M., Houben, J.P. and Knipschild, P.G. 1993. A Randomized Clinical Trial of Manual Therapy and Physiotherapy for Persistent Back and Neck Complaints: Subgroup Analysis and Relationship Between Outcome Measures. Journal of Manipulative and Physiological Therapeutics. 16 (4): 211-219.

Korr, I.M. 1975. Proprioceptors and Somatic Dysfunction. Journal of American Osteopathic Association. 74: 123-135.

Korr, I.M. 1978. The Neurobiologic Mechanisms in Manipulative Therapy. New York: Plenum Press. 466p. ISBN: 0-306-31150-X.

Lawrence, J.S. 1969. Disc Degeneration. Its Frequency and Relationship to Symtoms. Ann. Rheumatic Disease. 28: 121.

Leach, R.A. 1986. The Chiropractic Theories - A Synopsis of Scientific Research. 2nd Edition. Baltimore: Williams and Wilkens. 234p. ISBN: 0-683-04906-2.

Lee, D.G. 1994. Principles and Practice of Muscle Energy and Functional Techniques. In: Boyling, J.D. and Palastanga, N. Grieve's Modern Manual Therapy - The Vertebral Column. 2nd Edition. pp. 721-732. Singapore: Churchill Livingstone. 870p. ISBN: 0-443-04348-5.

Lewit, K. 1978. The Contribution of Clinical Observation to Neurobiological Mechanisms in Manipulative Therapy. In: Korr, I.M. The Neurobiological Mechanisms in Manipulative Therapy. pp. 3-25. New York: Plenum Press. 466p. ISBN: 0-306-31150-X.

McKinney, L.A. 1989. Early Mobilisation and Outcome in Acute Sprains of the Neck. British Medical Journal. 299: 1006-1008.

Mealy, K., Brennan, H. and Fenelon, G.C.C. 1986. Early Mobilisation of Acute Whiplash Injuries. British Medical Journal. 292: 656-657.

Mennell, J.MCM. 1990. The Validation of the Diagnosis 'Joint Dysfunction' in Synovial Joints of the Cervical Spine. Journal of Manipulative and Physiological Therapeutics. 13 (1): 7-12.

Michaeli, A. 1993. Reported Occurence and Nature of Complications Following Manipulative Physiotherapy in South Africa. Australian Physiotherapy. 39 (4): 309-315.

Mierau, D.,Cassidy, J.D., Bowen, V., Dupuis, P. and Noftall, F. 1988. Manipulation and Mobilisation of the Third Metacarpophalangeal Joint- A Quantitative Radiographic and Range of Motion Study. Manual Medicine. 3: 135-140.

Moore, K.L.1985. Clinically Orientated Anatomy. 2nd Edition. Baltimore, Williams and Wilkens. 1101p. ISBN: 0-683-06132-1

Nansel, D., Peneff, A., Cremata, E. and Carlson, J. 1990 . Time Course Considerations for the Effects of Unilateral Lower Cervical Adjustments with respect to the Amelioration of Cervical Lateral-Flexion Passive End-Range Assymetry . Journal of Manipulative and Physiological Therapeutics. 13 (6) : 297-304 .

Nordemar, R. and Thorner, C. 1981. Treatment of Acute Cervical Pain - A Comparative Group Study. Pain. 10: 93-101.

Nyiendo, J. and Haldeman, S. 1984. A Prospective Study of 2000 Patients Attending a Chiropractic College Teaching Clinic. Paper presented at the Eleventh Annual Meeting of the International Society for the Study of the Lumbar Spine. Montreal Canada, 3-7 June, 1984.

Parker, G.B., Tupling, H. and Pryor, D.S. 1979 . A Controlled Trial of Cervical Manipulation for Migraine. Chiropractic in New Zealand: Report .

Performance Attainment Associates. 1988. Crom Procedure Manual - Procedure for Measuring Neck Motion with the Crom. Minnesota: University of Minnesota. 8p.

Phillips, R.B.and Butler, R. 1982. Survey of Chiropractic in Dade County, Florida. Journal of Manipulative and Physiological Therapeutics. 5 (2): 83-89.

Rheault, W., Albright, B., Byers, C., Franta, M., Johnson, A., Skowronek, M. and Dougherty, J. 1992. Inter-tester Reliability of the Cervical Range of Motion Device. JOSPT. 15 (3): 147-150.

Sandoz, R. 1969. The Significance of the Manipulative Crack and of Other Articular Noises. Annals of Swiss Chiropractors' Association. Vol. IV: 47 -68.

