THE EFFECT OF INTERMITTENT, MECHANICAL CERVICAL TRACTION IN THE CHIROPRACTIC MANAGEMENT OF MECHANICAL NECK PAIN

by

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I, Roger Simon Wood, do declare that this dissertation is representative of my own work.

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DEDICATION

This research dissertation is dedicated to my exceptional parents, Jack and Janet Wood, for their belief in me. It is with your love, support, guidance and encouragement that I have been able to reach this goal.

Mom and Dad, Thank you.

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ABSTRACT

Mechanical neck pain is an extremely common condition. At any specific time, as many as 12% of the adult female population and 9% of the adult male population experience pain in the neck, with or without associated arm pain, and 35% of people can recall an episode of previous neck pain (Bland 1994:3). However, to date little research has been conducted to investigate which treatment protocol/s may be the most effective in the management of mechanical neck pain syndromes.

The aim of this study was to investigate whether the combination of chiropractic manipulative therapy and intermittent, mechanical cervical traction would be more effective in the treatment of mechanical neck pain than chiropractic manipulative therapy alone.

It was hypothesized that chiropractic cervical manipulative therapy and the combination of chiropractic cervical manipulative therapy and intermittent, mechanical cervical traction would both be effective in the treatment of mechanical neck pain. Moreover, with reference to objective and subjective clinical findings, it was hypothesized that the combination of chiropractic cervical manipulative therapy and intermittent, mechanical cervical traction would be more effective in the treatment of mechanical neck pain than chiropractic manipulative therapy alone.

This study was a randomised, controlled, comparative study consisting of a sample population of thirty patients suffering from mechanical neck pain. The thirty patients were randomly divided into two treatment groups of fifteen patients each; one group received chiropractic cervical manipulative therapy only whilst the other group received intermittent, mechanical cervical traction and chiropractic cervical manipulative therapy.

Each patient received a maximum of ten treatment sessions, with two treatments a week, over a five-week period. Patients were also reassessed at a one month follow-up consultation after the tenth treatment.

The patients were assessed for both subjective and objective responses to treatment. Subjective data was obtained from the following questionnaires: the CMCC Neck Disability Index, the McGill Short-form Pain Questionnaire and the Numerical Pain Rating Scale (NRS) – 101. Objective data was obtained from cervical goniometer measurements of the patient's range of motion. The data was collected at the first, fifth, final and one month follow-up consultations. Demographic data was also recorded.

Both subjective and objective data was analyzed at a 95% confidence interval. The Wilcoxon Signed Rank test was used to analyze data within each group and the Mann-Whitney U-test was used to analyse data comparing the two groups.

The results of this study suggest that there was a significant improvement within both groups in the form of decreased pain perception and functional disability and an increase

in cervical range of motion. There was no significant difference in the efficacy of the treatments when comparing the two groups. Moreover, both treatments produced similar favourable results.

As the sample size of patients was small, only tentative conclusions may be drawn from this study and it is recommended that further studies be conducted with a larger sample size. Future studies should also be conducted over a longer period to determine the long-term efficacy of chiropractic therapy.

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LIST OF ABBREVIATIONS

C.F.S - Cervical Facet Syndrome.

R.O.M. - Rang of Motion.

Group C – Treatment group that received cervical manipulative therapy only.

Group T – Treatment group that received intermittent cervical traction and cervical manipulative therapy.

IC – Initial consultation.

5C – Fifth consultation.

FC – Final consultation.

F/U – One month follow-up consultation.

p- value – two tailed probability of equaling or exceeding.

CHAPTER ONE

1.0 INTRODUCTION

Neck pain for part of the population is such an everyday event that it is sometimes viewed as a situation rather than a condition. Bland (1994:xiii) states that cervical spine syndromes are extremely common and are probably the fourth most common cause of pain. At any specific time, as many as 12% of the adult female population and 9% of the adult male population experience pain in the neck, with or without associated arm pain, and 35% of people can recall an episode of neck pain (Bland 1994:3).

The cervical spine has the ability for a wide range of movement in all planes, allowing for almost pure rotation and lateral flexion in addition to flexion and extension of the neck. The cervical spine forms a long lever with the head, weighing approximately 10% of the body weight, balanced on top (Gatterman 1990:205). This arrangement however predisposes the neck to injury when exposed to traumatic forces. Gatterman (1990:205) states that the most common injury to the neck is Joint Sprain with articular locking and accompanying muscle spasm. Other names also given to this same condition include: Cervical Zygapophyseal Pain (Dwyer et al. 1990); Cervical Joint Pain (Dwyer et al. 1990) and Posterior Facet Syndrome (Kirkaldy-Willis 1992:122) or Facet Syndrome (Gatterman 1990:369).

Research regarding the management of Cervical Facet Syndrome (C.F.S.) is in its infancy and a variety of conservative treatments are available. Gatterman (1990:232) states that manipulation of the cervical spine is the treatment of choice for C.F.S. Gatterman (1990:330-378) refers to a variety of other conservative treatments available such as: cryotherapy, heat therapy, soft tissue massage, immobilization or bracing, electrotherapy, acupuncture, ultra-sound therapy and cervical traction.

The most effective conservative treatment must be found to successfully manage C.F.S. This study investigates the efficacy of Manipulation and in the combination of Manipulation with Cervical Traction.

Gatterman (1990: 42) defines chiropractic manipulation as a passive manoeuver in which specifically directed manual forces are applied to vertebral or extra-vertebral articulations of the body, with the object of restoring mobility to restricted areas.

Kirkaldy-Willis (1992:283) refers to an adjustment or manipulation as a passive manual manoeuver during which a synovial joint is carried suddenly beyond the normal physiological range of movement without exceeding the boundaries of anatomical integrity.

Following manipulation Greenman (1993) states that joint surfaces are separated to a small degree, with reduction in spinal muscle hypertonicity resulting in increased mobility of the joint. Mierau et al. (1988) showed that manipulation of the third metacarpophalangeal joint resulted in increased joint mobility and radiographically greater joint surface separation.

Cassidy et al (1992a) showed in a randomized controlled study comparing manipulation to mobilization in the treatment of neck pain that both treatments increased R.O.M., but manipulation had a significantly greater effect on decreasing pain intensity (> 1.5 times). Cassidy et al. (1992b) showed an increase in all planes of post-treatment R.O.M. and a decrease in post-treatment pain scores (N.R.S. 101 questionnaire) following a single manipulation; however, this pilot study was not controlled. It should be noted that neither of these two studies included long-term follow up results. It is therefore of importance that future studies be controlled and designed with longer-term efficacy of chiropractic management of Cervical Facet Syndrome.

Gatterman (1990:365) defines traction as the application of a draw or pulling force along the long axis of the spine. Gatterman (1990:365) also refers to cervical traction as a useful adjunct to the chiropractic adjustment.

Positive physical changes occurring during cervical traction are highlighted by Kekosz et al. (1986) as:

- enlargement of the intervertebral foramen;
- separation of the vertebral bodies;
- separation of the facet joints and the release of the entrapped synovial membrane;

- stretching of the ligaments and joint capsule and,
- relaxation of the of the paraspinal muscles.

Gatterman (1990:369) refers to the effects of traction as:

- Suction – a subatmospheric pressure is created between the two vertebrae as they are pulled apart, thus resulting in a centripetal force on the disc.
- Distraction - the distance between the articular surfaces increases with sufficient traction.
- Ligamentous tautening – the anterior and posterior ligaments are stretched, causing further centripetal forces on the disc.
- Relaxation of musculature.
- Widening of Intervertebral Foramina.
- Straightening of spinal curves

Indications for traction according to Gatterman (1990) include:

* Disc protrusion, * Facet syndrome, * Nerve root compression,

* Spondylolisthesis, * Retrolisthesis, and * Discogenic spondyloarthrosis.

Traction may be continuous or intermittent and may be applied mechanically or manually. Gattermann (1990:365) identifies intermittent traction to cause or promote soft tissue stretch, joint separation and reduction of pain making it beneficial in the treatment of C.F.S. It appears useful in particular as the greatest separation occurs posteriorly. In a randomized clinical trial Zylbergold and Piper (1985) found that static, intermittent and manual traction all increased cervical mobility; whilst intermittent traction was the most effective in pain relief.

It is essential to study the various therapeutic modalities available to chiropractic so as to determine how they may be used to produce the most effective treatment as far as increased immediate and long-term relief from C.F.S. is concerned. More effective treatment leads to less financial burden on the patient, chiropractor, medical aid and society in general.

The purpose of this investigation is to evaluate the relative efficacy of cervical manipulation therapy combined with cervical traction versus cervical manipulation only, in terms of subjective and objective clinical findings, in order to determine the more effective approach to the treatment of cervical facet syndrome.

The first objective is to compare the relative efficacy of cervical manipulation and cervical traction as opposed to cervical manipulation only, in terms of subjective clinical findings in the treatment of cervical facet syndrome. The second objective is to compare the relative efficacy of cervical manipulation and cervical traction as opposed to cervical manipulation only, in terms of objective clinical findings in the treatment of cervical facet syndrome. The third objective is to integrate the data from the above two objectives in order to evaluate the most effective treatment for cervical facet syndrome.

CHAPTER TWO

2.0 REVIEW OF RELATED LITERATURE

2.1 INCIDENCE, PREVALENCE AND GENDER DISTRIBUTION OF MECHANICAL NECK PAIN SYNDROMES

Is the cervical spine clinically important?

The cervical spine is the most mobile area of the spine, and as a result it is prone to the greatest number of injuries. In the U.S.A., about 10,000 spinal cord injuries occur each year with approximately 80% of the victims under the age of 40 years and with the highest proportion of these injuries between the ages of 15 and 35 years (Serena et al.1995: 212). Serena et al. (1995:212) state that injuries to the cervical spine and possibly involving the spinal cord are potentially the most devastating and life-altering of all injuries compatible with life.

About 80% of all people who suffer from spinal column injuries are male (Serena et al. 1995:212). Falls account for 60% of injuries to the cervical vertebral column in patients over 75 years (Serena et al.1995:212). In younger patients 45% of injuries result from motor vehicle accidents (M.V.A.), 20% from falls, 15% from sports injuries, 15% from acts of violence and the remainder from other causes (Serena et al. 1995:212). Although Serena (1995:212) seems to refer to potentially gross cervical injury (such as in M.V.A.) and the possibility of cord damage, injuries can also simply result in cervical joint dysfunction to a varying degree.

Gatterman (1990:205) states that the most common injury to the neck is joint sprain with articular locking and accompanying muscle spasm. Other authors refer to this condition as Cervical Zygapophyseal Pain or Cervical Joint Pain (Dwyer et al. 1990: Aprill et al. 1990) or Posterior Facet Syndrome (Kirkaldy-Willis 1992:122) or Facet Syndrome (Skinner: 1995.212; Gatterman 1990:369).

Cervical spine pain syndromes are extremely common and are probably the fourth most common cause of visits to medical practitioners for pain (Bland 1994:xiii). More than 10% of the adult population recall having had at least three episodes of neck pain in one year (Hadler 1985). At any specific time, as many as 12% of the adult female population and 9% of the adult male population experience pain in the neck, with or without associated arm pain (Bland 1994:3). As much as 35% of the population can recall an episode of neck pain (Bland 1994:3).

Drew (1995) compared the types of conditions seen in private chiropractic practice in South Africa to the types of conditions seen at the Technikon Natal Chiropractic Day Clinic. It was found that 54.4% of patients treated at the teaching clinic presented with neck pain. 57.4% of patients treated in private practice complained of neck pain. However many of these patients concurrently suffered from headaches and/or arm pain. 14.8% of private practice patients and 16.7% of clinic patients had neck pain only (Drew 1995). Clearly most neck patients suffer concurrent and, from a traditional chiropractic point of view, related problems (such as headaches and/or arm pain).

2.2 JOINT DYSFUNCTION IN MECHANICAL NECK PAIN

Whether in the lumbar, thoracic or cervical spine the basic anatomical and functional unit of the vertebral column is made up of the three-joint complex formed by two posterior facet joints and a disc (Kirkaldy-Willis 1992:55).

The fibrocarilagenous disc has mechanical properties that allow for load and shock absorption. The posterior facet joints are paired, diarthrodial (freely movable) joints located between the inferior and superior articular facets of adjacent vertebrae. Their surface area is about two thirds of that of an intervertebral disc. They are lined by hyaline cartilage; a fibrocartilaginous meniscus (or menscoid) and lined with a synovial membrane. The fibrous capsule is lax enough to permit fairly free movement between joint surfaces (Bland 1994:51).

The zygapophyseal joints (or posterior facet joints) are not primarily weight- bearing; they function in stabilization of the motor segment. Displacement and dislocation of one vertebra on another is strongly prevented by a fail-safe locking mechanism provided by the orientation of the superior and inferior articular facets of adjacent vertebrae (Bland 1994:53). The facet joints are orientated in such a way that the superior facet faces forward and downward at about 45 degrees while the inferior facet faces upwards and backwards also at about 45 degrees (Bland 1994:53).

The joint capsules of the zygapophyseal joints are richly innervated by the medial branches of the cervical dorsal rami (Lord 1993).

When the cervical spine is subjected to forces causing injury the normal dynamic stabilizing effect of the bilateral facet joints is lost. Because these facet joints are richly innervated, abnormal orientation and the resultant dysfunction of the motor segment following injury results in neck pain.

Terms commonly used (and when defined clearly) interchangeably that refer to the loss of normal orientation and functioning of the facet joint in the chiropractic profession are: facet joint dysfunction, joint subluxation, subluxation syndrome, joint fixation and joint dysfunction.

2.2.1 Clinical Presentation of Cervical Joint Dysfunction.

Zygapophyseal joint facet syndrome is common, but because it is usually not demonstrable on radiographs it is frequently overlooked (Halderman 1992:208).

Bergmann et al. (1993:63) used the following diagnostic criteria to identify joint dysfunction:

1. Pain and Tenderness

Most primary musculoskeletal disorders manifest themselves by a painful response. The patient's description of the pain; its location and the intensity of tenderness are obtained from observation, percussion and palpation of osseous and soft tissue in the neck. There is a high inter- and intraexaminer reliability for osseous and paraspinal tenderness (Brantingham et al. 1995).

2. Asymmetry

Asymmetric qualities may be noted at multiple segmental levels or at an individual level in the cervical spine. Asymmetry and misalignment of vertebral segments is identified through observation, static palpation, and static radiography.

3. Range of Motion Abnormality

Changes in active, passive and accessory joint motions due to increased, decreased or aberrant motion are noted. Bergmann et al. (1993:63) state that it is thought that a decrease in motion is a common component of joint dysfunction. Abnormalities in motion in the cervical spine are identified through motion palpation and stress radiography. Gatterman (1990:232) refers to protective muscle spasm aiding in restricted vertebral motion and segment fixation detected on motion palpation. Crue (1957) highlighted that one of the diagnostic signs of cervical joint dysfunction is radiating pain on hyperextention of the cervical spine. Good to moderate intraexaminer reliability for detecting loss of accessory motion (joint play and end feel spring) has been reported (Brantingham et al. 1995).

4. Tone, Texture and Temperature Abnormality

Changes in the associated soft tissue including skin, fascia, muscle and ligaments are noted. They are identified through observation, palpation and possibly instrumentation.

5. Special tests

Special procedures and techniques will aid in the final diagnosis of joint dysfunction. (eg: Walker (1986) refers to placing the cervical spine into a combination of extension, lateral flexion and rotation to compress and elicit pain at or proximal to the effected side –also referred to as Kemp's Test).

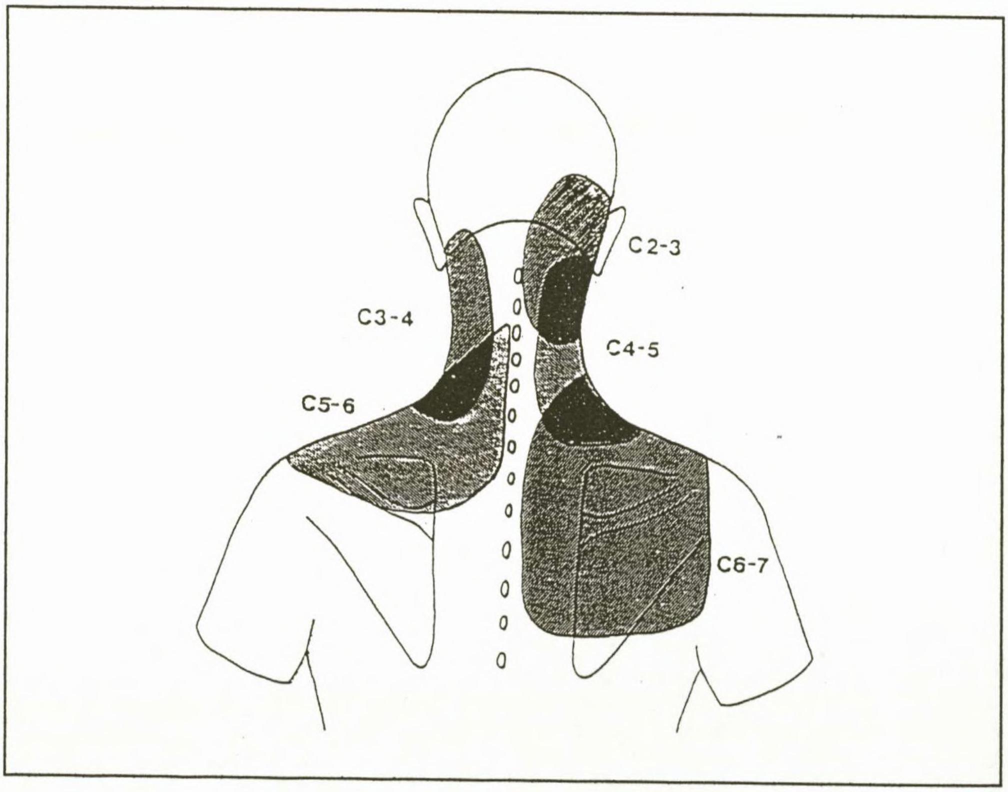
Gatterman (1990:232) refers to the most significant signs and symptoms of cervical facet syndrome (joint fixation or sprain) as neck pain and decreased range of motion.

Merrill et al. (1995:163) states that with a cervical sprain there has been damage to the ligamentous and capsular structures connecting the facet joints and vertebrae. There is limitation of motion and pain in the area of the injury and also pain along the muscle groups overlying the area of injury. No neurological symptoms are present.

It must be remembered that zygapophyseal joint dysfunction does not necessarily give rise to pain locally in the joint; it may give rise to pain at any place that shares a common nerve supply with the affected joint (Halderman 1992:208). Dwyer et al. (1990)

successfully developed a pain pattern for cervical facet syndrome. In this study joint segments were irritated by injection of a contrast medium into a specific facet joint. Each joint, once irritated produced a clinically distinguishable and characteristic pain-pattern. This led to the construction of pain charts that may be of value in determining the segmental location of symptomatic joints in patients presenting with cervical zygapophyseal pain.

This pain chart is shown in figure 2.1 below.



Aprill et al. (1990) tested the accuracy of these pain charts for predicting the segemental location of symptomatic joints in patients with cervical joint pain. The study was conducted on ten consecutive patients referred to a radiology practice for investigation of zygapophyseal joint pain. In nine of the ten patients there was complete concordance in the predicted levels using the pain pattern charts and the positive response to nerve blocks with anaesthetic injections into the joint of that level.

Aprill et al (1990) used the following criteria to identify pain stemming from a particular level :

C2-3: pain in upper cervical region and extending at least onto the occiput. Further extension towards ear, forehead, or vertex may occur.

C3-4: pain located over postero-lateral cervical region, extending cranially as far as the suboccipital region, but not substantially into the occipital region, and extending caudally over the postero-lateral aspect of the neck without entering the shoulder region.

C4-5: pain located over a more or less triangular area with two sides consisting of the posterior midline and postero-lateral border of the neck and a base running parallel to the spine of the scapula but slightly above it.

C5-6: pain in a triangular, mantle-like distribution with the apex directed to the midclavicular region posteriorly and the main area draping over the top, front and back of the shoulder girdle with a base coinciding with the spine of the scapula.

C6-7: pain over a more or less quadrangular area covering the supraspinous and infraspinous fossae.

Gatterman (1990:232) lists that a patient with cervical facet sprain will have :

- A history of unguarded movement or trauma;
- Neck pain;

- Neck stiffness (decreased range of motion);
- Protective muscle spasm;
- Pain radiating into the occiput and/or shoulder;
- Restricted vertebral motion on motion palpation of the cervical spine.

2.2.2 Models of Spinal Dysfunction

Mennell (1990) presented a paper with the intention to draw attention to the diagnosis of a mechanical cause of neck pain originating from the synovial joints of the cervical spine. Joint dysfunction involves the absence of normal mechanical joint play and therefore joint function becomes impaired and painful.

Schafer and Faye (1989:12-17) have hypothesized that there are four general types of fixations which lead to some degree of vertebral joint dysfunction. These include: muscular, ligamentous, articular and bony fixations. It is clinically important to attempt to judge the degree of fixation and nature of the fixation to evaluate the minimum force necessary during an adjustive thrust to "break down' the fixation if it is logical to do so (breaking a bony ankylosis, for example would be contraindicated).