Sandoz, R. 1976. Some Physical Mechanisms and Effects of Spinal Adjustments. Annals of Swiss Chiropractors' Association. Vol. VI: 91- 142.

Schafer, R.C.and Faye, L.J. 1989. Motion Palpation and Chiropractic Technic - Principles Of Dynamic Chiropractic. California: The Motion Palpation Institute. 426p. ISBN: 0924889-00-4.

Sloop, P.R., Smith, D.S., Goldenberg, E. and Dore, C. 1982. Manipulation for Chronic Neck Pain-A Double-Blind Controlled Study. Spine. 7 (6): 532-535.

Steyn, A.G.W., Smit, C.F. and Strasheim, C. 1994. Modern Statistics-In Practice. Pretoria, J.L. van Schaik Publishers. 736p. ISBN: 0-627-01989-7.

Vernon, H. 1988. Upper Cervical Syndrome: Chiropractic Diagnosis and Treatment. Baltimore: Williams and Wilkens. 253p. ISBN: 0-683-08591-3.

Vernon, H.T., Aker, P., Burns, S., Viljakaanen, S. and Short, L. 1990. Pressure Pain Threshold Evaluation of the Effect of Spinal Manipulation in the Treatment of Chronic Neck Pain: A Pilot Study. Journal of Manipulative and Physiological Therapeutics. 13 (1): 13-16.

Vernon, H. and Mior, S. 1991. The Neck Disability Index: A Study of Reliability and Validity. Journal of Manipulative and Physiological Therapeutics. 14 (7): 409-415.

White, A. and Punjabi, S. 1990 . Clinical Biomechanics of the Spine . Philadelphia: J.B. Lippincott. 722p. ISBN: 0-397-50720-8.

Wong, A. and Nansel, D. 1992. Comparisons Between Active vs. Passive End-Range Assessments in Subjects Exhibiting Cervical Range of Motion Assymmetries. Journal of Manipulative and Physiological Therapeutics. 15 (3): 159-163.

Wyke, B.D. 1985 Articular Neurology and Manipulative Therapy. In: Twomey, L.T., Scull, E.R., Kleynhans, A.M. and Idczak, R.M. Aspects of Manipulative Therapy. 2nd Edition. pp. 72-77. Melbourne: Churchill Livingstone. 194p. ISBN: 0-443-03036-7.

Youdas, J.W., Carey, J.R. and Garrett, T.R. 1991. Reliability of Measurements of Cervical Spine Range of Motion - Comparison of Three Methods. Physical Therapy. 71 (2): 98-104.

Appendix A

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 realise 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.

Appendix B

NUMERICAL RATING SCALE -101 QUESTIONNAIRE

Patient Name : ____________ File No. :_____ Date :_______

Please indicate on the line below , the number between 0 and 100 that best describes the pain you experience when it is at its worst . A zero (0) would mean "no pain at all", and one 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 you experience when it is at its least. A zero (0) would mean "no pain at all", and one hundred (100) would mean "pain as bad as it could be". Please write only one number .

____

Appendix C

SHORT - FORM McGILL PAIN QUESTIONNAIRE

Patient : ____________ File No : ______ Date : _______

	None	Mild	Moderate	Severe
Throbbing	0)____	1) ____	2) ____	3) ____
Shooting	0) ____	1) ____	2) ____	3) ____
Stabbing	0) ____	1) ____	2) ____	3) ____
Sharp	0) ____	1) ____	2) ____	3) ____
Cramping	0) ____	1) ____	2) ____	3) ____
Gnawing	0) ____	1) ____	2) ____	3) ____
Hot-Burning	0) ____	1) ____	2) ____	3) ____
Aching	0) ____	1) ____	2) ____	3) ____
Heavy	0) ____	1) ____	2) ____	3) ____
Tender	0) ____	1) ____	2) ____	3) ____
Splitting	0) ____	1) ____	2) ____	3) ____
Tiring-Exhausting	0) ____	1) ____	2) ____	3) ____
Sickening	0) ____	1) ____	2) ____	3) ____
Fearful	0) ____	1) ____	2) ____	3) ____
Punishing-Cruel	0) ____	1) ____	2) ____	3) ____

Appendix D

RANGE OF MOTION RESULT SHEET

Patient :__________ File No : _____ Date : _______

FLEXION ___________

EXTENSION _________

RIGHT ROTATION ________

LEFT ROTATION _________

RIGHT LATERAL FLEXION _________

LEFT LATERAL FLEXION _________

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 Current: TN
Other Other
X-ray Studies:
Previous: TN Current: TN
Other Other
Clinical path. lab.:
Previous: TN Current: TN
Other 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
  accomodation
  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
        broncophony
        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 hyperaesthaesia
  - 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, popliteal, post.tibial, dorsalis pedis
  - lymph nodes - epitrochlear, femoral (horizontal & vertical)
  - temperature (feet & 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 relexes
  - 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, organised)