Muscular fixations according to Schafer and Faye (1989: 12-14) are the most numerous type of fixation and describe the state of a muscle or muscles that fixate vertebrae and thereby hinder their normal movement. There is reason to believe that these paravertebral muscle spasms exist because they can be palpated as taut tender fibers under the skin. According to Schafer and Faye (1989:12) the most common paravertebral muscles affecting the spine when in a state of spasm include: the rotatores, multifidi, interspinales, intertransversarii (cervical), obliquus capitis (atlas-axis), levatores costarum, spinalis group and the quadratus lumborum muscles.

Ligamentous fixations develop due to a ligament's tendency to shorten in order to remove any slack in the previously injured ligament. Schafer and Faye (1989:16) state that one of the early physiological changes seen with chronically fixated vertebral articulations is shortening of ligaments.

Articular fixations according to Schafer and Faye (1989:17) are common manifestations in the human spine. In an articular fixation one lateral pair of articulations (inferior and superior facets of adjacent vertebrae) may become fixated while the contalateral pair may be normal initially. However because of the fixation of their contralateral facet joints, they also may become functionally incapable of motion. The major corrective effect of the chiropractic adjustment is produced by the forced opening of the facets (Schafer and Faye 1989:17). Without intervention, it is believed that long term degeneration of articulations may lead to irreversible bony ankylosis or bony fixations.

Kirkaldy-Willis (1992:105) states that the term dysfunction implies that at one anatomical level the three components of the joint (two facet joints and the intervertebral disc) are not functioning normally. Kirkaldy-Willis (1992:105) goes on to discuss the mechanism of vertebral dysfunction. An episode of rotational or compressive trauma or uncoordinated muscle contraction results in posterior joint strain. Because of small capsular tears, a small degree of joint subluxation takes place. The posterior joint synovium is injured, leading to synovitis. The posterior segmental muscles protect the joint by sustained hypertonic contraction. The muscles become ischemic and this causes more pain. Accumulation of metabolities in muscle further aggravates the pain and sustains the hypertonic state of contraction. The posterior joints continue to be splinted and loaded causing further subluxation of the joint and further injury to the synovium ...etc. All the above events are characteristic of phase I degeneration of the posterior joints (Kirkaldy-Willis 1992:59). However, the cyclic nature of the above events in the posterior joints results in fibrosis of the posterior joints (Phase II degeneration) and eventually bony ankylosis (phase III degeneration).

The subluxation complex encompasses elements of the kinesiopathology of joints and muscles, neuropathophysiology, and the biochemical effects of histopathology (Gatterman 1990: 40- 46). This holistic view emphasizes the totality of each individual patient, as opposed to the simplistic "bone out of place" view.

The neuropathophysiological changes occurring at the subluxation complex is based on the belief that a spinal joint fixation will affect neural elements intra or extra foraminally producing nerve irritation or nerve compression. Nerve irritation involves hyperexcitability of motor, sensory or autonomic elements of the spinal cord segment adjacent to the fixed vertebral motion segment, whereas nerve compression involves pressure on the nerve resulting in motor weakness, muscle atrophy or sensory loss.

The kinesiopathological changes occurring at the subluxation complex include: hypomobility of a motion segment as a result of muscle spasm resulting from joint sprain or increased muscle spindle activity, ligamentous shortening, intra-articular adhesions , intra-articular jamming due to meniscoid entrapment or even disc entrapment (Gatterman 1990:40-47).

The innervated synovial folds may interfere mechanically with joint movement, when they become entrapped between the facet surfaces, causing pain and muscle spasm (Haldeman 1992:206). Two main mechanisms by which pain may arise due to synovial fold pinching include:

- Traction on pain sensitive tissues such as the synovial folds and the fibrous joint capsule, and
- Synovial fold traumatic synovitis with associated tissue damage or rupture. This may cause the release of pain producing substances such as histamine, substance P, bradykinin and potassium ions – all of which result in increased nociceptive nerve impulses from the area.

Wyke (1985:72) refers to another hypothesized mechanism of spinal dysfunction. All synovial joints of the body, including the zygapophyseal joints of the vertebral column, are provided with four types of nerve receptors. Types I, II, III are corpuscular mechanoreceptors that are stimulated by an increase in tension in the tissue in which they are embedded. Type I are located in the superficial layers of the fibrous joint capsule and respond to very small increments of tension in their tissues. Type I receptors, in fact, respond to both static and dynamic articular influences. Type II mechanoreceptors are located within the deep layers of the joint capsule. They are inactive at rest and respond with a burst of activity when tension is applied to the joint capsule. Type III mechanoreceptors are absent from the ligaments of the vertebral column. The Type IV receptors are of special importance as their irritation is responsible for evoking pain. They are nociceptors that are entirely inactive in normal circumferences and only become active when they are irritated by the development of abnormal mechanical or chemical changes (as in joint inflammation) in the tissue in which they lie.

Afferent and efferent impulses pass from these receptors, within and surrounding the zygapophyseal joints, to and from the central nervous system. It can therefore be seen that when a zygapophyseal joint becomes irritated to such an extent the biomechanics of that joint and its surrounding soft tissues (eg: capsule) are altered. The stimulation of the mechanoreceptors and nociceptors within the capsule of that joint, as well as spill over nerve excitability to the surrounding musculature (at that spinal joint level), will result in the clinical signs of joint dysfunction. Degenerative, inflammatory or traumatic events have an effect on the joints thereby initiating this process.

2.2.3 Aetiology of Mechanical Neck Pain

A wide variety of factors seem to be identified by many authors in relation to the cause of mechanical neck pain. In some cases a single cause may be responsible for joint dysfunction (eg: motor vehicle accident – whiplash) while most times a combination of many factors seem to play a role. Put simply – any event that alters cervical joint function is capable of causing mechanical neck pain.

Mechanical joint dysfunction may result from acute injury, repetitive use injury, faulty posture or coordination, aging, immobilization, static overstress, congenital or developmental defects (Bergmann et al. 1993:55).

Spinal aches and pains directly attributable to unsuitable postures are well recognized. Common examples include the luxurious soft armchairs, prolonged car driving in poorly designed seats and the prone sleeping position (Grieve 1988:1276).

According to Mennell (1990) there are three constant etiological factors associated with mechanical joint dysfunction:

1) intrinsic trauma (ie: trauma pertaining exclusively to that joint);
2) immobilization, with which disuse and aging must be considered, and
3) factors residual from the healing of some more serious pathological condition.

Mennell (1990) states that it should not be surprising, therefore, to seek a mechanical treatment to restore normal joint play by mechanical means when mechanical dysfunction is the primary cause of symptoms.

2.3 ADJUSTMENTS

2.3.1 Introduction and Definition

Chiropractic manipulation (adjustment) utilizes specific short levers to which a high-velocity thrust of controlled amplitude is directed, with the aim of restoring mobility to individual articulations (Halderman 1992:49).

Grieve (1991) defines a manipulation as an accurately localised, single, quick and decisive movement of small amplitude, following careful positioning of the patient.

Basmajian (1985:28-29) states that thrust manipulative technique requires a high velocity, low amplitude motion which is delivered at the end of the pathological limit of an accessory range of motion. The thrust technique requires skill in force application especially in regard to amplitude. Thrust manipulations are necessary to snap an adhesion, alter vertebral position, normalize segmental motion and reduce pain (Basmajian 1985: 28).

Basmajian (1985:28-29) identifies three types of thrust manipulation:

1) Surgical thrust manipulation is performed under general anesthesia. Because of depression of nerve function there is no protection of joint structure during manipulation; therein lies the danger of surgical thrust manipulation.

2) General thrust manipulation involves a high-velocity, low amplitude stretch to more than one joint and possibly more than one segment.
3) Specific thrust manipulation involves three criteria:
    - Spinal locking to minimize force on uninvolved spinal segments and to maximize force on the involved segment.
    - The use of a high velocity movement. The quicker the manipulative thrust the less chance of affecting the adjacent spinal levels.
    - All thrust techniques require overpressure in the sense that the movement is performed at the end of the available joint range. In specific manipulation the overpressure is of very low amplitude.

Halderman (1992:448) states that probably the most widely accepted characteristics of the adjustive thrust are:

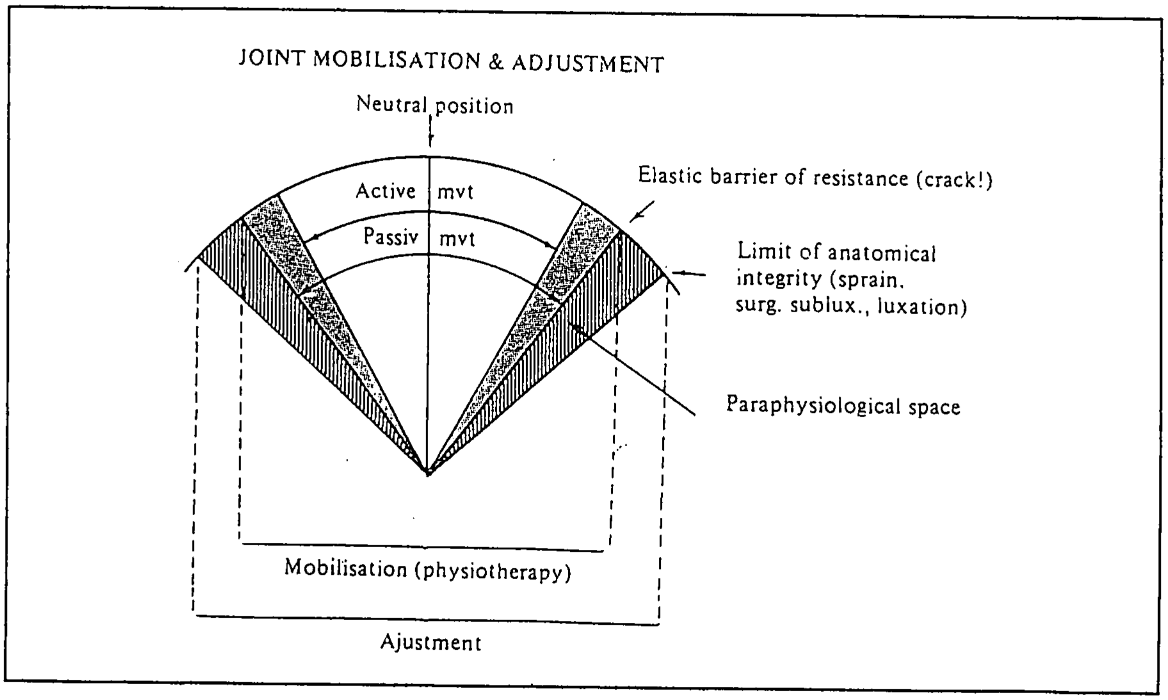
1) a controlled force delivered with high velocity,
2) a line of drive or specific direction, and
3) regulated depth and magnitude that are delivered through a specific contact using muscle power, body weight, or a mechanical device.

Upon reviewing the related literature on manipulation and its definition, nearly all major sources cite the definition offered by Sandoz (1976). A spinal adjustment can be defined as a passive, manual manoeuver during which an articular element is suddenly carried beyond the usual, physiological limit of movement without however exceeding the boundaries of anatomical integrity. The usual but not obligate characteristic of an adjustment is the thrust which is a brief, sudden and carefully dosed impulsion delivered at the end of the normal passive range of movement and which is usually accompanied by a cracking noise.

Gatterman (1990:42) defines chiropractic manipulation as a passive manoeuvre in which specifically directed manual forces are applied to vertebral or extravertebral articulations of the body, with the object of restoring mobility to restricted areas.

Kirkaldy-Willis (1992:283) refers to an adjustment or manipulation as a passive, manual maneuver during which a synovial joint is carried suddenly beyond the normal physiological range of movement without exceeding the boundaries of anatomical integrity.

Sandoz (1976) describes, with the aid of <u>figure 2.2</u>, the phases of an adjustment as follows.



The central arc represents the range of active movement of a joint in one plane, eg. flexion and extension. When the joint is moved passively the range of motion is increased in both directions. At the end of the passive range of motion a resistance is felt and is called the elastic barrier of resistance. It is up to this elastic barrier of resistance that ordinary mobilization (as performed by physiotherapists) takes place. Should the joint be forced beyond the elastic barrier of resistance a sudden give is felt, a cracking noise heard and the range of motion of that joint slightly increased beyond the usual physiological limit. The added range of motion is referred to as the paraphysiological space. At the end of the paraphysiological space a second barrier of resistance is experienced. This limit represents the limit of anatomical integrity of a joint. Forcing a joint past this barrier would produce ligamentous damage, a sprain of the joint and possibly even lead to a complete rupture of the joint capsule.

The qualities of an adjustive thrust should be such as to overcome the elastic resistance barrier without exceeding the barrier of anatomical integrity.

2.3.2 Hypothesized Mechanisms of an Adjustment

Before one attempts to study the effects of an adjustment on a pathological joint, one should fully understand the mechanisms of an adjustment on a normal diarthrodial joint.

Sandoz (1976) offers the following explanation of the events occurring in a joint during an adjustment: normally there exists a slight negative or subatmospheric pressure of between –40 to –60 mm H_2O in a joint space. When a joint is submitted to an axial traction the soft tissues (synovial folds, meniscoids and even the articular capsule) tend to be drawn centripetally until the elastic barrier of resistance is reached. If the traction is released before the crack occurs, then the joint surfaces elastically return back to their original position.

If the joint separation is forced, as in an adjustment, beyond the elastic barrier of resistance then gases are suddenly liberated from the synovial tissue fluid and a cracking noise is heard as the joint moves into the paraphysiological space. This phenomenon is known as cavitation and the energy released by this phenomenon is thought to be responsible for the cracking noise. After cavitation joint surfaces are maximally separated.

If the adjusted joint is left alone the gas bubbles slowly dissolve back into the tissues and the joint returns to its original position. The latent period or refactory period is the time during which a second cavitation cannot be elicited (approx. 15-20 min.) and is thought to represent the time needed for the gases to be reabsorbed into the tissues.

Sandoz (1976) highlights some important clinical facts with regards to adjustments:

1) After an adjustment the range of active and passive movement of a joint is temporarily increased, with the paraphysiological space being added to the range of passive movement.
2) This gain in range of movement does not only occur in the direction in which the joint was adjusted, but in all other directions as well.

3) During the refractory period the joint is consequently unstable and particularly susceptible to trauma.

4) One must keep in mind that during the refractory period the sole barrier of resistance is the barrier of anatomical integrity and should not be mistaken for the elastic barrier of resistance.

Basmajian (1985:37) states that joint restriction is the result of a loss of extensibility in the periarticular soft-tissue structures about the joint, ie. capsules, ligaments, connective tissue and myofascia. Restoration of extensibility to the joint capsule and ligaments as well as the myofascial tissues is a significant part of spinal manipulation. Forced movement may inhibit the formation of a joint contracture. Through the rupture of abnormal intra-articular and extra-articular adhesions the normal three-dimensional spatial pattern of the joint is maintained.

Application of passive manipulation or traction through the spinal joints results in changes in the joint capsule tension (Wyke 1985:76) and thereby the firing of the mechanoreceptors and nociceptors in the joint capsule. Wyke (1992:76) goes on to state that a manipulative therapist can operate this neurological mechanism and suggests that this mechanism is a more likely explanation for most of the therapeutic effect achieved in pain relief than others proposed. When a joint is manipulated in a direction there is a response from the mechanoreceptors located in the region of the joint capsule that is stretched. This consists of an initial brief burst of impulses from the Type II receptors that melt into prolonged Type I receptor impulses. At the same time there is reduction in the opposing region of joint capsule that is now being destretched (Wyke 1985:74).

On the other hand, when traction is applied axially, the mechanorecptors on all aspects of the joint are stimulated simultaneously (Wyke 1985:74).

The same mechanoreceptors also exert reciprocal reflexogenic influences on the muscle tone of surrounding striated muscle. It is believed that through this particular mechanism, manipulation gives rise to reflex changes in muscle tone and therefore helps to balance the activity of the muscles by restoring normal movement (Wyke 1985:75).

Basmajian (1985:41) acknowledges the psychological effects that spinal manipulation may have on a patient and states that doctors often do not appreciate fully the degree to which the laying on of hands as a placebo factor contributes to pain relief.

Basmajian (1985:41) goes on to recognize that emotional and stress related factors contribute to pain perception and that pain is a poorly measured clinical phenomenon. The effectiveness of a manipulative approach therefore must be based on two components – objective clinical changes such as range of motion and the patient's report of pain (a subjective finding).

These are just some of the hypothesized mechanisms that occur during an adjustment. It is, however, possible that a combination of these mechanisms and not simply one of them are at work when a joint is adjusted.

2.3.3 Studies Involving Adjustments

Mierau et al. (1988) studied the effects of manipulation and mobilization on the metacarpaophalangeal coaptation and mobility. Sixty-two third metacarpophalangeal (MCP) joints were studied radiographically before and after applying a long-axis distraction force across the joint space. An audible crack and radiographically visible gas arthrogram were highly associated with a significant decrease in joint coaptation under tension for the manipulated joints. There was no evidence of a gas arthrogram, audible crack or change in coaptation for the mobilized joints. Furthermore, the authors also studied 62 MCP joints that were randomly manipulated or mobilized in terms of passive flexion in the joints. The manipulated group demonstrated a significant increase in passive MCP flexion over the mobilized group.

Cassidy et al. (1992b) in a pre-test, post-test study took fifty consecutive outpatients suffering from unilateral neck pain, with no neurological deficit, and examined the effect that a single rotational manipulation had on pain and range of motion in the cervical spine. Pain intensity was measured using the Numerical Pain Rating Scale – 101 (NRS-101), while range of motion was measured using a cervical goniometer (Rangiometer-Maker, Inc., Flushing, MI.). Of the 50 patients in the study thirty-seven patients reported an improvement in pain; five reported an increase in pain immediately after manipulation and eight patients reported no change. Overall the NRS-101 pain scores decreased from a pre-treatment mean of 43.7 to a post-treatment value of 31.1 representing a mean improvement of over 12 points on the scale. All planes of range of motion increased after treatment. The greatest increases were recorded in rotation towards the side of pain (mean of 5.2 deg.), lateral flexion to the opposite side (mean 4.5 deg.) and lateral flexion towards the painful side (mean of 4.4 deg.). Post-treatment R.O.M. and NRS-101 scores showed a significant relationship between decrease in pain and an increase in ipsilateral rotation ($p < 0.0005$) and contralateral rotation ($p < 0.005$). This was not a randomized, controlled clinical trial and the results of this study cannot be seen as supporting the clinical efficacy of manipulation for neck pain. However, the correlation between an increase in cervical rotation and a decrease in pain is clinically instructive (Cassidy et al. 1992b).

Coulter et al. (1996:19) refers to Koes et al. (1992a, b, c; 1993) as receiving the highest quality score (73) by their raters among studies with subjects having sub-acute or chronic neck pain. The score may be somewhat misleading since only a small subset of subjects in these studies had neck pain. Koes et al. (1992c:19) studied 64 patients with nonspecific neck complaints as part of a larger study assessing the effectiveness of manual therapy for chronic nonspecific neck and back complains. Subjects were randomized into one of four treatments: 1) manual therapy including manipulation and mobilization; 2) physical therapy only; 3) placebo (detuned shortwave diathermy) and 4) usual general practioner care. Treatment was given for a maximum of three months. The following results are available for neck complaints only. At 12 weeks, the mean improvement in the main complaint, based on a 10-point VAS, was 4.5 for the manual therapy group and 4.1 for the physical therapy group. At 12 weeks, the mean improvement in physical functioning, based on cervical range of motion, was 4.8 for the manual therapy group and 3.4 for the physical therapy group. Inferential statistics were not calculated.

Cassidy et al. (1992a) received the second highest score (51) by Coulter et al. (1996:20). They studied 100 patients suffering from unilateral neck pain. Subjects were randomized to one of two groups: 1) one rotational manipulation delivered by a chiropractor or, 2) one session of mobilization. Immediately after the intervention, 85 % of the manipulated group reported pain improvement while 69% of the mobilized group reported improvement. The mean pain decrease in pain intensity, based on the 101-point numerical rating scale (NRS-101), decreased by 17.3 points in the manipulated group versus 10.5 points in the mobilization group. Increases in range of motion were all greater in the manipulated group, but none was statistically significant ($P>0.05$). This study demonstrates that a single manipulation is more effective than mobilization in decreasing pain in patients with mechanical neck pain. Both treatments increase range of motion in the neck to a similar degree. Further studies are required to determine the long- term benefits of continued manipulation in the treatment of mechanical neck pain (Cassidy et al. 1992a).

Sloop et al. (1982) received a score of 49 from Coulter et al. (1996:20). The study was conducted on 39 patients with cervical spondylosis or nonspecific neck pain who had been suffering for at least one month (6years the average). Twenty-one patients received an amnesic dose of diazepam and one rotational manipulation of the cervical spine. Eighteen patients served as controls and received diazepam only. After three weeks 57% of the manipulated group and 28% of the diazepam-only group felt the treatment was helpful (p= 0.13). At 12 weeks, the figures were 78% and 33% respectively. There were no statistically significant differences on a visual-analogue scale (VAS), but there was a greater trend toward improvement in the manipulated group (P=0.20) (Coulter et al. 1996:20). The authors of the study concluded that the value of a single manipulation of the cervical spine had, at the time of the study, not been established and that further exploration is needed. Coulter et al. (1996:20) states that this study may not have had enough power to detect a difference between the two treatment groups because only 39 patients were studied.

Mennell (1990) conducted a study involving patients suffering from neck pain and whose symptoms were determined clinically to be arising from joint dysfunction in one or more of the synovial interlaminar joints in the cervical spine. Eighty-three patients received manipulative therapy; 32 of them underwent anesthesia using sodium pentothal - to obtain muscular relaxation. 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 that a fair proportion of the 83 patients experienced minor recurrences of their neck pain during the two-year follow-up. This was attributed mostly to unguarded strain to the neck, but in all cases this was relieved by manipulation.

Howe et al. (1983) received a quality score of 42 from Coulter et al. (1996:20). In this randomized, controlled study involving 52 patients, Howe et al. (1983) studied the effects of manipulation on neck, arm or hand pain thought to be caused by a lesion of the cervical spine. Forty-one (79%) had suffered for more than four weeks. Twenty six patients were randomly assigned to receive azapropazone plus one to three rotational manipulations; while 26 were assigned to receive azapropazone only. Of the patients with neck pain 68% of the manipulated group and 6% of the control group improved immediately based on subjective reports of pain improvement (P.0.001). Of the patients with pain or paresthesia of the shoulder (n=39), 45% of the manipulated group and 6% of the control group showed immediate improvement ($P<0.02$). Among the patients with pain or paresthesia of the arm or hand 50% of the manipulated group and 11% of the control group showed immediate improvement, while at one week 75% and 57% showed improvement, respectively. Although these differences between the two groups are not statistically significant ($p>0.05$), they do show a trend towards a positive effect for manipulation (Coulter et al. 1996:20). What was noted was the significant increase in cervical R.O.M. in the manipulated group – particularly in rotation (ave. 5 degrees) and to a smaller degree lateral flexion (ave. 2 degrees). These improvements in rotation were still evident after 3 weeks. The control group did not show any improvement with regards to cervical motion.

Vernon et al. (1990) received a quality score of 37 among neck pain trials reviewed by Coulter et al. (1996:21). Nine subjects with chronic mechanical neck pain were studied. Five patients were randomly assigned to receive one rotational manipulation, while four patients were randomized to a mobilization group. Pressure pain threshold readings were taken at four points surrounding the joint fixation before and after manipulation or mobilization. There was a 40 to 55 % rise in pressure pain threshold for all four points around the fixation for the manipulated group, while there were no changes shown in the mobilization in the mobilization group ($P<0.0001$). A larger population group is needed to add weight to this study.

Nansel et al (1989) conducted a four group study of 43 patients with left – right lateral flexion asymmetries. Nine patients received no treatment; nine received a set-up but no thrust; 14 patients received a Gonstead- type manipulation to the restricted side of the cervical spine (C5-T1) and 11 patients received manipulation to the less restricted side. Thirty to fourty-five minutes following the treatment goniometer readings were taken and showed that asymmetric movement were significantly reduced only in the manipulation groups and to a much greater extent in the manipulation-to-the most-restricted-side group ($P<0.001$).

Nansel et al. (1990) studied subjects with lateral flexion asymmetries, comparing 16 patients with previous neck trauma to 16 patients with no history of cervical trauma. A single Gonstead-type of lower cervical manipulation (C6-T1) was given to the side of most restriction. Goniometer readings were taken at 30 min., 4 hr. and 48 hr. intervals.

Mean asymmetries decreased from 13.7 to 1.6 (30min after manipulation) and to 3.8 (48 hrs. after manipulation) in the no-previous trauma group. In the previous trauma group asymmetry improvement was not maintained (15.2 pre-manipulation to 2.7 after 30 min. to 11.4 after 48hrs after manipulation). Noted by the authors was the fact that the post-treatment mean differences in the previous trauma group were no longer significantly different from those recorded before treatment. In every case the re-established lateral flexion asymmetry was on the same side. These observations draw attention to the need for long-term assessment of the effects of continued cervical manipulation, thus allowing more comprehensive management of cervical motion dysfunction.

2.4 TRACTION

2.4.1 Introduction and Definition

Since the early days of Hippocrates (400 B.C.), where a man was tied by his legs to a ladder and then inverted, various forms of traction have been described for the relief of pain. Much of the literature is incomplete and seldom describes the technicalities of traction (eg. weight of patient, poundage used, body position or duration of treatment).

McDowell (1990:365) defines spinal traction as the application of a drawing or pulling force along the long axis of the spine in order to a) stretch soft tissues, b) separate joint surfaces, or c) separate bony fragments.

Fitz-Ritson (1984) offers a similar definition where traction is a technique in which a force is applied to a part of the body to stretch soft tissues, to separate joint surfaces or bony structures.

Traction is applied for immobilization of a body part or pain relief (Kekosz et al. 1986). Immobilization by cervical or lumbopelvic traction ensures that the spine is held in a restful position. Pain relief is attained by applying sufficient traction force to effect a change in the articular and soft tissue structures, such as separation of intervertebral disc spaces (Halderman 1992:503).

Traction may be either continuous or intermittent. It may be applied mechanically or manually. Traction may be applied with the patient sitting or lying supine.

Continuous or static traction is used from several minutes to several hours for the purpose of immobilizing a part and allowing soft tissue to relax. Intermittent traction utilizes alternatively applied traction and relaxation for a time period of several minutes to one half hour. This allows intermittent stretch of soft tissues, joint separation and reduction of pain (McDowell 1990:365).

Mechanical traction makes use of a mechanical traction unit. This allows the traction force to be set prior to treatment and maintained during the treatment period. Mechanical traction has in the past being closely associated with continuous traction; however, because of its benefits in keeping treatment repeatable and the fact that all the physical work is done by the machine, mechanical traction is being used more and more with intermittent traction therapy. Manual traction on the other hand is applied manually by the doctor. With manual traction the amount of traction may vary tremendously depending upon the patients condition, the part of the spine being under traction and the strength of the doctor. Importantly, Grieve (1991:253) highlights the effect of "laying on of hands" in manual traction and how it possibly plays an active role in some patients responding better to manual traction than to mechanical traction. Zylbergold and Piper (1985) state that greater control of head position and individual grading of the amount and duration of traction is achieved through manual traction. Manual traction allows for a more specific contact and allows the doctor to spontaneously adapt the traction force to meet the patients individual needs. Kekosz et al. (1986) refer to manual traction as the type of traction often performed in conjunction with manipulation.

2.4.2 Biomechanical Effects of Traction

The biomechanical effects of applying traction depend on the magnitude and direction of the applied force, the state of rest or motion of the patient, and the surface on which the patient is resting, as friction will always oppose the motion. The pulling force to one end of a patient resting on a stable surface must exceed the resistance due to friction in order to exert a distractive force. A force equal to almost half the body weight is calculated to be necessary to overcome friction in a supine patient in lumbopelvic traction (Kekosz et al. 1986).

If a tractive force is applied to a non-uniform structure (such as the spine), the greatest stretch will be found in the weakest part. In the human body the neck is much weaker than the trunk. It follows then that a tractive force applied at the upper end of the body will result in greater distraction in the cervical spine than in the thoracic and lumbosacral spine (Kekosz et al. 1986).

Whatever the reason for prescribing intermittent traction, its real effect must primarily be to move the spinal joints. This can only be achieved once the spinal curve is flattened. In doing so one is performing a range of joint-play movement to the spine as well as limited muscle stretching. The extent of movement occurring at any one junction in the cervical spine is limited by the integrity of the ligaments and apophyseal joints. In the neck, particularly, it is believed that opening of the facet joints helps to prevent loss of elasticity of the synovial capsules and formation of fibrous adhesions around the nerve roots. It may also relieve osteophytic impingement. Besides producing a joint-play movement at the apophyseal joint, it is thought that traction opens up the neural foramina, which may be a beneficial result in the presence of radicular inflammation (Zohn 1988:141).

Numerous researchers have documented the effects of distractive forces by measuring the width of the intervertebral disc space, the length of the arc formed by the cervical lordosis from the midpoint of the bodies from C2 to C7, and the height of the patient before and after traction. Results suggest that the therapeutic effect of traction is due primarily to the stretch of viscoelastic structures of muscles and ligaments, which results in the physiologic changes as follows (Kekosz et al. 1986):

- Enlargement of intervertebral foramina, with subsequent relief of compressive forces on nerve roots,
- Separation of vertebral bodies, with subsequent enlargement of disc space, producing a vacuum effect that assists in reducing disc prolapse,
- Separation of facet joints and release of entrapped synovial membrane,
- Release of adherent extradural and intradural nerve roots,
- Stretching of ligaments, especially the posterior longitudinal ligament,
- Stretching of the joint capsule,
- Relief of tension on spinal branches of vertebral arteries, and
- Relaxation of paraspinal muscle spasm.

Grieve (1982) states that the important effects of traction are most likely to be most valuable when it is employed to produce rhythmic longitudinal movement rather than a frank distractive effect. Among these important effects are (Grieve (1982):

- The simple mobilization of joints with reversible stiffness.
- Modification of the abnormal patterns of afferent impulse traffic from joint mechano-receptors, particularly at the cranio-vertebral junction.
- Relief of pain by inhibitory effects upon afferent neurone traffic subserving pain.
- The reduction of muscle spasm.
- The stretching of muscle and connective tissues.
- The improvement of tissue-fluid exchange in muscle and connective tissue.

- The likely improvement of arterial, venous and lymphatic flow.

McDowell (1990:369) lists the biomechanical effects of traction as:

- Suction. A subatmospheric pressure is created when two vertebrae are pulled apart, causing a centripetal force on the disc.
- Distraction. The distance between the articular surfaces increases with suffient traction.
- Ligamentous tautening. The anterior and posterior longitudinal ligaments are stretched, causing further centripetal force on the disc.
- Relaxation of the musculature.
- Widening of the intervertebral foramen.
- Straightening of the spinal curves.

Grieve (1982) and again Grieve (1991:265) refers to the following findings with regards to cervical traction:

- Most experimenters, with poundages above 9kg, some of them very high, separated the vertebrae by about 1-1.5 mm per space, measured at posterior vertebral levels.
- By far the greatest separation occurs posteriorly, and is greatest with increasing flexion.
- The normal cervical lordosis is eradicated at pulls of about 9-11 kg.
- A traction force of 13.5 kg for only 7 seconds will separate the vertebrae posteriorly, the amount increasing with flexion.

- At a constant angle, a traction force of 22.5 kg produces greater separation than 13.5 kg, but the amount of separation is not significantly different at 7, 30, or 60 seconds.
- When separation of vertebral bodies is desired, high tractive forces for short periods will achieve it.
- Upper cervical segments do not separate as easily as lower cervical segments.
- Rhythmic traction produces twice as much separation as sustained traction.
- When traction forces are removed, restoration to normal dimensions is four to five times quicker in posterior structures. Restoration in anterior structures is much slower.
- As would be expected, less separation occurs in 50-year-old patients than in normal 20-year olds.

Zohn (1988:143) states that traction, mechanical or manual, constant or intermittent, certainly has a place in therapy if it is prescribed for the right reason. If there is a loss of joint play in a given cervical facet joint, the traction, in trying to open up all the joints, will either open them all up, or because of compensation in the joints above and below, fail to move the affected facet joint at all. Traction may, in fact, further strain it, making the pain worse. Hence, traction used in cervical pain to move or to open up a locked facet joint is not the best choice of treatment. Joint manipulation is preferable (Zohn 1988 : 144).

2.4.3 Inadequacies of Traction and the Importance of Set-up

Cervical traction is used frequently in physical therapy for the effective relief of cervical symptoms. However, inadequacies exist in traditional cervical traction. Walker (1986) lists these inadequacies as follows:

- Traction usually is applied to the neck in a nonspecific manner, simultaneously affecting several cervical joints.
- Traction usually is applied with the involved area in the neutral position, limiting its effectiveness to only a few pathological conditions (eg. herniated disc).
- Patients have no control over either the force exerted by the traction unit or the duration of the hold-and-relax periods. An exception is the home unit in which the patients activate the weights with their arms, creating tension in both the cervical and upper extremity muscles.
- Traditional traction halters have an occipital band and a chin strap that subject the temporomandibular joint (TMJ) to potentially injurious forces.
- Traditional traction often is applied with the patient in a sitting position, although the physical therapy literature reports that the optimum position for cervical traction is supine.

Walker (1986) goes on to state that in addition to the limited effectiveness resulting from these drawbacks – or, perhaps because of them – patient compliance with traditional traction methods are poor, further limiting treatment effectiveness.

Because of these inadequacies in traditional cervical traction and the resultant low patient compliance to cervical traction, it is of utmost importance that the supervising doctor has full knowledge of all aspects of cervical traction and the optimum patient set-up. Correct positioning of the patient for traction aims to maximize the beneficial effects of traction whilst still enabling the treatment session to be as comfortable as possible for the patient.

Cervical traction may be applied with the patient either **sitting** or **supine**. There are advantages and disadvantages to both methods, but most authors seem to prefer the supine posture for traction application (McDowell 1990:371; Geiringer et al. 1988:442 ; Zylbergold and Piper 1985 ; Walker 1986 ; Sherrif 1994:793; Wong et al. 1992) This reduces the effect of gravity on the spine and is more conducive to relaxation (Sheriff 1994:793). Cox (1992:507) states that when cervical traction is applied in the sitting position less stability is provided to the cervical spine than when the patient is supine. When cervical traction is applied with the patient sitting or standing, more discomfort is felt, as the cervical nerve roots are extended farther in this posture. Kekosz et al. (1986) states that the upright position is the most comfortable and because it increases the size of the intervertebral foramina and reduces the compressive force through the facet joints.

Cervical traction, as with lumbar traction, may be **continuous or intermittent**. Continuous traction is used for several minutes to several hours at a time for the purpose of immobilizing and allowing soft tissue to relax. Intermittent traction involves alternating periods of traction and relaxation for a time period of several minutes to one-half hour. This allows intermittent stretch of soft tissues, joint separation and reduction of pain (McDowell 1990:365). Grieve (1982) states that rhythmic traction (intermittent traction) produces twice as much separation as sustained traction.

A randomized clinical trial by Zylbergold and Piper (1985) was conducted to evaluate the efficacy of three commonly employed forms of traction in the treatment of cervical spine disorders. One hundred consenting men and women - of similar age, diagnosis and chronicity – were assigned to one of four treatment groups: static traction, intermittent traction, manual traction or no traction. The patients received two visits weekly over a 6-week period. All four groups received neck care instructions, moist heat for 15 minutes and an exercise programme of range of motion and isometric exercises. Group one then received *static traction* of 25 pounds for a 15-minute period in the supine position with the neck angled at 25 degrees flexion. Group two received *intermittent traction* of 25 pounds for a 15-minute period (ratio 10 seconds on, 10 seconds off) in the supine position with the neck angled at 25 degrees flexion. Group three received 15 minutes of *manual traction* in the supine position with the neck angled at approximately 25 degrees flexion. A minimum of 20 pulls was manually applied. Patients allocated to the fourth group received *no traction.* Results show that although all groups improved significantly, patients receiving intermittent traction performed significantly better than those assigned to the no traction or static groups in terms of pain, forward flexion, right rotation, and left rotation.

Clinicians and investigators have been trying for many years to ascertain the minimal amount and time that a tractive force must be applied to the cervical spine in order for traction to be effective. In reviewing the literature, one finds a great deal of variation in the **magnitude** and **duration** of the tractive force given in cervical traction. One must always remember that the magnitude and duration of traction must achieve optimal results with a minimum of discomfort to the patient.

Zylbergold and Piper (1985) state that some investigators use more than 90 kg of cervical traction force while others maintain that less than 4.5 kg is sufficient to produce a desirable response in the cervical spine. Zylbergold and Piper (1985) themselves used a traction force of 25 pounds in both their static and intermittent traction groups. Zylbergold and Piper (1985) state that recommendations as to the duration of traction vary greatly from as little as 2 minutes to as great as 24 hours. Zylbergold and Piper (1985) themselves applied traction for a period of 15 minutes in both their static and intermittent traction groups. Hinterbuchner (1985:180) refers to studies where traction forces vary from 40 or 60 pounds for 20 minutes to forces as great as 300 pounds. Effective cervical traction is achieved at the range of 20 – 35 pounds as no traction takes place until the weight used exceeds that of the weight of the head (Hinterbuchner 1985:193). Grieve (1882) states that forces greater than or equal to 20 pounds (9kg) separate the vertebrae by 1- 1.5mm per space measured at posterior vertebral angles. Normal cervical lordosis is eradicated with 20-25 pounds of traction (Grieve 1982). Kekosz et al. (1986) states that for sitting traction initially only 5-10 lb of weight should be used. The weight should then be gradually increased to 15-20 lb – no more than 30 lb.

Traction may be maintained for 15 to 20 minutes (Kekosz et al. 1986). Grieve (1982) states that a force of 13.5 kg for only 7 seconds will separate the vertebrae posteriorly. Wong et al. (1992), in evaluating the effects of different traction angles on vertebral separation, used a traction force of 13.5 kg for a duration 8 seconds loading followed by 6 seconds of unloading with a total traction time of 20 minutes.
With a weight of 25 pounds, cycling 7 seconds on, 5 seconds off on the cervical spine flexed at 24 degrees, maximal vertebral separation occurs after 25 minutes (Geiringer 1988: 442).

Crue (1957) was the first to call to attention the fact that the **position** of the cervical spine, and therefore the angle of pull, during traction could have a profound effect on the effectiveness of traction. He studied 20 patients with a history of neck pain who showed no relief with cervical traction in the supine position. He reported that when traction was applied with 20 degrees to 30 degrees of cervical spine flexion, 19 of the 20 patients showed moderate to complete relief.

Wong et al. (1992) evaluated cervical intervertebral separation under different traction angles. The study involved 17 young normal adults without a history of neck trauma or pain who received intermittent cervical traction in the supine position. A traction force of 13.5 kg was applied for 8 seconds and was followed by unloading for 6 seconds alternately, with a total traction time of 20 minutes. The positions of traction were measured by a goniometer in a neutral position, in 30 degrees flexion and in 15 degrees extension. The subjects received traction in the three different neck positions in a time interval of 24-48 hours. A radiographic study of the cervical spine in lateral views was performed before and after each traction cycle. In all cases, the anterior and posterior intervertebral spaces were increased by traction at neutral position and in 30 degrees flexion, but not in 15 degrees extension. The effects of separation were reported as follows- Neutral position : anterior separation C4-5 (12%) > C3-4 (8%), posterior separation C6-7 (37%) > C3-4 (22%) > C4-5 (19%). 30 degrees flexion : anterior separation C2-3 (21%) > C4-5 (16%) > C5-6 (15%) > C3-4 (10%), posterior separation C6-7 (20%) > C5-6 (19%) > C4-5 (17%). There was significantly a decrease in intervertebral separation posteriorly in extension traction, especially at C6-7 (-50%), C5-6 (-37%), C4-5 (-26%), and C3-4 (-14%). The authors state that with a hot pack placed over the posterior neck muscles before traction for muscle relaxation, horizontal neck traction could provide the best effect, especially in the posterior intervertebral separation although it is less effective in anterior intervertebral separation. Anterior separation was more effective in 30 degrees flexion. In flexion traction, posterior separation increases at only the lower cervical levels (C4, C5, C6).

From these results one sees that neck flexion should be used to localize posterior separation to the lower cervical facet joints and horizontal traction be used for separation of the upper cervical levels. That traction in neck extension could not provide any significant increase in intervertebral separation was also demonstrated by Wong et al. (1992). It must be noted that a number of patients reported discomfort during traction in extension; one subject even insisted in immediate discontinuation of the traction.

Hinterbuchner (1985:193) states that the angle of pull in the cervical traction should be at about 20 degrees to 25 degrees of forward flexion. This requires that greater pull be applied to the occipital part of the halter rather than the part under the chin. Zylbergold and Piper (1985) used supine traction with the cervical spine at 25 degrees flexion. Kekosz et al. (1986) refers to the optimal angle of pull for upright traction as being 20 - 25 degrees of forward flexion. Geiringer (1988:442) states that with the maximal effect occurring between 20 – 30 degrees of neck flexion, cervical traction is therefore routinely ordered with the neck flexed to within this range. If cervical traction is being used for conditions unrelated to nerve root compression (eg. muscle spasm), less flexion or even the neutral position might be prescribed. Neck extension during traction should be avoided regardless of the underlying condition (Geiringer 1988:442)

2.5 INDICATIONS AND CONTRAINDICATIONS

2.5.1 Cervical Manipulation Indications

Spinal manipulative therapy is applicable in all musculoskeletal pain problems of the back, pelvis, and neck pain in which loss of vertebral function or local tenderness on induced motion may be a contributing factor, and if there are no contraindications. All visceral or systemic pathologic conditions must be excluded (Geiringer et al. 1988:446).

The primary indication for spinal manipulation is a reversible mechanical derangement of the intervertebral joint, which produces a barrier to normal motion. This movement restriction has been referred to as joint fixation, joint locking or joint blockage and can be determined clinically by motion palpation, local tenderness and stress radiographs (Gatterman 1990:52).