Memory and attention:
- orientation (time, place, person)
- remote memory
- recent memory
- new learning ability

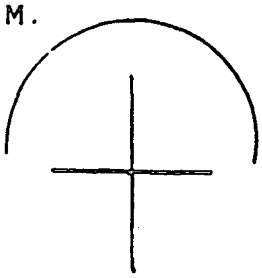
Higher cognitive functions:
- information and vocabulary (general & specialised knowledge)
- abstract thinking.

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

REGIONAL EXAMINATION - CERVICAL SPINE

Observation:

posture
size
swellings
scars
discoloration
hair line
R.O.M.



Flexion 45° chin to larynx
chin to chest
Extension 70° Forehead parallel to ground

L. Rotation 70°
R. Rotation 70°
L. lat. flex 45°
R. lat. flex 45°

/ painless limitation
// painful limitation

Palpation: lymph nodes
trachea
thyroid gland

Orthopaedic:

tenderness:
trigger points:
- SCM
- trapezius
- scaleni
- levator scapulae
- posterior musculature

doorbell sign
cervical compression
Kemp's test
lateral compression
cervical distraction
Adson's test
Halstead's test
costoclavicular test
hyperabduction (Wright's) test
Eden's (traction) test
shoulder abduction test
shoulder depression test
dizziness rotation test
Lhermitte's sign
Brachial plexus tension
O'Donoghue manoeuvre

Neurological:

Dermatomes:	L.	R.

C2
C3
C4
C5
C6
C7
C8
T1

Myotomes: C1
C2
C3
C4
C5
C6
C7
C8
T1

Reflexes:

C5
C6
C7

Vascular:

BP L / R /
Carotids
Subclavian arteries
Wallenberg's test

Motion palpation:

Jt.play		Left						Right					Jt.play	
P/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							

Appendix H

PATIENT INFORMED CONSENT FORM

I the undersigned , ... , have been explained the nature of this research project involving the treatment of neck pain and therefore give my informed consent to be examined , treated and / or X- Rayed at the Technikon Natal Chiropractic Day Clinic . I agree to comply with the instructions as stipulated by the intern in order for the successful completion of this research project .

Signature : .... Date : ....

Appendix I

DISABILITY\ ADJ.	PRE.TX	POST.TX	3WKS. TX	3WKS. F-UP
1	38%	48%	14%	54%
2	20%	22%	16%	22%
3	42%	26%	20%	39%
4	36%	20%	16%	18%
5	22%	14%	16%	8%
6	58%	38%	44%	51%
7	14%	4%	14%	6%
8	16%	8%	0%	2%
9	18%	14%	4%	6%
10	28%	0%	14%	2%
11	24%	18%	12%	8%
12	40%	27%	20%	30%
13	22%	14%	4%	10%
14	24%	14%	4%	2%
15	24%	18%	4%	2%

DISABILITY/ MOB.	PRE.TX	POST.TX	3WKS. TX	3WKS. F-UP
1	30%	30%	22%	18%
2	12%	12%	10%	14%
3	34%	38%	34%	30%
4	40%	36%	8%	54%
5	12%	11%	0%	0%
6	42%	24%	16%	14%
7	30%	20%	6%	18%
8	49%	33%	0%	0%
9	48%	48%	33%	32%
10	48%	24%	30%	32%
11	22%	18%	8%	10%
12	32%	18%	20%	6%
13	18%	10%	4%	18%
14	44%	42%	34%	46%
15	16%	20%	4%	2%

Appendix J

McGILL PAIN/ADJ.	PRE.TX	POST.TX	3WKS. TX	3WKS. F-Up
1	20%	29%	9%	16%
2	4%	4%	4%	4%
3	47%	18%	2%	28%
4	42%	18%	18%	12%
5	22%	0%	0%	0%
6	73%	4%	10%	78%
7	4%	2%	2%	4%
8	10%	0%	0%	0%
9	13%	7%	4%	0%
10	13%	0%	2%	2%
11	4%	0%	0%	2%
12	4%	0%	0%	2%
13	6%	2%	2%	2%
14	29%	2%	2%	4%
15	8%	4%	2%	2%

McGILL PAIN/MOB.	PRE.TX	POST.TX	3WKS. TX	3WKS. F-UP
1	18%	7%	4%	7%
2	9%	4%	16%	11%
3	9%	7%	7%	7%
4	22%	11%	2%	24%
5	4%	4%	0%	0%
6	53%	7%	2%	4%
7	38%	16%	7%	22%
8	13%	0%	0%	0%
9	20%	16%	2%	32%
10	51%	11%	17%	11%
11	20%	9%	13%	4%
12	7%	4%	4%	4%
13	7%	4%	2%	11%
14	58%	20%	33%	58%
15	36%	20%	16%	4%

Appendix K

NRS-101/WORST ADJ.	PRE.TX	POST.TX	3WKS. TX	3WKS. F-UP
1	90%	80%	60%	95%
2	60%	5%	20%	10%
3	75%	25%	80%	75%
4	80%	40%	80%	60%
5	80%	80%	50%	60%
6	95%	0%	55%	40%
7	50%	10%	50%	70%
8	50%	50%	0%	0%
9	90%	50%	70%	100%
10	60%	25%	95%	10%
11	75%	75%	85%	40%
12	80%	0%	0%	20%
13	100%	100%	10%	20%
14	80%	80%	40%	50%
15	60%	60%	10%	10%

NRS-101/WORST MOB.	PRE.TX	POST.TX	3WKS. TX	3WKS. F-UP
1	95%	95%	45%	60%
2	85%	85%	80%	80%
3	85%	85%	80%	80%
4	60%	60%	20%	85%
5	60%	60%	0%	15%
6	80%	60%	40%	30%
7	80%	40%	10%	80%
8	70%	40%	0%	0%
9	100%	100%	50%	80%
10	90%	70%	40%	50%
11	70%	70%	20%	20%
12	90%	70%	90%	95%
13	65%	50%	15%	40%
14	90%	70%	80%	90%
15	90%	80%	70%	60%

Appendix L

NRS-101/LEAST ADJ.	PRE.TX	POST.TX	3WKS. TX	3WKS. F-UP
1	40%	60%	0%	75%
2	5%	5%	0%	5%
3	75%	25%	15%	25%
4	20%	20%	20%	20%
5	10%	10%	5%	5%
6	0%	0%	5%	0%
7	10%	0%	10%	8%
8	10%	0%	0%	0%
9	20%	20%	30%	5%
10	10%	10%	75%	0%
11	15%	5%	5%	20%
12	0%	0%	0%	0%
13	20%	20%	0%	0%
14	20%	0%	0%	0%
15	5%	0%	0%	0%

NRS-101/LEAST MOB.	PRE.TX	POST.TX	3WKS. TX	3WKS. F-UP
1	40%	40%	15%	5%
2	5%	5%	5%	5%
3	20%	20%	10%	20%
4	40%	40%	5%	50%
5	5%	5%	0%	0%
6	60%	40%	10%	5%
7	40%	30%	5%	30%
8	30%	10%	0%	0%
9	40%	40%	20%	20%
10	50%	40%	40%	20%
11	30%	30%	0%	0%
12	50%	30%	45%	30%
13	10%	15%	5%	10%
14	30%	20%	10%	10%
15	50%	50%	30%	25%

Appendix M

ROM FLEXION ADJ.	PRE.TX	POST.TX	3WKS. TX	3WKS. F-UP
1	74	56	64	64
2	44	46	48	50
3	27	44	38	36
4	44	58	50	58
5	48	44	54	52
6	54	44	48	72
7	60	50	48	50
8	40	44	42	34
9	68	60	70	70
10	44	50	36	52
11	58	54	50	50
12	72	70	74	70
13	24	30	28	30
14	32	38	42	38
15	62	69	60	66

ROM FLEXION MOB.	PRE.TX	POST.TX	3WKS. TX	3WKS. F-UP
1	58	46	60	50
2	30	34	34	32
3	68	68	68	60
4	40	38	60	40
5	68	70	72	62
6	40	58	54	46
7	70	82	66	70
8	48	50	44	42
9	60	70	62	60
10	40	54	42	46
11	54	60	60	52
12	36	50	40	40
13	50	50	46	50
14	40	50	52	48
15	40	50	54	56

Appendix N

ROM EXTENSION ADJ.	PRE.TX	POST.TX	3WKS. TX	3WKS. F-UP
1	68	76	90	76
2	82	74	82	78
3	74	70	64	86
4	54	60	62	58
5	68	62	54	50
6	78	80	86	78
7	68	70	78	74
8	70	82	90	76
9	90	82	82	70
10	50	58	36	60
11	80	84	90	74
12	84	76	78	80
13	74	90	82	80
14	76	82	80	78
15	78	76	72	78