2.5.2 Cervical Manipulation Contraindications

- Vascular complications (eg. vertebral-basilar insufficiency),
- Atherosclerosis of major blood vessels,
- Aneurysm,
- Tumors – especially of the lung, thyroid, prostate, breast and bone (primary or metastasis),
- Bone infections – especially tuberculosis and bacterial infection (osteomyelitis),
- Traumatic injuries (eg. fractures),
- Joint and ligament instability or hypermobility and syndromes such as Marfan and Ehler-Danlos,
- Unstable spondylolisthesis,
- Arthritides – especially rheumatoid arthritis, ankylosing spondylitis, psoriatic arthritis, osteoarthritis (unstable phase and late phase) and Reiters syndrome,
- Metabolic disorders (eg. severe diabetes, clotting disorders, osteopenia, osteoporosis and osteomalacia),
- Neurological complications (eg. sacral nerve involvement from medial or massive disc protrusion or cauda equina syndrome, disc lesions with advanced neurological deficits and myelopathy). Gatterman (1990:55-68) and Geiringer et al. (1988:447)

2.5.3 Cervical Traction Indications

Cervical traction has been used for a wide spectrum of painful conditions, based on its physiological effects of vertebral separation, widening of the intervertebral foramina and possibly reduction of herniated disc material and muscle tension (Geiringer et al. 1988:442).

Halderman (1992:508) refers to disc herniation with disc protusion and facet joint subluxation complexes as the major indications for spinal traction. Halderman (1992:510) also refers to traction being used for the relaxation of paravertebral muscles and to increase vertical and sagittal diameters of the intervertebral foramina to reduce nerve root compression forces. Kekosz et al. (1986) lists the general indications for traction as :

- Degenerative disc disease, with or without nerve root irritation,
- Prolapsed intervertebral disc (note. Traction may, however, induce cord compression)
- Facet joint osteoarthritis and capsulitis.

McDowell (1990:369) refers to the following indications for spinal traction:

- Intervertebral disc protrusion, medial and lateral,
- Facet syndrome,
- Nerve root compression,

- Spondylolisthesis,
- Retrolisthesis,
- Discogenic spondyloarthrosis,
- Anterior or posterior innominate,
- Sacrum inferiority,
- Early scoliosis, and
- Muscular spasm.

2.5.4 Cervical Traction Contraindications

- Inadequate expertise in the application of traction constitutes the single greatest contraindication to its use, because it is the most commonly flouted principle in use (Geiringer et al. 1988:443),
- Acute traumatic injuries,
- Spinal malignancy (primary or metastatic),
- Cerebrovascular insufficiency,
- Temporomandibular joint syndrome,
- Uncontrolled hypertension,
- Severe cardiovascular disease,
- Rheumatoid arthritis,
- Spondylitis,
- Osteoporosis or osteopaenia,
- Spinal infection, including osteomyelitis and diskitis,

- Large central disk and spinal cord compression,
- Aneurysm,
- Appreciable involuntary head or neck movements (eg. Parkinsonism),
- Uncooporative patient (Kekosz et al. 1986) and (Geiringer et al. 1988:443).

2.6 SUMMARY

There is little doubt that mechanical neck pain is clinically important when considering that injuries to the cervical spine and spinal cord are potentially the most devastating and life altering of all injuries compatible with life. In the U.S.A., about 10,000 spinal cord injuries occur each year with approximately 80% of the victims under the age of 40 years and with the highest proportion of these injuries between the ages of 15 and 35 years. (Serena et al.1995: 212). Although Serena et al. (1995:212) seems to refer to potentially gross cervical injury (such as in M.V.A.) and the possibility of cord damage, injuries can also result in cervical joint dysfunction to a varying degree.

Cervical spine pain syndromes are extremely common and are probably the fourth most common cause of pain (Bland 1994:xiii). Hadler (1985) found that more than 10% of the population recalled having had at least three episodes of pain in the neck in the year preceding the study. At any specific time, as many as 12% of the adult female population and 9% of the adult male population experience pain in the neck, with or without associated arm pain (Bland 1994:3). As much as 35% of the population call recall an episode of neck pain (Bland 1994:3).

The approach in treating cervical injuries is firstly the early recognition of cervical spine injuries and the prevention of neurological complications and finally the restoration and maintenance of spinal alignment to provide stable weight bearing (Serena et al. 1995:212).

It is the methods used in the restoration of normal spinal curves or alignment and essentially the restoration of normal biomechanical functioning of the cervical spine that seem to vary greatly from author to author within the medical profession as well as from one profession to another.

The treatment of cervical zygapophyseal joint pain is still in its infancy. Because the condition has been verified only recently, it has not been possible to establish formally an appropriate, reliable method of treatment (Lord et al 1993).

Lord et al. (1993) identify two forms of therapy that have been advocated in the treatment of cervical zygapophyseal joint pain. Intra-articular injections of corticosteroids are an established and commonly practiced method of treating arthritic pain in the limbs. Consequently, they have been advocated for cervical zygapophyseal joint pain. This has been done on the basis of uncontrolled studies. The success rate, however, is not overwhelming. Between 33% and 64% of patients obtain relief that lasts between 3 days and 13 months. Before this therapy is endorsed it must be subjected to controlled studies (Lord et al. 1993). A second method of treatment is percutaneous radiofrequency medial branch neurotomy. The rationale for this procedure is that if anesthetizing the nerves that supply a symptomatic cervical zygapophyseal joint relieves pain, then coagulating the same nerves should provide long-term relief. Patients can obtain relief of pain for periods of up to 12 months or more. If pain recurs, the procedure can be repeated to reinstate relief. Before this therapy can be endorsed it needs to be evaluated under controlled conditions (Lord et al. 1993). These are two examples of expensive and highly invasive protocols used in the management of zygapophyseal joint pain. These two treatment protocols do not carry a very high success rate either.

Are these invasive techniques really restoring zygapophyseal joint function or merely removing the pain? Therefore should we perhaps be looking at more conservative approaches in the management of cervical zygapophyseal joint pain which could possibly be as effective or even more effective in the reduction of pain and restoration of cervical joint function?

When looking at more conservative treatments, chiropractic stands out as possibly a more viable option with regards to pain relief and restoration of function in zygapophyseal joint pain. Sloop et al. (1982) when comparing the effects of diazepam versus the combination of diazepam and manipulation for the treatment of non-specific neck pain found that after three weeks 57% of the manipulated and 28% of the diazepam-only group felt the treatment was helpful. At twelve weeks these figures were 78% and 33% respectively. When looking at studies like those by Cassidy et al. (1992a), Cassidy et al. (1992b) and Vernon et al. (1990) one realizes how cervical manipulation not only reduces pain but also restores cervical mobility and cervical function. In the study by Cassidy et al. (1992a) 85% of the manipulated patients reported pain relief immediately after treatment. These studies tend to suggest that conservative Chiropractic management of cervical zygapophyseal joint pain carries a higher success rate of providing pain relief and restoring cervical function than do the invasive techniques mentioned above.

McDowell (1990:330-378) identifies numerous adjunctive therapy modalities that the professional may use in conjunction with other therapies in the control of mechanical neck pain and the restoration of cervical function. These include:

- Heat therapy,
- Cryotherapy,
- Contrast heat and cold therapy,
- Low-voltage galvanism,
- High voltage therapy,
- Low frequency alternating current therapy,
- Transcutaneous Electrical Nerve Stimulation (TENS),
- Meridian therapy (Acupuncture),
- Interferential Elecrical Therapy,
- Ulrasound,
- Massage therapy,
- Orthotics (eg, cervical collar) and,
- Spinal traction

With biomechanical effects such as stretching of soft tissues; joint separation; reduction of pain by inhibitory effects upon nociceptive traffic; ligamentous tautening; relaxation of musculature; modification of abnormal patterns of afferent impulse traffic from joint mechanoreceptors; stretching of the joint capsule; separation of facet joints and the release of an entrapped synovial membrane and the simple mobilization of joint with reversible stiffness (McDowell 1990:369 ; Grieve 1982 ; Kekosz et al. 1986) it is of little surprise that the use of spinal traction can be traced as far back as Hippocrates (400 B.C.) and that traction has long been indicated for the relief of pain and restoration of zygapophyseal joint function (McDowell 1990:369 ; Halderman 1992:508 ; Kekosz et al. 1986 and Geiringer et al. 1988:442).

The choice of physiological therapeutics can be a difficult one. Most modalities have a number of positive effects, and many overlap in their repertoire of effects (Gatterman 1990:331). These procedures deserve high priority as they support conservative chiropractic manipulative care.

Thus if manipulation in conjunction with cervical traction can reduce the duration of symptoms and overall medical costs (of the patient and health profession); whilst restoring the patient's economic productivity, it seems relevant to investigate the effectiveness of combining different therapeutic modalities in the management of cervical zygapophyseal joint dysfunction syndrome.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 INTRODUCTION

This chapter deals with the collection of data and the research methodology used. The treatment interventions and the process of statistical analysis are discussed here.

The object of this study was to evaluate the relative efficacy of cervical manipulative therapy combined with cervical traction versus cervical manipulation only, in terms of subjective and objective clinical findings, in order to determine the more effective approach to the treatment of cervical facet syndrome.

This study was a randomised, controlled, comparative study where the objectives were to assess each of the two treatment groups for intra-group improvement and then inter-group analysis could determine which of the two treatments is more effective. The more effective of the two treatments might then be considered to be the treatment of choice in the chiropractic management of cervical facet syndrome.

3.2 STUDY DESIGN

Patients were recruited into this study by placing advertisements in local newspapers indicating that free treatment would be given to patients suffering from neck pain who would be willing to participate in the research programme.

A sample size of thirty subjects was admitted to the study on completion of a comprehensive case history (Appendix A), physical examination (Appendix B) and cervical regional examination (Appendix C). This was done to ensure that the patients met all of the criteria set out for the study. Radiological examinations were prescribed where clinically it was necessary to rule out any contra-indications to either of the two treatment groups in the study. The criteria for this study was as follows:

- Subjects who participated in this study received treatment at the Technikon Natal Chiropractic Clinic only.
- Patients were only accepted into the study if they were between the ages of 15 and 60 years.
- Patients showing signs and symptoms of cervical facet syndrome (Bergmann et al. 1993:63; Gatterman 1990:232; Merril et al.1995:163; Halderman 1992:208; Dwyer et al. 1990; Aprill et al 1990) were accepted into this study.
- Patients presenting with any of the contra-indications for cervical traction (Kekosz et al. 1986; Geiringer et al. 1988:443) or cervical manipulation (Gatterman 1990:55-68; Geiringer et al. 1988:447) were not accepted into the study.
- Patients presenting with other forms of mechanical neck pain (eg. Myofascial Pain Dysfunction Syndrome) in conjunction with cervical facet syndrome and which are

not contra-indicated to cervical traction or cervical manipulation were accepted into the study. Cervical facet syndrome was the only condition treated.

- Patients receiving treatment for other medical conditions related or unrelated to cervical facet syndrome that could affect the efficacy of treatments given in this study were not accepted into this study.
- Patients presenting with acute unstable cervical facet syndromes following severe trauma (eg. whiplash injuries) were not accepted into the study. Only patients presenting with sub-acute or chronic cervical facet syndrome were accepted into this study.
- Patients who became asymptomatic before the treatment period was up and then experienced a subsequent episode of neck pain due to a different injury were excluded from the study, as the results of the treatments would be negated and confused.

The thirty subjects used for this study were randomly assigned into two equally sized groups of 15 subjects each. Group one (C) received cervical manipulative therapy only. Group two (T) received intermittent cervical traction and cervical manipulative therapy. The randomization was done as follows: a roster (Appendix E) was drawn up that randomly listed all thirty patients by number and treatment group. Thirty labels marked with numbers one to thirty were then folded and placed into a hat. The contents were then agitated to mix the labels. As each patient entered the study a number was drawn out of the hat which then, using the roster, corresponded to one of the two treatment groups to which the patient was then assigned. Patients were not given the opportunity to choose a treatment group as this would lead to the addition of unwanted bias to the study. In the event of a patient dropping out of the study (four people did not finish the study and were excluded) his/her number was then re-entered into the hat.

On the initial consultation patients were screened for the presence of cervical facet syndrome and for any condition/s that would be contra-indicatory for the patient to be entered into the study. The screening process included - a case history (Appendix A), physical examination (Appendix B) and regional cervical spine examination (Appendix C). If after the initial examination it was clinically indicated, subjects underwent radiological examination evaluation of the cervical spine to exclude any contra-indications for either cervical spine traction or cervical manipulative therapy.

Patients eligible for inclusion into the study were then required to complete an informed consent form (Appendix D) and were assigned to the relevant treatment group by the process previously mentioned. There was no patient blindness with regards to the treatment protocol of each treatment group, as this was explained to each patient before they began treatment.

Symptomatic joints were identified by motion palpation (Schafer and Faye 1989:98-110) and orthopaedic tests. Orthopaedic tests specifically useful in identifying zygapophyseal joint dysfunction and thereby aiding in the diagnosis of cervical facet syndrome include: Foraminal Compression Test (Magee 1992:50), Maximum Cervical Compression Test

(Magee 1992:52), Kemp's Test described by Walker (1986) and static joint challenge of the cervical facet joints.

3.3 TREATMENT

Subjects in Group one (C) received chiropractic manipulative therapy of the cervical spine only. Treatment was administered by the examiner in the form of a diversified rotatory break adjustment (Good 1992; Szaraz 1990: 50 ; Schafer and Faye 1989:133). The rotatory break adjustment was performed in the supine position with the point of contact being on the ipsilateral side to the diagnosed facet joint syndrome. If more than one joint was symptomatic then all were manipulated.

Subjects in Group two (T) received intermittent cervical traction which was then followed by chiropractic manipulative therapy of the cervical spine. Intermittent traction was performed using the Eltrac 471 traction unit made by Enraf Nonius and distributed by Physio Tritronics, 2 Belfast Rd, Bayhead, Durban. The traction was applied as follows: The subject was placed comfortably in a supine position on the traction table. One to two pillows were placed under the subject's head for both comfort and to place the neck in flexion (approx. 25 degrees) for the traction period. The traction rope was attached to the head halter, which sits under the chin and around the occiput of the patient. The rope angle is then set at 25 degrees to the horizontal with the use of a protractor, so that the angle of pull during the traction is set at 25 degrees. The Eltrac 471 traction unit has the ability to have a sliding top or fixed top. Both the cephalid and caudal portions of the tabletop were fixed and were locked in a stable position. For the purpose of this study only intermittent cervical traction was used. The intermittent traction consisted of a 10 second period of pull and a 10 second period of relaxation and was applied for a period of 15 minutes. The traction force applied varied from 10 kg to 15 kg (depending on the patient's tolerance) at maximum pull. Following traction the patient received chiropractic manipulative therapy to the cervical spine only. The manipulation was administered by the examiner in the form of a diversified rotatory break adjustment (Good 1992; Szaraz 1990: 50; Schafer and Faye 1989:133). The rotatory break adjustment was performed in the supine position with the point of contact being on the ipsilateral side to the diagnosed facet joint syndrome. If more than one joint was symptomatic then all were manipulated.

In both treatment groups no additional treatments (eg. ultrasound, soft tissue therapy, heat therapy etc.) were given. These could have had an effect on the subjective and objective clinical findings of this study.

Subjects in group one and group two received a maximum of ten treatment sessions with two treatments a week, over a five-week period. Prior to the first, fifth and tenth treatments, patients were required to complete the following questionnaires:

- CMCC Neck Disability Index (Vernon and Moir 1991) (Appendix F)
- McGill Short-form Pain Questionnaire (Melzack 1987) (Appendix G)
- Numerical Pain Rating Scale 101 (Jenson et al. 1986) (Appendix H).

Cervical range of motion readings were then taken by the examiner with the use a cervical goniometer and recorded (Appendix I). The patients were then treated according to their assigned group.

A follow-up consultation took place one month after the tenth treatment. No treatment took place during this follow-up consultation as it was used purely to analyze the efficacy of the treatment after a one- month lay off from treatment. This was done with the patients filling out the same questionnaires as mentioned above and also included the recording of the cervical range of motion with the cervical goniometer by the examiner.

If a patient become asymptomatic during the study (ie. before the tenth treatment) the follow-up consultation still took place one month after the time the tenth consultation would have been scheduled for. Any decline in the patients condition during the one-month lay off was not treated until after the one-month follow-up consultation.

3.4 MEASUREMENTS AND OBSERVATIONS

3.4.1 Subjective Measurements

A) The CMCC Neck Disability Index (Appendix F)

The Neck Disability Index (Vernon and Moir 1991) provides information regarding the extent to which the patient's pain influences their normal daily activities. It consists of ten sections of six questions each. For each section the total possible score is 5 points, with the points distribution varying from zero if the first statement of the respective section was marked, and up to five if the sixth statement was chosen. The points obtained for each section were added, with the maximum possible score being fifty, and decreased by five for each section not completed. The final score was converted to a percentage score for each individual patient.

Vernon and Mior (1991) suggest that the Neck Disability Index has a high degree of reliability and internal consistency. It appears to be sensitive to changes in disability during the course of treatment and to the intensity of the problem. In addition, the questionnaire is relevant to a broad age spectrum, is not affected by gender and has an adequate level of validity.

B) The McGill Short-form Pain Questionnaire (Appendix G)

The McGill Short-form Pain Questionnaire (Melzack 1987) is a subjective questionnaire that pertains specifically to the sensory and affective dimensions of pain. It is used to measure the extent of pain experienced by the patient. The questionnaire is divided into two sections. Questions 1 to 11 represent the sensory dimension of pain and questions 12 to 15 represent the affective dimension; it assesses the behavioral and emotional aspects of pain. Each adjective was ranked on an intensity scale of: 0 = none, 1 = moderate and 3 = severe. The sum of all the completed sections were calculated and given a percentage of the highest possible score. If all the sections were completed the highest possible score was fourty-five and decreased by three for each section not completed.

C) The Numerical Pain Rating Scale 101 (Appendix H)

The Numerical Pain Rating Scale 101 (Jensen et al. 1986) was used to measure the patients subjective response to treatment in terms of their perception of pain intensity. The patient is required to indicate by means of a percentage the intensity of the pain experienced before a treatment when, a) the pain is at it's worst, and b) when the pain is at it's least. The average pain intensity was calculated by adding the percentages representing the worst pain and the least pain and then dividing this total by two. The average pain intensity values were then used for statistical analysis.

Jensen et al . (1986) conducted a study where six methods of judging pain intensity were compared according to five criteria:

(a) ease of administration of scoring; (b) relative rates of incorrect responding; (c) sensitivity as defined by the number of available response categories; (d) sensitivity as defined by statistical power; and (e) the magnitude of the relationship between each scale and a linear combination of pain intensity indices.

The results of this comparative study indicated that the Numerical Pain Rating Scale 101 (NRS 101) had the following practical advantages over the other methods because : (1) it was simple and practical to administer and score; (2) it could be administered either verbally or in written form; and (3) the scale does not seem to be associated with age (Jensen et al. 1986).

3.4.2 Objective Measurement

The objective data collected for this study consisted of an investigation into the range of motion in the cervical spine. This was measured by a CROM (Cervical Range of Motion) goniometer, a product of Performance Attainment Associates.

Measurement values were read and recorded in flexion, extension, left lateral flexion, right lateral flexion, left rotation and right rotation (Appendix I). Measurements were recorded in degrees prior to the first, fifth, tenth and at the one month follow-up consultations. The readings produced by the CROM goniometer were recorded (Appendix I) and used for statistical analysis of the objective data.

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 floor. 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. When measuring rotation the patient sat so the magnetic yoke pointed in the direction of north. Measurements were made in the following manner:

(A) Flexion / Extension measurements – 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 getting the patient to tilt his/her head back and try to get their forehead parallel to the ceiling. These readings were taken off the sagittal plane meter and recorded. Only one reading for each direction was taken.

(B) Left / Right lateral Flexion measurements – The patient was instructed to laterally flex his/her neck as far as possible to the left and right without elevating the shoulders. Care was taken to ensure that this movement was kept as pure as possible and did not include any neck flexion or extension or rotation The two measurements were recorded.

(C) Left / Right rotation measurements – For rotation the magnetic yoke was used and the rotation arm fitted. The saggital plane and lateral flexion meters were checked to ensure that they were at zero degrees, while the rotation meter was set at zero before any rotation took place. The patient was instructed to turn (rotate) his/her head as far as possible to the left and then the right, keeping the eyes along horizontal plane. By ensuring that the saggital and lateral flexion meters stayed at zero the degree of movement for left rotation and right rotation was recorded.

In a study conducted by Youdas et al. (1992) to determine the reliability of the Cervical Range of Motion Instrument as compared to two other instruments, it was found that the Cervical Range of Motion Instrument demonstrated a high degree of reliability.

It was also found that the Cervical Range of Motion Instrument was reliable when two physical therapists took repeated measurements on the same patient. In addition, it was found that during the measuring procedure no further aggravation of the patient's condition was induced (Youdas et al. 1992).

3.5 STATISTICAL PROCEDURES FOR DATA ASSESSMENT

3.5.1 Treatment of Data

Statistical analysis was conducted on the objective and subjective data collected on the first, fifth, tenth and one-month follow-up consultations. The data was analyzed using the computer software program Statagraphics Plus version 6, manufactured by Manugistics. The results obtained from the data were then used to solve each of the objectives of the study.

Since the sample size per group was small (15 subjects per group), non-parametric tests (i.e. Wilcoxon's Signed Rank test and Mann-Whitney U-test) were utilized for statistical analysis. Parametric tests such as the two-sample unpaired t-test were not used as the sample size was too small (Gulezian 1979:335).

The Wilcoxon's Signed Rank test (intra-group analysis) was used to determine whether any significant differences occurred between the initial (IC) and fifth consultation (5C), the initial (IC) and final consultation (FC), the initial (IC) and the follow-up consultation (F/U) and between the final (FC) and the one month follow-up consultation (FU) within the two treatment groups. All tests were done at the Alpha = 0.05 level of significance.

The Mann-Whitney U-test (inter-group analysis) was used to determine whether there was any significant difference between the two groups at the initial consultation, fifth consultation, final consultation and one month follow-up consultation. Each hypothesis test conducted was treated similarly to that mentioned for the Wilcoxon's Signed Rank test.

The null hypothesis (Ho) in each respective hypothesis test, stated that there would be no significant improvement between the initial consultation and fifth consultation, initial consultation and final consultation, initial consultation and follow-up consultation and between the final consultation and follow-up consultation.
The alternative hypothesis (Ha) stated the contrary to what the null hypothesis stated (i.e. there would be a significant improvement).

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

The decision rule stated that to reject the null hypothesis (Ho), $p \leq$ alpha $= 0.05$ and to accept the null hypothesis (Ho) , $p \geq$ alpha $= 0.05$, where 'p' equals the observed significance level of the test (Gulezian 1979:335).

The first objective was to evaluate the effectiveness of cervical manipulative therapy, in terms of objective and subjective clinical findings in the treatment of cervical facet syndrome.

The second objective was to evaluate the effectiveness of intermittent cervical traction combined with cervical manipulative therapy, in terms of objective and subjective clinical findings in the treatment of cervical facet syndrome.

The third objective was to interpret the data obtained during this study, in terms of the objective and subjective data collected, in order to determine which of the treatment methods was more effective in the treatment of cervical facet syndrome. The Mann-Whitney U-test was chosen because of its application to an inter-group statistical analysis of a small sample size (Daniel 1978:82-86).

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

CHAPTER FOUR

4.1 INTRODUCTION

This chapter covers the results obtained from the statistical analysis of the data collected from the:

- CMCC Neck Disability Index Questionnaire,
- Short-form McGill Pain Questionnaire,
- Numerical Pain Rating Scale – 101, and
- Cervical Range of Motion measurements.

KEY ABBREVIATIONS

Group C – Treatment group that received cervical manipulative therapy only.

Group T – Treatment group that received intermittent cervical traction and cervical manipulative therapy.

IC – Initial consultation.

5C – Fifth consultation.

FC – Final consultation.

F/U – One month follow-up consultation.

p- value – two tailed probability of equaling or exceeding.

If p = alpha/2 = > 0,025 then no significant difference (5%level of significance).

If p = alpha/2 = $\leq$ 0.025 then significant difference (5 % level of significance).

4.2 TREATMENT OF THE DATA

4.2.1.1 Treatment of the Subjective Data

The subjective data was treated as follows:

1. The questionnaires were screened in order to determine whether they had been completed correctly and completely.
2. The scores obtained from the three questionnaires were expressed as percentages and recorded separately for the two groups.
3. The data then underwent statistical analysis.

4.2.1.2 Treatment of the Objective Data

The objective data was treated as follows:

1. The cervical ranges of motion were measured by means of a goniometer and the recordings documented in degrees of flexion, extension, left / right lateral flexion and left / right rotation. This was done separately for the two groups.
2. The data then underwent statistical analysis.

4.2.2 Statistical Analysis of the Data

The statistical analysis was conducted at 95% confidence level based on the advice given by the Technikon Natal statistician for the following reasons:

i) the study consisted of a small sample size (30 subjects),and

ii) the statistical testing was of a non-parametric nature.

4.2.2.1 Non-Parametric Paired Hypothesis Tests

A) Subjective Data

Using the **Wilcoxen Signed Rank Test**, which is a test to analyze the data within each group, the subjective results were obtained for each of the questionnaires for both treatment groups. The percentages compared were:

1. The initial consultation (IC) and the fifth consultation (5C),
2. The initial consultation (IC) and the final consultation (FC),
3. The initial consultation (IC) and the follow-up consultation (F/U),
4. The final consultation (FC) and the follow-up consultation (F/U).

i.e.

Treatment group (C)	Treatment group (T)
IC : 5C	IC : 5C
IC : FC	IC : FC
IC : F/U	IC : F/U
FC : F/U	FC : F/U

B) Objective Data

Using the **Wilcoxen Signed Rank Test** for both treatment groups the cervical ranges of motion were statistically analyzed. The degrees of motion for each plane of motion were compared as follows:

1. The initial consultation (IC) and the fifth consultation (5C),
2. The initial consultation (IC) and the final consultation (FC),
3. The initial consultation (IC) and the follow-up consultation (F/U),
4. The final consultation (FC) and the follow-up consultation (F/U).

i.e.	**Treatment group (C)**	**Treatment group (T)**
	IC : 5C	IC : 5C
	IC : FC	IC : FC
	IC : F/U	IC : F/U
	FC : F/U	FC : F/U

The Wilcoxon Signed Rank Test was chosen because of its less restrictive assumptions and near equivalence in sensitivity to the parametric t-test (Daniel 1978:31-36).

4.2.2.2 Non-Parametric Unpaired Hypothesis Tests

A) Subjective Data

Utilizing the **Mann-Whitney U-Test** (to analyze the data between the two groups) the percentages, taken separately for each questionnaire, were compared using the mean percentages of the two treatment groups. The mean percentages compared were the following:

1. The initial consultations (IC) of treatment group (C) and treatment group (T),
2. The fifth consultations (5C) of treatment group (C) and treatment group (T),
3. The final consultations (FC) of treatment group (C) and treatment group (T),
4. The one month follow-up consultations (F/U) of treatment group (C) and treatment group (T).

i.e.	**Treatment group (C)**	compared to	**Treatment group (T)**
	IC	-	IC
	5C	-	5C
	FC	-	FC
	F/U	-	F/U

The level of significance was determined by comparing these figures.

B) Objective data

Utilizing the **Mann-Whitney U-Test** the mean ranges (in degrees) of cervical range of motion for the two groups were compared. The values compared were the following:

1. The initial consultations (IC) of treatment group (C) and treatment group (T),
2. The fifth consultations (5C) of treatment group (C) and treatment group (T),
3. The final consultations (FC) of treatment group (C) and treatment group (T),
4. The one month follow-up consultations (F/U) of treatment group (C) and treatment group (T).

i.e.	**Treatment group (C)**	compared to	**Treatment group (T)**
	IC	-	IC
	5C	-	5C
	FC	-	FC
	F/U	-	F/U

The level of significance was determined by comparing these figures.

4.3 RESULTS

4.3.1 The CMCC The Neck Disability Index

Table 4.1 The mean values and results of the Wilcoxons Signed Rank Test for the CMCC Neck Disability Index of the two groups between the initial consultation (IC) and the Fifth consultation (5C).

	IC	5C	P value
Group C	25.9	20.7	0.0613685
Group T	25.3	16.3	0.00982331

The null hypothesis was accepted for the cervical manipulative group which indicated, that at the 5% level of significance no statistically significant change took place between the initial consultation and the fifth consultation.

The null hypothesis was rejected for the cervical traction group which indicated, that at the 5% level of significance a statistically significant difference took place between the initial consultation and the fifth consultation.

Table 4.2 The mean values and results of the Wilcoxon's Signed Rank Test for the CMCC Neck Disability Index of the two groups between the initial consultation (IC) and final consultation (FC).

	IC	FC	P value
Group C	25.9	9.1	0.00194461
Group T	25.3	13.3	0.00194591

The null hypothesis was rejected in both groups which indicated, that at the 5% level of significance a statistically significant difference took place during the treatment period.

Table 4.3 The mean values and results of the Wilcoxon's Signed Rank Test for the CMCC Neck Disability Index of the two groups between the initial consultation (IC) and the follow-up consultation (F/U).

	IC	F/U	p value
Group C	25.9	10	0.00194591
Group T	25.3	9.1	0.000512096

The null hypothesis was rejected in both groups which indicated, that at the 5% level of significance a statistically significant difference took place between the initial consultation and the one month follow-up consultation.

Table 4.4 The mean values and results of the Wilcoxon's Signed Rank Test for the CMCC Neck Disability Index of the two groups between the final consultation (FC) and the follow-up consultation (F/U).

	FC	F/U	p value
Group C	9.1	10	0.751826
Group T	13.3	9.1	0.265001

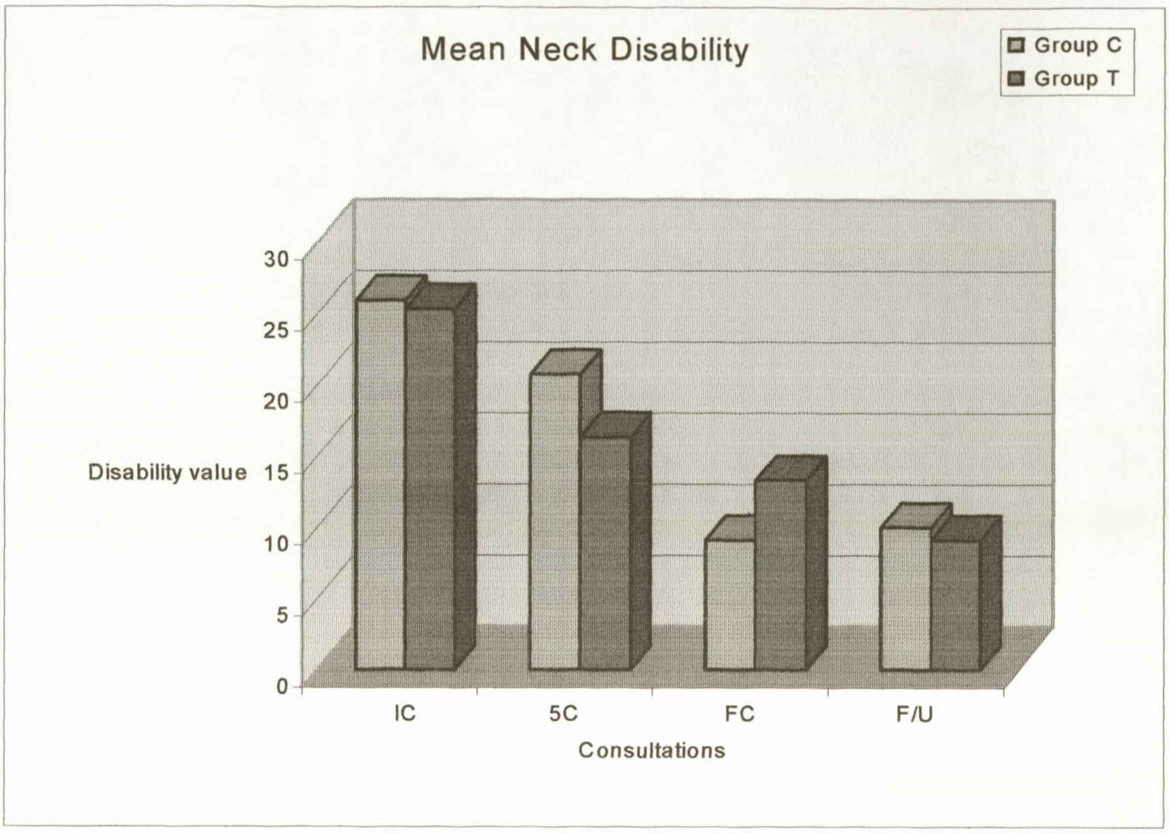
The null hypothesis was accepted in both groups which indicated, that at the 5% level of significance no statistically significant difference took place between the final consultation and the one month follow-up consultation.

Table 4.5 The results of the Mann-Whitney U-Test for the CMCC Neck Disability Index comparing the two treatment groups at the initial consultation (IC), fifth consultation (5C), final consultation (FC) and follow-up consultation (F/U).

	IC	5C	FC	F/U
p value	0.950252	0.489987	0.0796299	0.933369

The null hypothesis was accepted at the initial, fifth, final and one month follow-up consultations which indicated, that at the 5% level of significance no statistically significant difference took place between the two groups during the treatment period.

Figure 4.1 The mean values of the CMCC Neck Disability Index at the initial consultation (IC), fifth consultation (5C), final consultation (FC) and follow-up consultation (F/U).



4.3.2 The McGill Short-form Pain Questionnaire

Table 4.6 The mean values and results of the Wilcoxon's Signed Rank Test for the McGill Short-form Pain Questionnaire of the two groups between the initial consultation (IC) and the Fifth consultation (5C).

	IC	5C	P value
Group C	32.4	10.8	0.00328359
Group T	34.5	18.8	0.00982331

The null hypothesis was rejected in both groups, which indicated that at the 5% level of significance a statistically significant difference took place between the initial consultation and the fifth consultation.

Table 4.7 The mean values and results of the Wilcoxon's Signed Rank Test for the McGill Short-form Pain Questionnaire of the two groups between the initial consultation (IC) and final consultation (FC).

	IC	FC	P value
Group C	32.4	7	0.000300669
Group T	34.5	11.9	0.000874198

The null hypothesis was rejected in both groups, which indicated that at the 5% level of significance a statistically significant difference took place during the treatment period.

Table 4.8 The mean values and results of the Wilcoxon's Signed Rank Test for the McGill Short-form Pain Questionnaire of the two groups between the initial consultation (IC) and the follow-up consultation (F/U).

	IC	F/U	p value
Group C	32.4	7.1	0.000512096
Group T	34.5	10.7	0.00194591

The null hypothesis was rejected in both groups, which indicated that at the 5% level of significance a statistically significant difference took place between the initial consultation and the one month follow-up consultation.

Table 4.9 The mean values and results of the Wilcoxon's Signed Rank Test for the McGill Short-form Pain Questionnaire of the two groups between the final consultation (FC) and the follow-up consultation (F/U).

	FC	F/U	p value
Group C	7	7.1	1.0
Group T	11.9	10.7	0.789264

The null hypothesis was accepted in both groups, which indicated that at the 5% level of significance no statistically significant difference took place between the final consultation and the one month follow-up consultation.

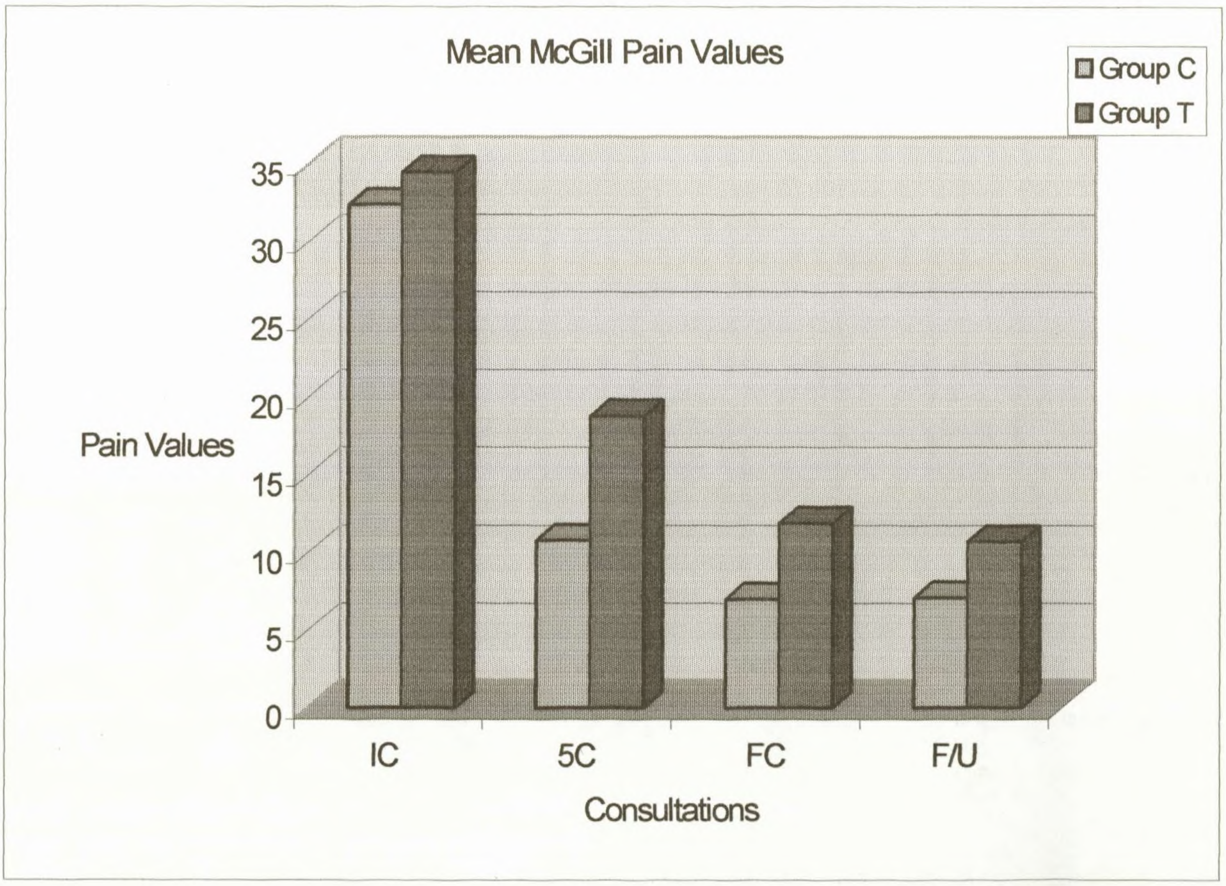
Table 4.10 The results of the Mann-Whitney U-test for the McGill Short-form Pain Questionnaire comparing the two treatment groups at the initial consultation (IC), fifth consultation (5C), final consultation (FC) and follow-up consultation (F/U).

	IC	5C	FC	F/U
p value	0.771051	0.0164926	0.122295	0.368755

The null hypothesis was accepted at the initial, final and one month follow-up consultations, which indicated that at the 5% level of significance no statistically significant difference took place between the two groups.

The null hypothesis was rejected at the fifth consultation, which indicated that at the 5% level of significance a statistically significant difference occurred between the two groups.

Figure 4.2 The mean values of the McGill Short-form Pain Questionnaire at the initial consultation (IC), fifth consultation (5C), final consultation (FC) and follow-up consultation (F/U).



4.3.3 The Numerical Pain Rating Scale (NRS) 101

Table 4.11 The mean values and results of the Wilcoxon's Signed Rank Test for the Numerical Pain Rating Scale - 101 of the two groups between the initial consultation (IC) and the Fifth consultation (5C).

	IC	5C	P value
Group C	43.4	24.9	0.0161569
Group T	56.6	37	0.00194591

The null hypothesis was rejected in both groups, which indicated that at the 5% level of significance a statistically significant difference took place between the initial consultation and the fifth consultation.

Table 4.12 The mean values and results of the Wilcoxon's Signed Rank Test for the Numerical Pain Rating Scale -101 of the two groups between the initial consultation (IC) and final consultation (FC).

	IC	FC	P value
Group C	43.4	18.7	0.0161569
Group T	56.6	31.5	0.00328359

The null hypothesis was rejected in both groups, which indicated that at the 5% level of significance a statistically significant difference took place during the treatment period.

Table 4.13 The mean values and results of the Wilcoxon's Signed Rank Test for the Numerical Pain Rating Scale - 101 of the two groups between the initial consultation (IC) and the follow-up consultation (F/U).

	IC	F/U	p value
Group C	43.4	17.2	0.000512096
Group T	56.6	26.1	0.000300669

The null hypothesis was rejected in both groups, which indicated that at the 5% level of significance a statistically significant difference took place between the initial consultation and the one month follow-up consultation.

Table 4.14 The mean values and results of the Wilcoxon's Signed Rank Test for the Numerical Pain Rating Scale - 101 of the two groups between the final consultation (FC) and the follow-up consultation (F/U).

	FC	F/U	p value
Group C	18.7	17.2	0.772826
Group T	31.5	26.1	0.096092

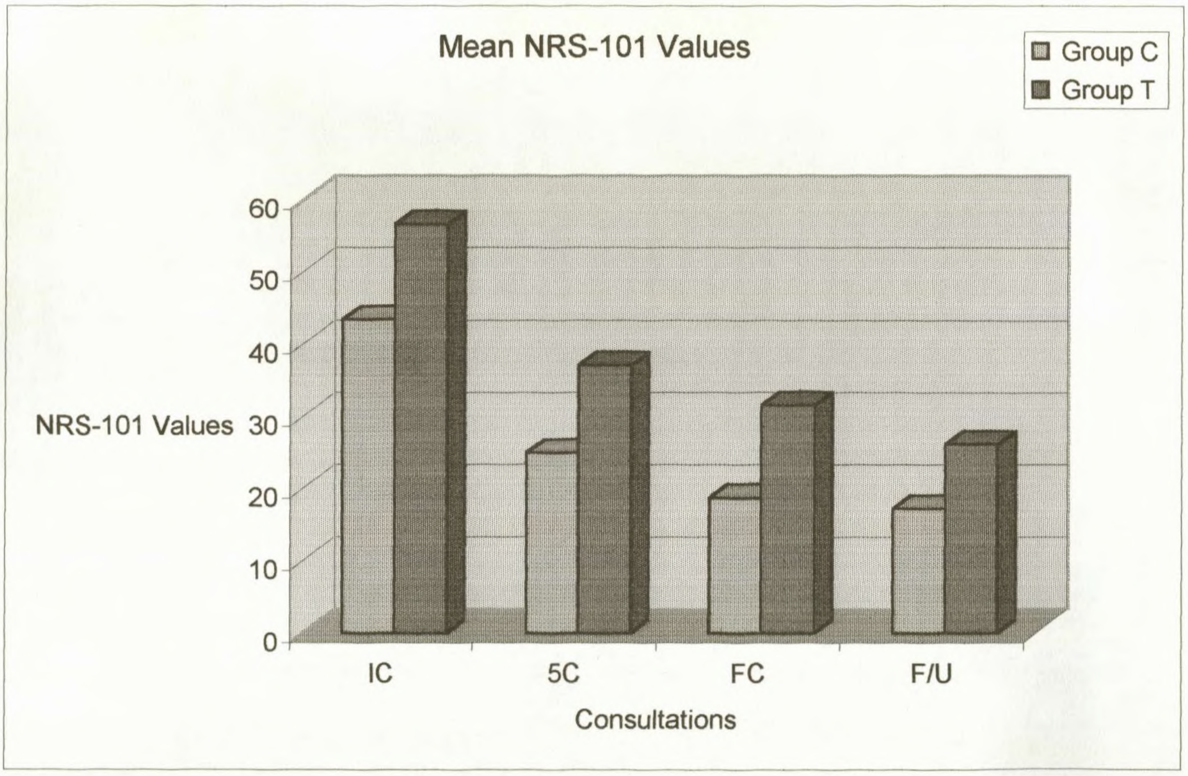
The null hypothesis was accepted in both groups, which indicated that at the 5% level of significance no statistically significant difference took place between the final consultation and the one month follow-up consultation.