ROM EXTENSION MOB.	PRE.TX	POST.TX	3WKS. TX	3WKS. F-UP
1	80	74	86	74
2	66	64	78	44
3	62	64	62	76
4	64	72	76	62
5	82	90	84	80
6	30	54	56	40
7	115	115	115	82
8	82	90	90	82
9	80	72	80	82
10	54	74	68	72
11	90	92	92	92
12	56	54	42	40
13	70	72	72	66
14	50	60	74	52
15	84	102	112	96

Appendix O

ROM R.ROTATION ADJ.	PRE.TX	POST.TX	3WKS. TX	3WKS. F-UP
1	90	78	78	71
2	56	62	62	58
3	54	68	54	59
4	60	69	68	70
5	64	60	66	62
6	66	52	70	64
7	69	72	63	66
8	62	64	66	72
9	70	70	73	66
10	48	64	52	64
11	62	82	74	74
12	76	70	74	74
13	74	70	72	72
14	70	70	68	70
15	76	84	80	82

ROM R.ROTATION MOB.	PRE.TX	POST.TX	3WKS. TX	3WKS. F-UP
1	68	64	64	74
2	46	54	50	50
3	64	72	76	70
4	54	66	70	60
5	72	74	66	70
6	62	70	70	72
7	80	76	78	76
8	72	72	72	74
9	72	74	74	66
10	70	78	70	66
11	66	64	69	70
12	60	60	52	60
13	32	46	46	46
14	46	56	66	62
15	70	72	82	74

Appendix P

ROM L.ROTATION ADJ.	PRE.TX	POST.TX	3WKS. TX	3WKS. F-UP
1	86	68	94	76
2	82	72	68	70
3	78	60	76	62
4	52	62	66	78
5	79	72	66	72
6	74	82	66	74
7	64	68	74	64
8	62	60	72	64
9	76	78	78	74
10	48	58	47	56
11	70	80	74	78
12	70	62	64	60
13	70	78	74	76
14	68	74	72	74
15	78	94	84	80

ROM L.ROTATION MOB.	PRE.TX	POST.TX	3WKS. TX	3WKS. F-UP
1	68	62	90	78
2	60	60	66	60
3	66	78	76	69
4	50	62	70	48
5	84	82	86	80
6	58	68	70	66
7	82	78	86	70
8	78	80	70	72
9	82	82	70	70
10	66	70	72	72
11	60	68	62	68
12	48	54	52	52
13	66	68	72	70
14	52	70	52	70
15	82	82	84	86

Appendix Q

ROM R.LAT.FLEX. ADJ.	PRE.TX	POST.TX	3WKS. TX	3WKS. F-UP
1	56	56	64	46
2	36	36	42	40
3	40	40	46	40
4	32	38	32	34
5	42	37	32	37
6	32	46	36	34
7	30	34	40	32
8	26	36	32	30
9	48	48	44	44
10	30	32	30	24
11	44	54	50	56
12	56	52	54	54
13	60	58	60	60
14	42	44	48	46
15	48	50	50	48

ROM R.LAT.FLEX. MOB.	PRE.TX	POST.TX	3WKS. TX	3WKS. F-UP
1	36	36	46	38
2	24	32	50	32
3	38	40	42	46
4	50	48	50	42
5	56	40	46	39
6	32	50	50	44
7	70	66	60	46
8	46	50	50	44
9	52	50	50	62
10	40	42	42	44
11	30	36	30	30
12	32	30	26	24
13	30	32	36	38
14	29	36	36	34
15	50	56	62	62

Appendix R

ROM L.LAT.FLEX. ADJ.	PRE.TX	POST.TX	3WKS. TX	3WKS. F-UP
1	58	50	66	40
2	54	38	38	42
3	38	50	44	34
4	29	32	32	46
5	42	47	44	48
6	43	38	42	46
7	48	42	46	48
8	32	40	36	30
9	46	52	56	52
10	26	28	26	26
11	52	54	58	46
12	50	52	56	54
13	48	72	58	58
14	46	46	46	44
15	54	60	58	60

ROM L.LAT.FLEX. MOB.	PRE.TX	POST.TX	3WKS. TX	3WKS. F-UP
1	46	44	52	40
2	44	40	46	33
3	40	48	50	52
4	48	42	47	38
5	50	46	60	49
6	40	50	44	48
7	64	64	64	54
8	50	52	54	46
9	50	58	54	54
10	38	50	42	48
11	34	40	32	34
12	28	26	26	26
13	40	44	46	48
14	32	40	42	42
15	56	54	62	60