Table 4.15 The results of the Mann-Whitney U-Test for the Numerical Pain Rating Scale – 101 comparing the two treatment groups at the initial consultation (IC), fifth consultation (5C), final consultation (FC) and follow-up consultation (F/U).

	IC	5C	FC	F/U
P value	0.274907	0.0452964	0.070493	0.176535

The null hypothesis was accepted at the initial, fifth, final and one month follow-up consultations, which indicated that at the 5% level of significance no statistically significant difference took place between the two groups.

Figure 4.3 The mean values of the Numerical Pain Rating Scale - 101 at the initial consultation (IC), fifth consultation (5C), final consultation (FC) and follow-up consultation (F/U).



4.3.4 Cervical Ranges of Motion

4.3.4.1 **Flexion**

Table 4.16 The mean values and results of the Wilcoxon's Signed Rank Test for cervical flexion of the two groups between the initial consultation (IC) and the Fifth consultation (5C).

	IC	5C	P value
Group C	48.1	54.7	0.00982331
Group T	50.3	57.6	0.148914

The null hypothesis was rejected for the cervical manipulative group, which indicated that at the 5% level of significance a statistically significant difference took place between the initial consultation and the fifth consultation.

The null hypothesis was accepted for the cervical traction group, which indicated that at the 5% level of significance no statistically significant difference took place between the initial consultation and the fifth consultation.

Table 4.17 The mean values and results of the Wilcoxon's Signed Rank Test for cervical flexion of the two groups between the initial consultation (IC) and final consultation (FC).

	IC	FC	P value
Group C	48.1	57.5	0.00982331
Group T	50.3	55.2	1.0

The null hypothesis was rejected for the cervical manipulative group, which indicated that at the 5% level of significance a statistically significant difference took place during the treatment period.

The null hypothesis was accepted for the cervical traction group, which indicated that at the 5% level of significance no statistically significant difference took place during the treatment period.

Table 4.18 The mean values and results of the Wilcoxon's Signed Rank Test for the cervical flexion of the two groups between the initial consultation (IC) and the follow-up consultation (F/U).

	IC	F/U	p value
Group C	48.1	55.9	0.0388669
Group T	50.3	57.3	0.267256

The null hypothesis was accepted in both groups, which indicated that at the 5% level of significance no statistically significant difference took place between the initial consultation and the one month follow-up consultation.

Table 4.19 The mean values and results of the Wilcoxon's Signed Rank Test for cervical flexion of the two groups between the final consultation (FC) and the follow-up consultation (F/U).

	FC	F/U	p value
Group C	57.5	55.9	0.579097
Group T	55.2	57.3	0.789264

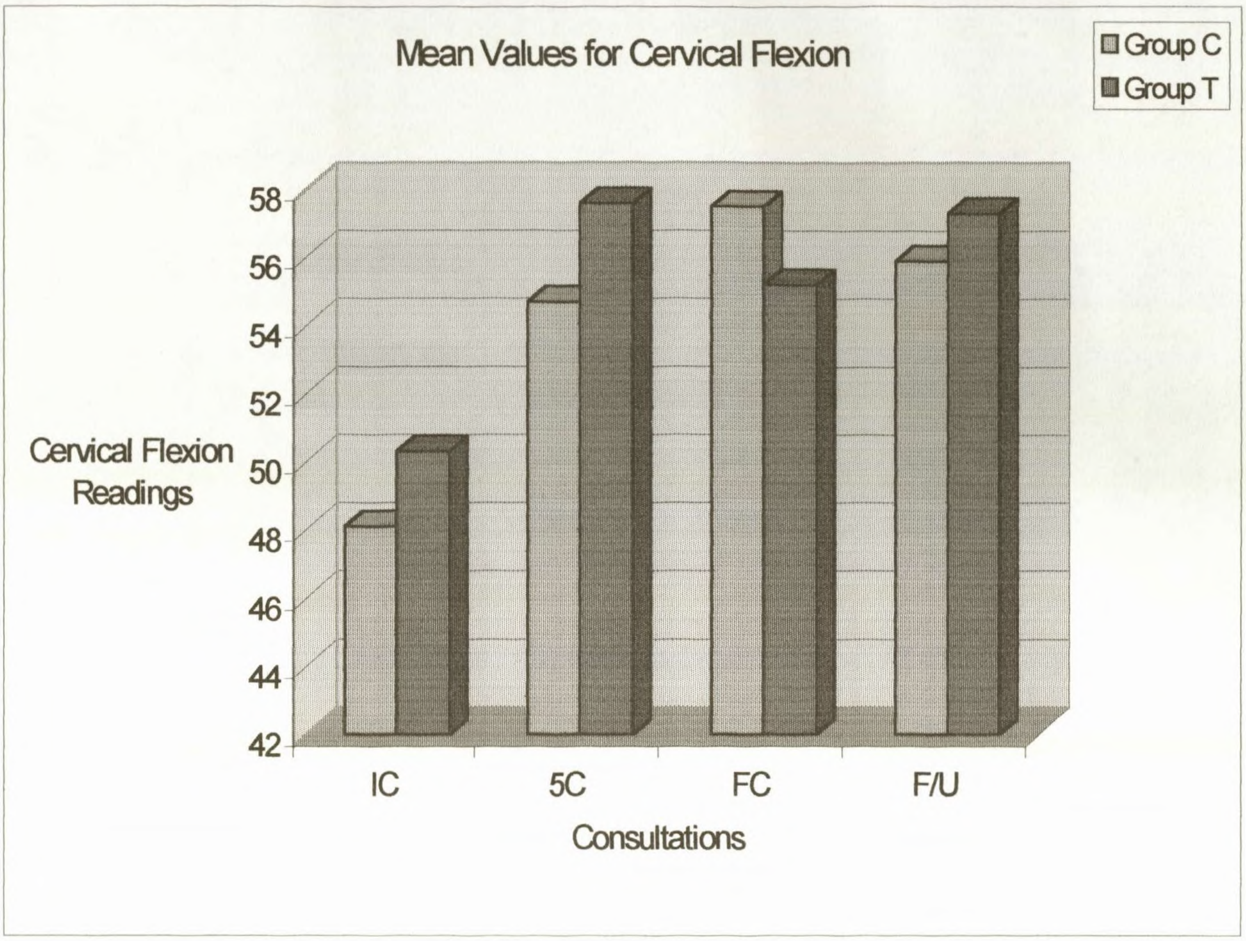
The null hypothesis was accepted in both groups, which indicated that at the 5% level of significance no statistically significant difference took place between the final consultation and the one month follow-up consultation.

Table 4.20 The results of the Mann-Whitney U-Test for cervical flexion comparing the two treatment groups at the initial consultation (IC), fifth consultation (5C), final consultation (FC) and follow-up consultation (F/U).

	IC	5C	FC	F/U
p value	0.755363	0.47975	0.900658	0.983402

The null hypothesis was accepted at the initial, fifth, final and one month follow-up consultations, which indicated that at the 5% level of significance no statistically significant difference took place between the two groups.

Figure 4.4 The mean values of cervical flexion at the initial consultation (IC), fifth consultation (5C), final consultation (FC) and follow-up consultation (F/U).



4.3.4.2 **Extension**

Table 4.21 The mean values and results of the Wilcoxon's Signed Rank Test for cervical extension of the two groups between the initial consultation (IC) and the Fifth consultation (5C).

	IC	5C	P value
Group C	55.9	55.7	0.789264
Group T	50.6	56.9	0.0613685

The null hypothesis was accepted in both groups, which indicated that at the 5% level of significance no statistically significant difference took place between the initial consultation and fifth consultation.

Table 4.22 The mean values and results of the Wilcoxon's Signed Rank Test for cervical extension of the two groups between the initial consultation (IC) and final consultation (FC).

	IC	FC	P value
Group C	55.9	58.2	0.605574
Group T	50.6	56.4	0.0613685

The null hypothesis was accepted in both groups, which indicated that at the 5% level of significance no statistically significant difference took place during the treatment period.

Table 4.23 The mean values and results of the Wilcoxon's Signed Rank Test for the cervical extension of the two groups between the initial consultation (IC) and the follow-up consultation (F/U).

	IC	F/U	p value
Group C	55.9	57.9	0.605574
Group T	50.6	58	0.0613685

The null hypothesis was accepted in both groups, which indicated that at the 5% level of significance no statistically significant difference took place between the initial consultation and the one month follow-up consultation.

Table 4.24 <u>The mean values and results of the Wilcoxon's Signed Rank Test for cervical extension of the two groups between the final consultation (FC) and the follow-up consultation (F/U).</u>

	FC	F/U	p value
Group C	58.2	57.9	0.267256
Group T	56.4	58	0.605574

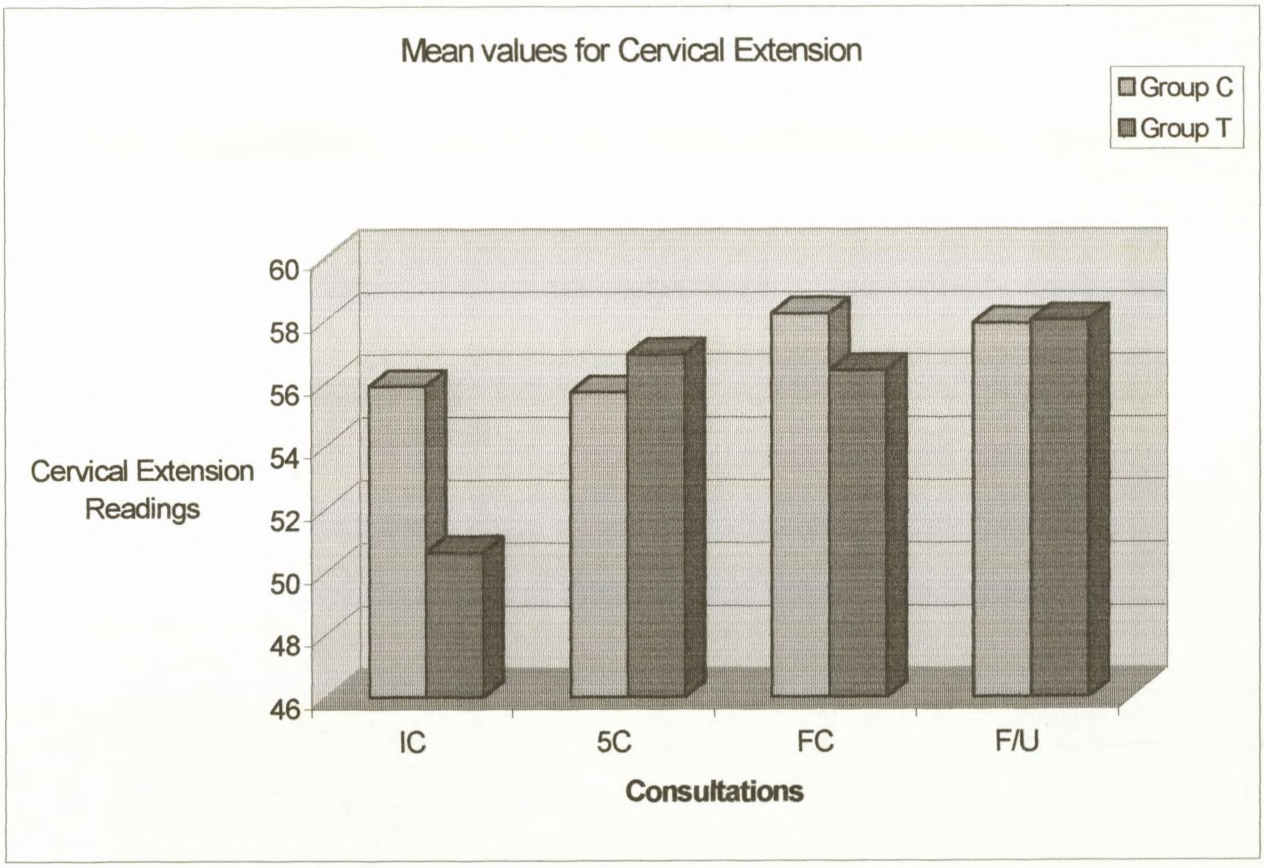
The null hypothesis was accepted in both groups, which indicated that at the 5% level of significance no statistically significant difference took place between the final consultation and the one month follow-up consultation.

Table 4.25 <u>The results of the Mann-Whitney U-Test for cervical extension comparing the two treatment groups at the initial consultation (IC), fifth consultation (5C), final consultation (FC) and follow-up consultation (F/U).</u>

	IC	5C	FC	F/U
p value	0.244959	0.770802	0.950274	0.851734

The null hypothesis was accepted at the initial, fifth, final and one month follow-up consultations, which indicated that at the 5% level of significance no statistically significant difference took place between the two groups.

Figure 4.5 The mean values of cervical extension at the initial consultation (IC), fifth consultation (5C), final consultation (FC) and follow-up consultation (F/U).



4.3.4.3 **Left Lateral Flexion**

Table 4.26 The mean values and results of the Wilcoxon's Signed Rank Test for cervical left lateral flexion of the two groups between the initial consultation (IC) and the Fifth consultation (5C).

	IC	5C	P value
Group C	37.9	40.2	0.121335
Group T	36.9	41	0.267256

The null hypothesis was accepted in both groups, which indicated that at the 5% level of significance no statistically significant difference took place between the initial consultation and the fifth consultation.

Table 4.27 The mean values and results of the Wilcoxon's Signed Rank Test for cervical left lateral flexion of the two groups between the initial consultation (IC) and final consultation (FC).

	IC	FC	P value
Group C	37.9	43.4	0.605574
Group T	36.9	43.6	0.00982331

The null hypothesis was accepted for the cervical manipulative group, which indicated that at the 5% level of significance no statistically significant difference took place during the treatment period.

The null hypothesis was rejected for the cervical traction group, which indicated that at the 5% level of significance a statistically significant difference took place during the treatment period.

Table 4.28 The mean values and results of the Wilcoxon's Signed Rank Test for the cervical left lateral flexion of the two groups between the initial consultation (IC) and the follow-up consultation (F/U).

	IC	F/U	p value
Group C	37.9	43.3	0.148914
Group T	36.9	42.1	0.0388669

The null hypothesis was accepted in both groups, which indicated that at the 5% level of significance no statistically significant difference took place between the initial consultation and the follow-up consultation.

Table 4.29 The mean values and results of the Wilcoxon's Signed Rank Test for cervical left lateral flexion of the two groups between the final consultation (FC) and the follow-up consultation (F/U).

	FC	F/U	p value
Group C	43.4	43.3	1.0
Group T	43.6	42.1	0.301698

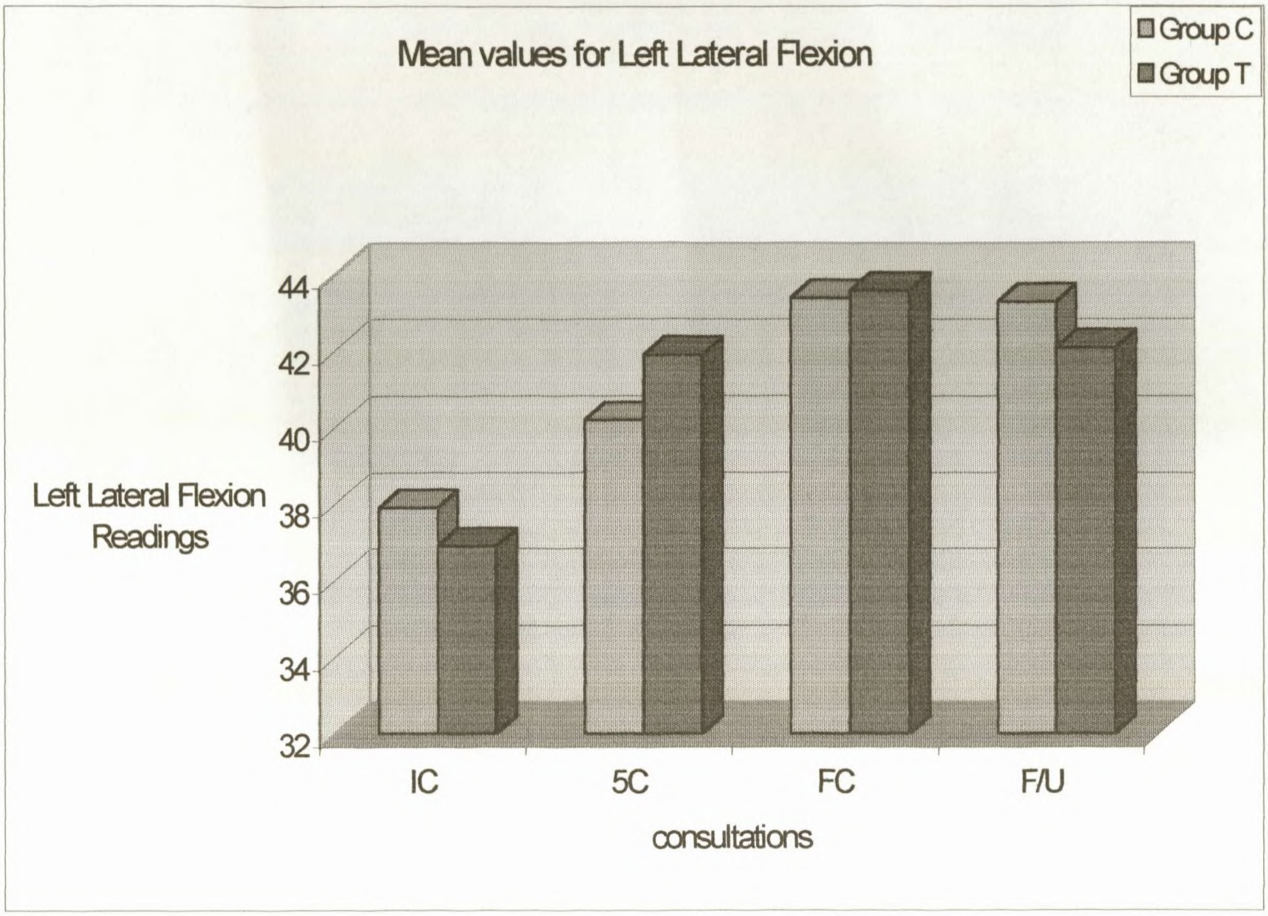
The null hypothesis was accepted in both groups, which indicated that at the 5% level of significance no statistically significant difference took place between the final consultation and the one month follow-up consultation.

Table 4.30 The results of the Mann-Whitney U-Test for cervical left lateral flexion comparing the two treatment groups at the initial consultation (IC), fifth consultation (5C), final consultation (FC) and follow-up consultation (F/U).

	IC	5C	FC	F/U
p value	0.770527	0.602586	0.933704	0.867857

The null hypothesis was accepted at the initial, fifth, final and one month follow-up consultations, which indicated that at the 5% level of significance no statistically significant difference took place between the two groups.

Figure 4.6 The mean values of cervical left lateral flexion at the initial consultation (IC), fifth consultation (5C), final consultation (FC) and follow-up consultation (F/U).



4.3.4.4 **Right Lateral Flexion**

Table 4.31 The mean values and results of the Wilcoxon's Signed Rank Test for cervical right lateral flexion of the two groups between the initial consultation (IC) and the Fifth consultation (5C).

	IC	5C	P value
Group C	34.3	37.4	0.301698
Group T	32.4	38.4	0.0613685

The null hypothesis was accepted in both groups, which indicated that at the 5% level of significance no statistically significant difference took place between the initial consultation and the fifth consultation.

Table 4.32 The mean values and results of the Wilcoxon's Signed Rank Test for cervical right lateral flexion of the two groups between the initial consultation (IC) and final consultation (FC).

	IC	FC	P value
Group C	34.3	41.1	0.0613685
Group T	32.4	39.4	0.00554577

The null hypothesis was accepted for the cervical manipulative group, which indicated that at the 5% level of significance no statistically significant difference took place during the treatment period.

The null hypothesis was rejected for the cervical traction group, which indicated that at the 5% level of significance a statistically significant difference took place during the treatment period.

Table 4.33 The mean values and results of the Wilcoxon's Signed Rank Test for the cervical right lateral flexion of the two groups between the initial consultation (IC) and the follow-up consultation (F/U).

	IC	F/U	p value
Group C	34.3	41.7	0.0388669
Group T	32.4	39.8	0.181449

The null hypothesis was accepted in both groups, which indicated that at the 5% level of significance no statistically significant difference took place between the initial consultation and the one month follow-up consultation.

Table 4.34 The mean values and results of the Wilcoxon's Signed Rank Test for cervical right lateral flexion of the two groups between the final consultation (FC) and the follow-up consultation (F/U).

	FC	F/U	p value
Group C	41.1	41.7	0.422676
Group T	39.4	39.8	0.422676

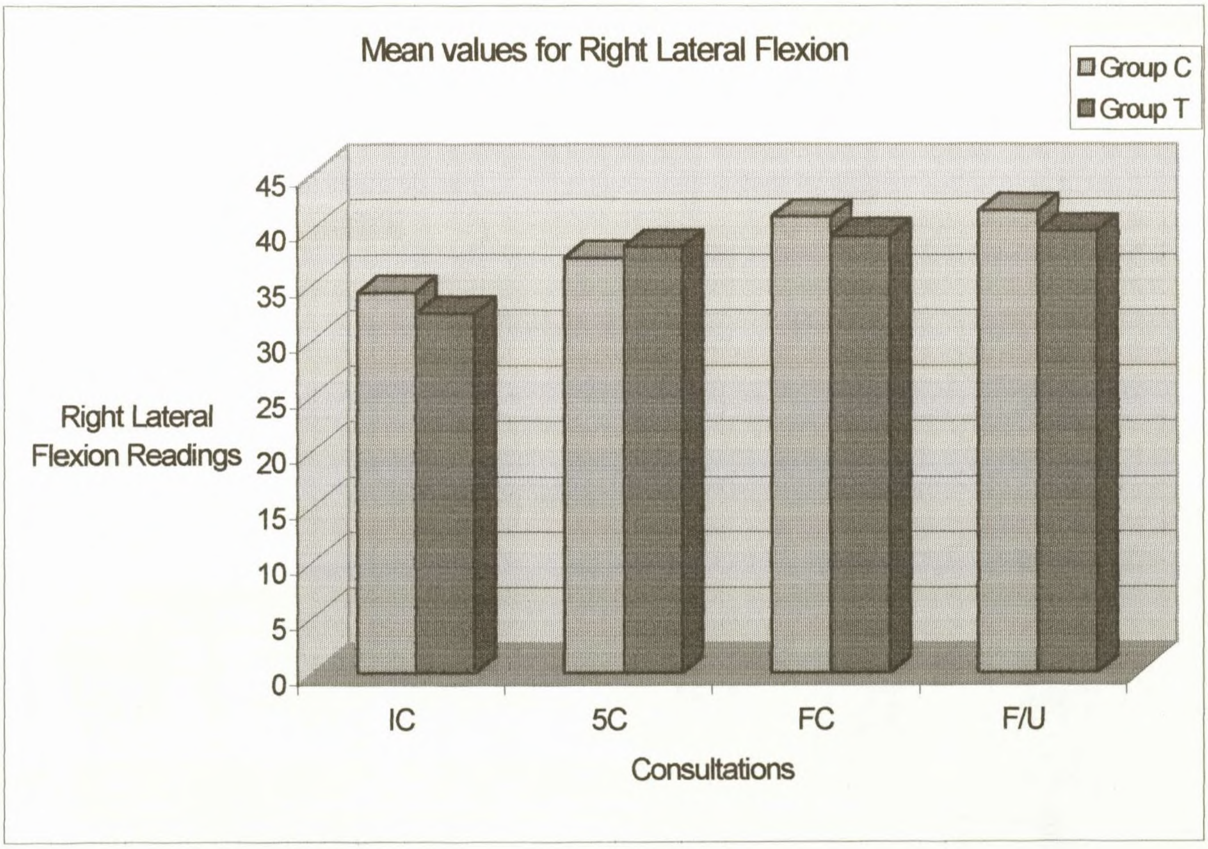
The null hypothesis was accepted in both groups, which indicated that at the 5% level of significance no statistically significant difference took place between the final consultation and the one month follow-up consultation.

Table 4.35 The results of the Mann-Whitney U-Test for cervical right lateral flexion comparing the two treatment groups at the initial consultation (IC), fifth consultation (5C), final consultation (FC) and follow-up consultation (F/U).

	IC	5C	FC	F/U
p value	0.588489	0.917296	0.787134	0.40516

The null hypothesis was accepted at the initial, fifth, final and one month follow-up consultations, which indicated that at the 5% level of significance no statistically significant difference took place between the two groups.

Figure 4.7 The mean values of cervical right lateral flexion at the initial consultation (IC), fifth consultation (5C), final consultation (FC) and follow-up consultation (F/U).



4.3.4.5 **Left Rotation**

Table 4.36 The mean values and results of the Wilcoxon's Signed Rank Test for cervical left rotation of the two groups between the initial consultation (IC) and the Fifth consultation (5C).

	IC	5C	P value
Group C	52.9	60.6	0.0388669
Group T	55.9	65.1	0.00256896

The null hypothesis was accepted for the cervical manipulative group, which indicated that at the 5% level of significance no statistically significant difference took place between the initial consultation and the fifth consultation.

The null hypothesis was rejected for the traction group, which indicated that at the 5% level of significance a statistically significant difference took place between the initial consultation and the fifth consultation.

Table 4.37 The mean values and results of the Wilcoxon's Signed Rank Test for cervical left rotation of the two groups between the initial consultation (IC) and final consultation (FC).

	IC	FC	P value
Group C	52.9	60.3	0.00937481
Group T	55.9	64.1	0.00328359

The null hypothesis was rejected in both groups, which indicated that at the 5% level of significance a statistically significant difference took place during the treatment period.

Table 4.38 The mean values and results of the Wilcoxon's Signed Rank Test for the cervical left rotation of the two groups between the initial consultation (IC) and the follow-up consultation (F/U).

	IC	F/U	p value
Group C	52.9	58.3	0.0265001
Group T	55.9	63.2	0.0433079

The null hypothesis was accepted in both groups, which indicated that at the 5% level of significance no statistically significant difference took place between the initial consultation and the one month follow-up consultation.

Table 4.39 The mean values and results of the Wilcoxon's Signed Rank Test for cervical left rotation of the two groups between the final consultation (FC) and the follow-up consultation (F/U).

	FC	F/U	p value
Group C	60.3	58.3	0.0704401
Group T	64.1	63.2	0.267256

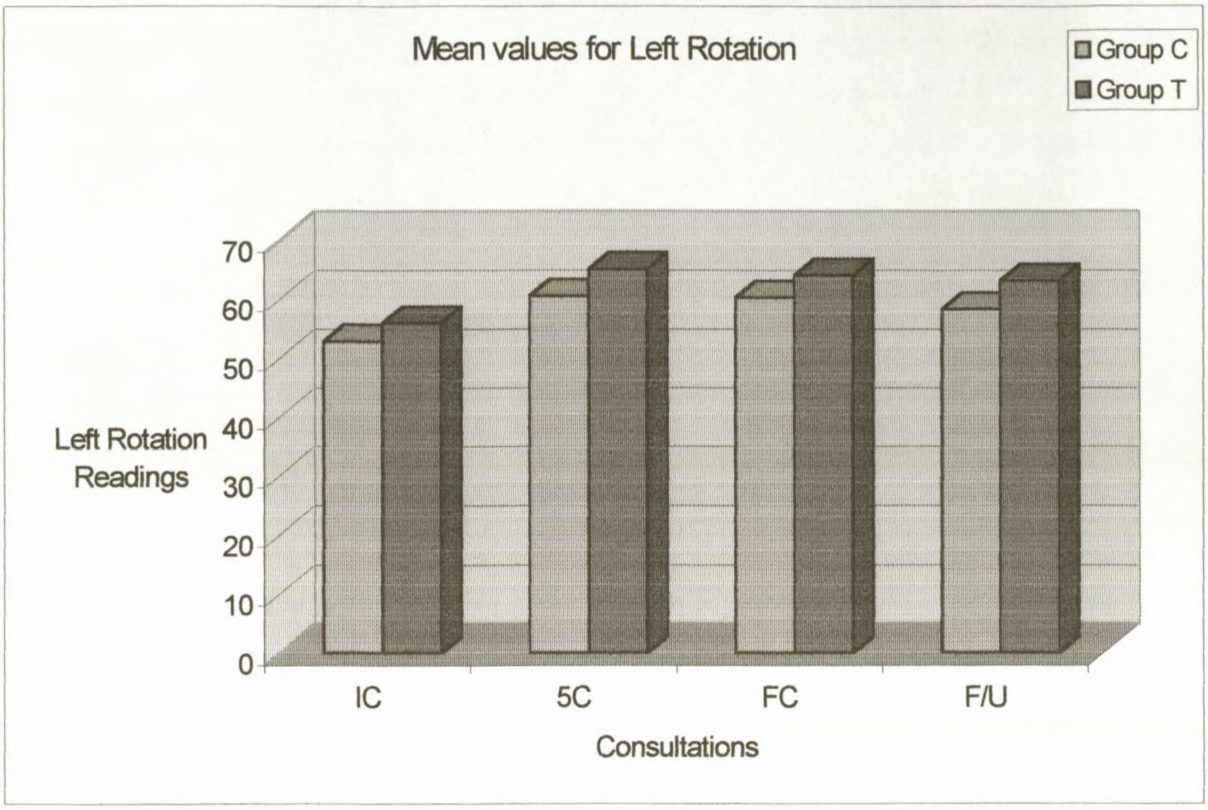
The null hypothesis was accepted in both groups, which indicated that at the 5% level of significance no statistically significant difference took place between the final consultation and the one month follow-up consultation.

Table 4.40 The results of the Mann-Whitney U-Test for cervical left rotation comparing the two treatment groups at the initial consultation (IC), fifth consultation (5C), final consultation (FC) and follow-up consultation (F/U).

	IC	5C	FC	F/U
p value	0.33673	0.0862795	0.347991	0.252108

The null hypothesis was accepted at the initial, fifth, final and one month follow-up consultations, which indicated that at the 5% level of significance no statistically significant difference took place between the two groups.

Figure 4.8 The mean values of cervical left rotation at the initial consultation (IC), fifth consultation (5C), final consultation (FC) and follow-up consultation (F/U).



4.3.4.6 **Right Rotation**

Table 4.41 The mean values and results of the Wilcoxon's Signed Rank Test for cervical right rotation of the two groups between the initial consultation (IC) and the Fifth consultation (5C).

	IC	5C	P value
Group C	56.2	59.5	0.267256
Group T	52.5	59.8	0.0003000669

The null hypothesis was accepted for the cervical manipulative group, which indicated that at the 5% level of significance no statistically significant difference took place between the initial consultation and the fifth consultation.

The null hypothesis was rejected for the cervical traction group, which indicated that at the 5% level of significance a statistically significant difference took place between the initial consultation and the fifth consultation.

Table 4.42 <u>The mean values and results of the Wilcoxon's Signed Rank Test for cervical right rotation of the two groups between the initial consultation (IC) and final consultation (FC).</u>

	IC	FC	P value
Group C	56.2	62.7	0.0161569
Group T	52.5	62.2	0.00328359

The null hypothesis was rejected in both groups, which indicated that at the 5% level of significance a statistically significant difference took place during the treatment period.

Table 4.43 <u>The mean values and results of the Wilcoxon's Signed Rank Test for the cervical right rotation of the two groups between the initial consultation (IC) and the follow-up consultation (F/U).</u>

	IC	F/U	p value
Group C	56.2	61.9	0.0161569
Group T	52.5	62.5	0.00554577

The null hypothesis was rejected in both groups, which indicated that at the 5% level of significance a statistically significant difference took place between the initial consultation and the one month follow-up consultation.

Table 4.44 <u>The mean values and results of the Wilcoxon's Signed Rank Test for cervical right rotation of the two groups between the final consultation (FC) and the follow-up consultation (F/U).</u>

	FC	F/U	p value
Group C	56.2	61.9	1.0
Group T	52.5	62.5	1.0

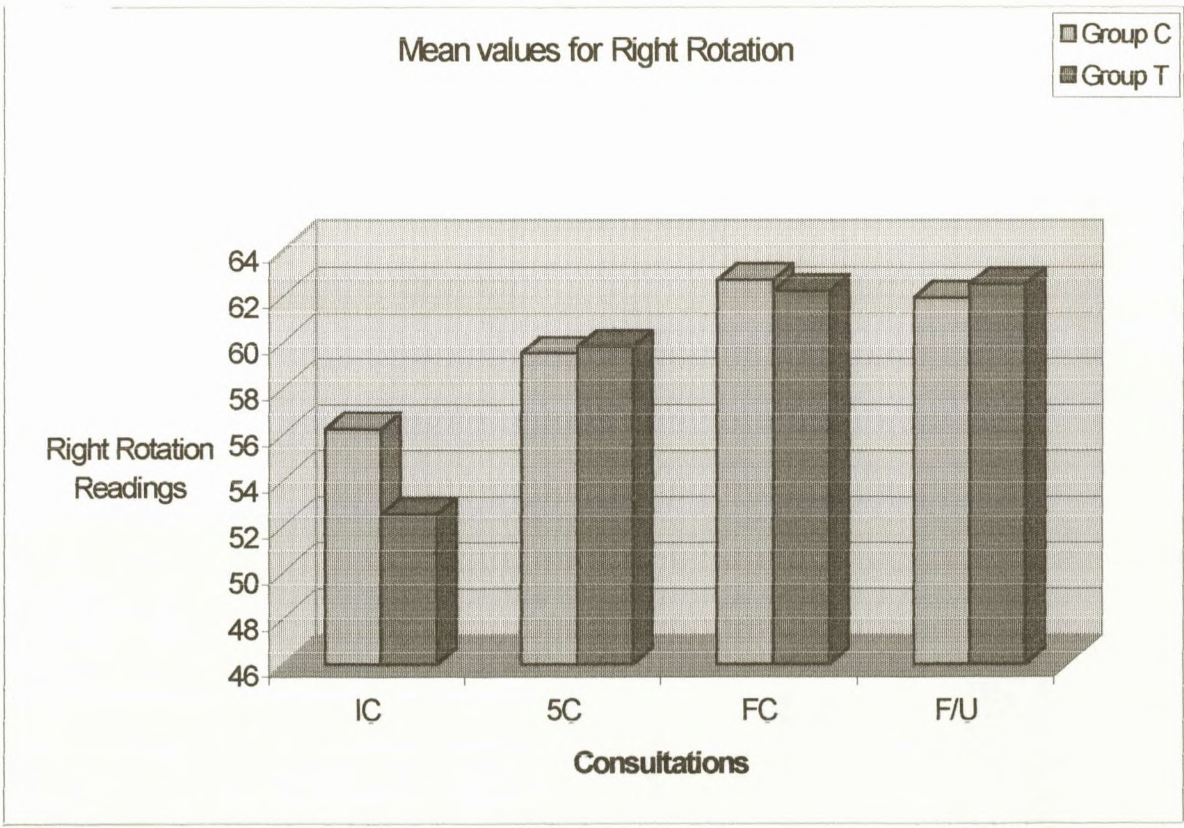
The null hypothesis was accepted in both groups, which indicated that at the 5% level of significance no statistically significant difference took place between the final consultation and the one month follow-up consultation.

Table 4.45 <u>The results of the Mann-Whitney U-Test for cervical right rotation comparing the two treatment groups at the initial consultation (IC), fifth consultation (5C), final consultation (FC) and follow-up consultation (F/U).</u>

	IC	5C	FC	F/U
p value	0.307528	0.818966	0.950224	0.818467

The null hypothesis was accepted at the initial, fifth, final and one month follow-up consultations, which indicated that at the 5% level of significance no statistically significant difference took place between the two groups.

Figure 4.9 The mean values of cervical right rotation at the initial consultation (IC), fifth consultation (5C), final consultation (FC) and follow-up consultation (F/U).



4. 4. DEMOGRAPHIC DATA

Table 4.46 Demographic Data

	Cervical manipulative therapy Group	Cervical Traction and manipulative therapy Group	Total
Sex distribution	8 Females 7 Males	11 Females 4 Males	19 Females 11 Males
Age distribution			
Age range	24 → 59	20 → 53	20 → 59
Average age	43.9	35.5	39.7
Racial distribution			
White	12	10	22
Indian	3	5	8
Occupation			
Housewife	3	3	6
Retired	2	0	2
Student	1	4	5
Manager	1	2	3
Accountant	1	0	1
Self employed	3	0	3
Mechanic	1	0	1
Attorney	1	0	1
Sales representative	1	2	3
Engineer	0	1	1
Credit clerk	0	1	1
Lecturer	1	1	2
Administrator	0	1	1

CHAPTER FIVE

DISCUSSION

5.1. INTRODUCTION

This chapter provides a description of the results obtained from the CMCC Neck Disability Index, McGill Short – form Pain Questionnaire, Numerical Pain Rating Scale 101 and goniometer readings for cervical spine ranges of motion.

5.1.1 Intra-treatment data comparison

The evaluation of the intra-treatment results of the first consultation to the fifth and final consultations (treatment period), provided an indication of the efficacy of the treatment regime. Evaluation of the results between the final consultation and follow-up consultation (follow-up period) indicated whether the treatment efficacy was maintained. Evaluation of the results of the first consultation to the follow-up consultation (overall consultation period) indicated the long term efficiency and if there was a favorable response to treatment.

5.1.2 Inter-treatment data comparison

Evaluation of the inter-treatment data of the first consultation measurements illustrated any variance in the subjective and objective findings between the two groups in terms of their original signs and symptoms at the beginning of the study.

The comparison of the data obtained at the fifth and final consultations demonstrated any difference in the rate of improvement between the two groups.

The inter-treatment evaluation of the one month follow-up consultation measurements indicated which treatment method would be more effective on a long term basis.

5.2 SUBJECTIVE DATA

5.2.1 The CMCC Neck Disability Index

5.2.1.1 Intra-treatment comparison

Significant improvement was noted in the treatment period (*Table 4.2*) and overall consultation period (*Table 4.3*) for both the cervical manipulative therapy group and the cervical traction therapy group. A significant improvement in disability was noted early in the treatment period (after the fifth consultation) (*Table 4.1*) in the cervical traction therapy group, while no improvement was noted in the cervical manipulative therapy group. No significant change was seen to exist in either group after the one month follow-up period (*Table 4.4*) suggesting that the improvement in disability after the treatment period (*Table 4.2*) was maintained in both groups.

5.2.1.2 Inter-treatment comparison

The inter-treatment analysis between the two groups, using the Mann – Whitney U-test, showed that no significant statistical difference exists between the two groups at the first, fifth, final and one month follow-up consultations (*Table 4.5*).

5.2.2. The McGill Short-form Pain Questionnaire

5.2.2.1 Intra-treatment Comparison

Significant improvement was noted in the treatment period (*Table 4.6* and *Table 4.7*) and overall consultation period (*Table 4.8*) for both the cervical manipulative therapy group and the cervical traction therapy group. No significant change was noted in either group after the one month follow-up period (*Table 4.9*) suggesting that the improvement in pain after the treatment period (*Table 4.7*) was maintained in both groups.

5.2.2.2. Inter-treatment comparison

The inter-treatment analysis between the two groups showed that no significant statistical differences existed between the two groups at the first, final and one month follow-up consultations (*Table 4.10*). A significant statistical difference did exist between the two groups at the fifth consultation favouring the cervical traction therapy group (*Table 4.10*).

5.2.3 The Numerical Pain Rating Scale (NRS) – 101

5.2.3.1 Intra-treatment Comparison

Significant improvement was noted in the treatment period (*Table 4.11* and *Table 4.12*) and the overall consultation period (*Table 4.13*) in both the cervical manipulative therapy group and the cervical traction therapy group. No significant statistical change was seen in either group after the one month follow-up period (*Table 4.14*) suggesting that the improvement in pain after the treatment period (*Table 4.12*) was maintained in both groups.

5.2.3.2 Inter-treatment Comparison

The inter-treatment analysis between the two groups showed that no significant statistical difference existed between the two groups at the first, fifth, final and one month follow-up consultations (*Table 4.15*).

5.3 OBJECTIVE DATA

5.3.1 Cervical Ranges of Motion

5.3.1.1 Intra-treatment Comparison

Upon evaluation of cervical flexion there was a significant statistical improvement in the treatment period (*Table 4.16* and *Table 4.17*) in the cervical manipulative therapy group. No significant statistical differences were shown to exist in the treatment period *(Table 4.16* and *Table 4.17*) in the cervical traction therapy group. No significant differences were noted in either group for the overall consultation period. No significant differences were noted in either group after the one month follow-up period (*Table 4.19*).

No significant statistical differences were shown to exist in cervical extension in either the cervical manipulative therapy group or the cervical traction therapy group during the treatment period (*Table 4.21* and *Table 4.22*) or the overall consultation period (*Table 4.23*). No significant statistical differences were noted in either group after the one month follow-up period (*Table 4.24*).

With regards to left lateral flexion no significant statistical difference existed during the treatment period (*Table 4.26* and *Table 4.27*) in the cervical manipulative therapy group. A significant statistical difference did exist after the treatment period (*Table 4.27*) in the cervical traction therapy group. This significant statistical difference is shown at the end of the treatment period (*Table 4.27*) as both groups showed no significant statistical difference after the fifth consultation (*Table 4.26*). No significant statistical difference existed in left lateral flexion after the overall consultation period (*Table 4.28*) in either of the two groups. No significant difference was seen in left lateral flexion after the one month follow-up period (*Table 4.29*) in either the cervical manipulative therapy group or the cervical traction group.

On analysis of the results of the readings for right lateral flexion it can be seen that no significant statistical difference existed after the treatment period (*Table 4.31 and Table 4.32*) in the cervical manipulative therapy group. A significant statistical difference was noted after the treatment period (*Table 4.32*) in the cervical traction therapy group. Both groups did not show any significant change after the overall consultation period (*Table 4.33*) or after the one month follow-up period (*Table 4.34*).

Results for left rotation showed a significant statistical difference to exist in both the cervical manipulative therapy group and the cervical traction therapy group after the treatment period (*Table 4.37*). The cervical traction therapy group showed a significant statistical change in left rotation throughout the treatment period (*Table 4.36* and *Table 4.37*). The cervical manipulative therapy group showed no significant change after the fifth consultation period (*Table 4.36*) but a significant difference at the end of the treatment (*Table 4.37*). No significant statistical differences were shown to exist after the overall consultation period (*Table 4.38*) or after the one month follow-up period (*Table 4.39*) in either group.

Right rotation anaylsis revealed a significant statistical difference existed after the treatment period (*Table 4.42*) in both the cervical manipulative therapy group and the cervical traction therapy group. However, no significant change existed after the fifth consultation in the cervical manipulative therapy group while a significant difference existed in the cervical traction therapy group (*Table 4.41*). A significant statistical change was noted in right rotation in both groups after the overall consultation period (*Table 4.43*). No significant statistical difference existed in either group after one month follow-up period (*Table 4.44*) suggesting that the improvement after the treatment period was maintained.

5.3.1.2 Inter-treatment Comparison

On analysis of the cervical ranges of motion (flexion, extension, left lateral flexion, right lateral flexion, left rotation and right rotation) no significant statistical differences were shown to exist at the first, fifth, final and follow-up consultations between the two groups (*Table 4.20, Table 4.25, Table 4.30, Table 4.35, Table 4.40, Table 4.45*).

5.4 DISCUSSION OF SUBJECTIVE AND OBJECTIVE DATA

In terms of subjective and objective findings:

a) Hypothesis one stated that cervical manipulative therapy would be effective in the management of mechanical neck pain.

b) Hypothesis two stated that intermittent mechanical cervical traction therapy combined with cervical manipulative therapy would be effective in the management of mechanical neck pain.

c) Hypothesis three stated that intermittent mechanical cervical traction therapy combined with cervical manipulative therapy would be more effective in the management of mechanical neck pain than cervical manipulative therapy only.

Therefore, in terms of the patients subjective response to treatment it was shown that cervical manipulative therapy seems to be effective in improving disability and decreasing the perception of pain in both the short term (treatment period) and importantly the long term (overall consultation period).

In terms of the patients subjective response to treatment it was shown that cervical traction therapy combined with cervical manipulative therapy seems to be effective in improving disability and decreasing the perception of pain in both the short term (treatment period) and importantly the long term (overall consultation period).

The results of this study agree with those of Cassidy et al. (1992a), Cassidy et al. (1992b), Sloop et al. (1982), Mennell (1990), Howe et al. (1983) and Vernon et al. (1990) in which subjects receiving Spinal Manipulative therapy demonstrated significant reductions in pain perception and functional disability.

In terms of subjective findings, when analysing the two groups to see which of the two treatments was the more effective in the management of mechanical neck pain, no significant statistical difference was seen to exist. Although the McGill Short-form Questionnaire showed a significant difference in favour of the cervical traction therapy group after the fifth consultation, with these patients showing increased relief of pain sooner. This difference was more importantly not carried through to after the treatment period or the overall consultation period.

In terms of the patients objective response to treatment it was shown that cervical manipulative therapy seems to be effective in significantly improving the cervical range of motion in flexion and right rotation in the short term (during the treatment period). However, these statistically significant improvements do not continue in the long term (i.e. over the entire consultation period). Extension, left lateral flexion and right lateral flexion showed no statistical significant improvement throughout the entire consultation period.

In terms of the patients objective response to treatment it was shown that combining cervical traction therapy and cervical manipulative therapy was effective in significantly improving the cervical range of motion in left lateral flexion, right lateral flexion, left rotation and right rotation in the short term (i.e. the treatment period).
However, these statistically significant improvements do not continue into the long term (i.e. over the entire consultation period). Flexion and extension showed no statistically significant improvement throughout the overall consultation period.

It should be noted that although only certain ranges of motion show a statistically significant improvement in increased movement, all ranges of motion in both groups were improved to some degree in the study.

Improvements in range of motion correspond with those by Koes et al. (1992a,b,c), Koes et al. (1993), Nansel et al. (1989), Nansel et al. (1990), Zylbergold and Piper (1985) and Cassidy et al. (1992b), however which ranges of motion are statistically significantly improved vary from study to study. Cassidy et al. (1992b) found that all planes of range of motion increased after treatment (single rotational manipulation) and that the greatest increases were recorded in rotation towards the affected side, lateral flexion to the opposite side and lateral flexion to the painful side. Cassidy et al. (1992b) state that there is a correlation between an increase in cervical rotation and a decrease in pain which is clinically instructive. Cassidy et al. (1992a) found increases in range of motion were all greater in the manipulated group, but none was statistically significant.

When analysing the inter-treatment results to see which of the two treatment protocols was the more effective in the management of mechanical neck pain, no statistical significant difference was noted.

Therefore, in terms of subjective and objective findings both hypothesis one and hypothesis two are accepted but hypothesis three is rejected.

5.5 STUDY WEAKNESS

The size of this study was too small and did not represent the normal distribution of the population. If future studies are proposed for similar trials then it is suggested that a larger sample size be used to get a fairer representation of the general population.

When gathering the subjective data difficulties were encountered due to the differences in perceived pain and the description thereof. This became particularly evident in the McGill Short-form Questionnaire. These differences seemed to occur along cultural lines where words used to describe a type of pain differ from person to person. A larger sample size could possibly eliminate any discrepancies concerning small changes in pain description, disability and intensity.

In gathering the objective data difficulty was experienced with the calibration on the cervical goniometer. It was marked in a two-degree scale and became difficult when measuring small variations and cervical range of motion. Human error cannot be excluded in the accurate reading of these small variations in motion.

5.6 CONCLUSION

From the statistical analysis of data gathered from this study, it was concluded that there was no significant benefit in combining cervical traction therapy with cervical manipulative therapy in the management of mechanical neck pain. However, both treatment groups showed significant improvement with regard to pain reduction, disability reduction and the improvement in cervical range of motion.

It was concluded in terms of subjective and objective clinical findings that both treatment protocols were equally effective.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

This study consisted of 30 subjects all of who were diagnosed with cervical joint dysfunction syndrome (or cervical facet syndrome). The subjects were randomly divided into two treatments groups, with each group consisting of fifteen subjects. Group one received cervical manipulative therapy only. Group two received cervical traction therapy and cervical manipulative therapy only. Each patient received a maximum of ten treatments over a five-week period together with a one month follow-up consultation.

The results of this study indicated that a statistically significant subjective improvement existed in the form of decreased pain perception and functional disability in both groups. These improvements were noted to exist after the treatment period (short term) and at the one month follow-up period (long term).

The cervical manipulative therapy group showed a significant objective improvement in cervical range of motion during the treatment period (short term) for flexion, left rotation and right rotation only. The cervical traction therapy group showed a significant objective improvement in cervical range of motion during the treatment period (short term) for left lateral flexion, right lateral flexion, left rotation and right rotation only. Both groups showed no significant statistical improvement in cervical range of motion after the overall consultation period (long term).

Although the results for cervical range of motion (objective findings) did not match closely with the subjective results in both groups subjects did demonstrate a favourable clinical response in terms of decreased mean scores for pain perception and functional disability and increased mean scores of cervical ranges of motion.

6.2 RECOMMENDATIONS

The results of this investigation are based on a small sample size and require confirmation and modification using a larger sample size, which would represent a normal distribution of the population. In future studies it would be advised to perform long term trials in which patients are monitored for at least 6 months to a year, in order to investigate the long term benefit of the treatment.

This study used only one adjustment technique (rotatory cervical adjustment with an index contact). It is possible that better results could be experienced using other adjustive techniques in the management of mechanical neck pain.

To conclude, this study has shown that the combination of intermittent cervical traction and cervical manipulative therapy is as beneficial in the treatment of mechanical neck pain as cervical manipulative therapy alone.

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APPENDIX A

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: Current:

X-Ray Studies:
Previous: Current:

Clinical Path. lab:
Previous: Current:

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 Medical 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. Immediate Family Medical History:

- Age
- Health
- Cause of Death
- DM
- Heart Disease
- TB
- Stroke
- Kidney Disease
- CA
- Arthritis
- Anaemia
- Headaches
- Thyroid Disease
- Epilepsy
- Mental Illness
- Alcoholism
- Drug Addiction
- Other

8. Psychosocial history:

- Home Situation and 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

APPENDIX B

TECHNIKON NATAL

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

Patient:____________________File#: ____________________Date:__________
Clinician:____________________Signature:____________________
Intern:____________________Signature:____________________

1. VITALS

Pulse rate:
Respiratory rate:
Blood pressure: R L
Temperature:
Height:
Weight:

2. GENERAL EXAMINATION

General Impression:
Skin:
Jaundice:
Pallor:
Clubbing:
Cyanosis (Central/Peripheral):
Oedema:
Lymph nodes
- Head and neck:
- Axillary:
- Epitrochlear:
- Inguinal:

Urinalysis:

3. CARDIOVASCULAR EXAMINATION

1) Is this patient in **Cardiac Failure** ?
2) Does this patient have signs of **Infective Endocarditis** ?
3) Does this patient have **Rheumatic Heart Disease ?**

Inspection
- Scars
- Chest deformity:
- Precordial bulge:
- Neck -JVP:

Palpation:
- Apex Beat (character + location):
- Right or left ventricular heave:
- Epigastric Pulsations:
- Palpable P2:
- Palpable A2:

Pulses: - General Impression:
- Radio-femoral delay:
- Carotid:
- Radial:
- Dorsalis pedis:
- Posterior tibial:
- Popliteal:
- Femoral:

Percussion: - borders of heart

Auscultation: - heart valves (mitral, aortic, tricuspid, pulmonary)
- Murmurs (timing,systolic/diastolic, site, radiation, grade).

4. RESPIRATORY EXAMINATION

1) Is this patient in **Respiratory Distress** ?

Inspection - Barrel chest:
- Pectus carinatum/cavinatum:
- Left precordial bulge:
- Symmetry of movement:
- Scars:

Palpation - Tracheal symmetry:
- Tracheal tug:
- Thyroid Gland:
- Symmetry of movement (ant + post)
- Tactile fremitus:

Percussion - Percussion note:
- Cardiac dullness:
- Liver dullness:

Auscultation - Normal breath sounds bilat.:
- Adventitious sounds (crackles, wheezes, crepitations)
- Pleural frictional rub:
- Vocal resonance - Whispering pectoriloquy:
  - Bronchophony:
  - Egophony:

5. ABDOMINAL EXAMINATION

1) Is this patient in **Liver Failure** ?

Inspection - Shape:
- Scars:
- Hernias:

Palpation - Superficial:
- Deep = Organomegally:

- Masses (intra- or extramural)
- Aorta:

Percussion
- Rebound tenderness:
- Ascites:
- Masses:

Auscultation
- Bowel sounds:
- Arteries (aortic, renal, iliac, femoral, hepatic)

Rectal Examination
- Perianal skin:
- Sphincter tone & S4 Dermatome:
- Obvious masses:
- Prostate:
- Appendix:

6. G.U.T EXAMINATION

External genitalia:
Hernias:
Masses:
Discharges:

7. NEUROLOGICAL EXAMINATION

Gait and Posture
- Abnormalities in gait:
- Walking on heels (L4-L5):
- Walking on toes (S1-S2):
- Rombergs test (Pronator Drift):

Higher Mental Function
- Information and Vocabulary:
- Calculating ability:
- Abstract Thinking:

G.C.S.:
- Eyes:
- Motor:
- Verbal:

Evidence of head trauma:

Evidence of Meningism:
- Neck mobility and Brudzinski's sign:
- Kernigs sign:

Cranial Nerves:

I Any loss of smell/taste:
Nose examination:

II External examination of eye:
- Visual Acuity:
- Visual fields by confrontation:

- Pupillary light reflexes = Direct:
  = Consensual:
- Fundoscopy findings:

III Ocular Muscles:
Eye opening strength:

IV Inferior and Medial movement of eye:

V
a. Sensory - Ophthalmic:
- Maxillary:
- Mandibular:

b. Motor - Masseter:
- Jaw lateral movement:

c. Reflexes - Corneal reflex
- Jaw jerk

VI Lateral movement of eyes

VII
a. Motor - Raise eyebrows:
- Frown:
- Close eyes against resistance:
- Show teeth:
- Blow out cheeks:

b. Taste - Anterior two-thirds of tongue:

VIII General Hearing:
Rinnes = L: R:
Webers lateralisation:
Vestibular function - Nystagmus:
- Rombergs:
- Wallenbergs:
Otoscope examination:

IX & X Gag reflex:
Uvula deviation:
Speech quality:

XI Shoulder lift:
S.C.M. strength:

XII Inspection of tongue (deviation):

Motor System:

a. Power
- Shoulder = Abduction & Adduction:
  = Flexion & Extension:
- Elbow = Flexion & Extension:
- Wrist = Flexion & Extension:

- Forearm = Supination & Pronation:
- Fingers = Extension (Interphalangeals & M.C.P's):
- Thumb = Opposition:
- Hip = Flexion & Extension:
  = Adduction & Abduction:
- Knee = Flexion & Extension:
- Foot = Dorsiflexion & Plantar flexion:
  = Inversion & Eversion:
  = Toe (Plantarflexion & Dorsiflexion):

b. Tone
- Shoulder:
- Elbow:
- Wrist:
- Lower limb - Int. & Ext. rotation:
- Knee clonus:
- ankle clonus:

c. Reflexes
- Biceps:
- Triceps:
- Supinator:
- Knee:
- Ankle:
- Abdominal:
- Plantar:

Sensory System:

a. Dermatomes
- Light touch:
- Crude touch:
- Pain:
- Temperature:
- Two point discrimination:

b. Joint position sense
- Finger:
- Toe:

c. Vibration:
- Big toe:
- Tibial tuberosity:
- ASIS:
- Interphalangeal Joint:
- Sternum:

Cerebellar function:

Obvious signs of cerebellar dysfunction:
= Intention Tremor:
= Nystagmus:
= Truncal Ataxia:

Finger-nose test (Dysmetria):
Rapid alternating movements (Dysdiadochokinesia):
Heel-shin test:
Heel-toe gait:
Reflexes:
Signs of Parkinsons:

8. **SPINAL EXAMINATION:**(See Regional examination)

Obvious Abnormalities:
Spinous Percussion:
R.O.M:
Other:

9. **BREAST EXAMINATION:**

Summon female chaperon.

Inspection
- Hands rested in lap:
- Hands pressed on hips:
- Arms above head:
- Leaning forward:

Palpation
- masses:
- tenderness:
- axillary tail:
- nipple:
- regional lymph nodes:

APPENDIX C

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC
REGIONAL EXAMINATION - *CERVICAL SPINE*

Patient: ______________________________ File: ______________

Date: ______________ Intern/Resident: ______________________________

Clinician: ______________________________ Sign: ______________

OBSERVATION:

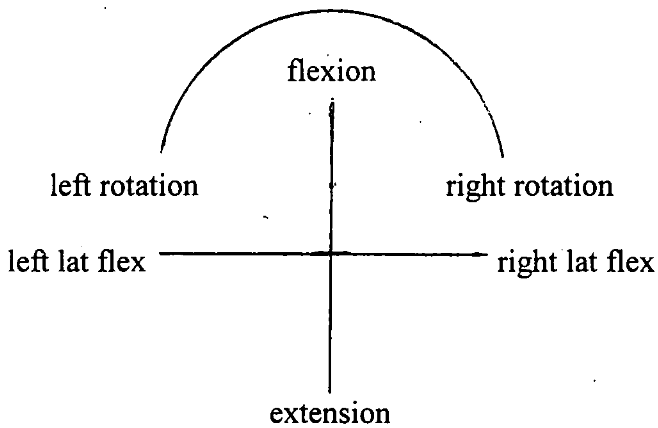
Posture
Swellings
Scars
Discolouration
Hair Line
Bony & Soft Tissue Contours

Shoulder position:
Left:
Right:
Muscle spasm
Facial expression

RANGE OF MOTION:

Flexion (45'):
L/R Rotation (70'):

Extension (70'):
L/R Lat Flex (45'):



PALPATION:

Lymph Nodes
Thyroid Gland

Trachea

ORTHOPAEDIC EXAMINATION:

Tenderness

Trigger Points:	SCM	Trapezius
	Scalenii	Lev Scap
	Post Cervicals	

Doorbell sign
Kemp's test
Cervical distraction
Halstead's test
Hyperabduction test
Shoulder abduction test

Cervical compression
Lateral compression
Adson's test
Costoclavicular test
Eden's test
Shoulder depression test

Dizziness rotation test
Brachial plexus tension

Lhermitte's sign

NEUROLOGICAL EXAMINATION:

Dermatomes	Left	Right	Myotomes	Left	Right	Reflexes	Left	Right
C2			C1			C5		
C3			C2			C6		
C4			C3			C7		
C5			C4					
C6			C5					
C7			C6					
C8			C7					
T1			C8					
			T1					

VASCULAR:

	Left	Right
Blood Pressure		
Carotid arts.		
Subclavian arts.		
Wallenberg's test		

MOTION PALPATION & JOINT PLAY:

Left: Motion Palpation:
Joint Play:

Right: Motion palpation:
Joint Play:

Upper T horacics:
Motion Palpation:
Joint Play:

Basic Exam: Shoulder:
Case History:

ROM: Active:
Passive:
RIM:
Orthopaedic/Neuro/
Vascular:
Observ/Palpation:

Basic Exam: Thoracic Spine:
Case History:

ROM: Motion Palp:
Active:
Passive:
Orthopaedic/Neuro/
Vascular:
Observ/Palpation:

APPENDIX D

INFORMED CONSENT FORM

(To be completed in duplicate by patient/subject*) *Delete whichever is not applicable.

TITLE OF RESEARCH PROJECT

____

____

NAME OF SUPERVISOR

____

NAME OF RESEARCH STUDENT

____

PLEASE CIRCLE THE APPROPRIATE ANSWER

1. Have you read the research information sheet? YES/NO

2. Have you had an opportunity to ask questions regarding this study? YES/NO
3. Have you received satisfactory answers to your questions? YES/NO

4. Have you had an opportunity to discuss this study? YES/NO
5. Have you received enough information about this study? YES/NO

6. Who have you spoken to? ______________________________

7. Do you understand the implications of your involvement in this study? YES/NO

8. Do you understand that you are free to withdraw from this study? YES/NO
   a) at any time
   b) without having to give a reason for withdrawing, and
   c) without affecting your future health care.

9. Do you agree to voluntarily participate in this study? YES/NO

PATIENT/SUBJECT* Name____________________ Signature____________________
(in block letters)

PARENT/GUARDIAN* Name____________________ Signature____________________
(in block letters)

WITNESS Name____________________ Signature____________________
(in block letters)

RESEARCH STUDENT Name____________________ Signature____________________
(in block letters)

APPENDIX E

PATIENT RANDOMIZATION ROSTER

1)	T	16)	C
2)	T	17)	C
3)	C	18)	T
4)	C	19)	C
5)	C	20)	T
6)	C	21)	C
7)	T	22)	T
8)	T	23)	T
9)	T	24)	C
10)	C	25)	C
11)	C	26)	C
12)	T	27)	C
13)	T	28)	T
14)	C	29)	T
15)	T	30)	T

APPENDIX F

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 G

SHORT-FORM McGILL PAIN QUESTIONNAIRE

RONALD MELZACK

PATIENT'S NAME: ______________________ 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) ____

NO PAIN |——————————————————————| WORST POSSIBLE PAIN

PPI

0	NO PAIN	____
1	MILD	____
2	DISCOMFORTING	____
3	DISTRESSING	____
4	HORRIBLE	____
5	EXCRUCIATING	____

FIGURE 10.5. The short-form McGill Pain Questionnaire. Descriptors 1–11 represent the sensory dimension of pain experience and 12–15 represent the affective dimension. Each descriptor is ranked on an intensity scale of 0 = none, 1 = mild, 2 = moderate, 3 = severe. The Present Pain Intensity (PPI) of the standard long-form MPQ and the Visual Analogue Scale are also included to provide overall pain intensity scores. Copyright 1984 Ronald Melzack.

APPENDIX H

Patient name:__________________ Res.No:_______ Date:_______

7.4 <u>NUMERICAL RATING SCALE-101 QUESTIONNAIRE</u>

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

____

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

____

APPENDIX I

CERVICAL RANGE OF MOTION RECORDING SHEET

Name: ……………………………….……………   File number: ………..

MOTION	**IC**	**5C**	**FC**	**F/U**
FLEXION				
EXTENSION				
LEFT LATERAL FLEXION				
RIGHT LATERAL FLEXION				
LEFT ROTATION				
RIGHT ROTATION				