A STUDY TO DETERMINE THE ROLE OF SOFT TISSUE THERAPY IN THE
CHIROPRACTIC MANAGEMENT OF CERVICAL FACET SYNDROME.

A dissertation submitted to the Faculty of Health Sciences, Technikon
Witwatersrand, in partial fulfillment of the requirements
for a Masters degree in Technology: Chiropractic.

by

STUART J. WHITE

I hereby declare that this work is my own in both conception and execution except
where otherwise indicated in the text.

[Signature]
Stuart J. White

Date
07/02/2001

Approved for final submission

[Signature]
Supervisor: Dr. A.Y.B. Cullinan
B.A. M. Tech: Chiropractic (Natal)

Date
07/02/2001

[Signature]
Co-supervisor: Dr. A.J. Deall
M. Tech: Chiropractic (Natal) C.C.S.P.

Date
07/02/2001

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For my parents, Harry and Gale who have taught me so much in giving so unselfishly over the years. To my brother, Michael and sister, Susan for their support, and to my friend Dannielle for believing in me.
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ABSTRACT

This randomised, controlled, comparative pilot study was undertaken in order to evaluate the relative effectiveness of massage therapy in combination with spinal manipulative therapy as compared to either therapy alone, in the treatment of chronic cervical facet syndrome.

It was hypothesised that all three treatment protocols would be effective in the treatment of chronic cervical facet syndrome, but that the combined therapy would be most effective, as this treatment is directed at the joints as well as the musculature of the cervical spine.

It was hoped that the combination therapy would offer a shorter recovery time and more of a long-term effect than the other groups. This would benefit the patient in terms of an improved quality of life and in reducing the financial cost of treatment.

Forty-five patients' were recruited by means of newspaper advertisements and posters distributed around Technikon Witwatersrand and surrounding neighbourhoods. Only those patients' who conformed to the specified delimitations and diagnostic criteria were accepted to form part of the study. The 45 patients' were placed randomly into three groups of 15 patients' each.

The first group received massage therapy, the second group received chiropractic manipulative therapy and the third group received a combination of massage therapy and chiropractic manipulative therapy.

Each patient received 5 treatments over a 2-week period and attended a follow-up consultation 2 weeks after the final treatment. The follow-up consultation was used to assess the lasting effects of the treatment protocol.

The objective data in the form of cervical range of motion was obtained by means of the Cervical Range of Motion instrument (C.R.O.M. goniometer).
The subjective data was collected by means of the Neck Pain and Disability Index
(Vernon-Mior) and the McGill Pain Questionnaire.

Data was analysed on a 95% confidence level by means of the Wilcoxon Signed Rank
test for intra-group comparison and the Mann-Whitney Rank Sum test for comparison
between groups.

The results indicated that the chiropractic manipulative therapy and combination groups
were equally effective in increasing cervical range of motion, as well as in reducing neck
pain and disability, from the initial treatment to the follow-up consultation.
Where the combination group did achieve better results than the chiropractic
manipulative therapy group was from the final treatment to the follow-up consultation.
Although these results were not statistically significant, trends showed that the
combination group improved in five out of six ranges of motion, compared to two out of
six for the adjustment group. Thus it was noted that in order to achieve a potentially
lasting increase in cervical range of motion, the combination therapy should be the
treatment of choice.

Trends indicated that the most effective treatment protocol for the treatment of chronic
cervical facet syndrome is a combination of massage therapy prior to chiropractic
manipulative therapy. The advantage of this combination is that not only are the joints of
the cervical spine treated, but so are the muscles that move them.
Although slightly more time-consuming, the combination therapy treatment tends to offer
the patient the best results in terms of lasting benefit.
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## CHAPTER ONE

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LIST OF ABBREVIATIONS

Bench T.M. = Bench thumb move.

Conf. = Confidence.

C.R.O.M. goniometer = Cervical range of motion goniometer.

F/u = Follow-up.

F.S.U. = Functional spinal unit.

Left Lat. Flexion = Left lateral flexion.

M.T. = Massage therapy.

Max. = Maximum.

Min. = Minimum.

Right Lat. Flexion = Right lateral flexion.

R.O.M. = Range of motion.

Rx. = Treatment.

S.M.T. = Spinal manipulative therapy.
DEFINITION OF TERMS

Articular fixation:
A dynamic fault in which an articulation has become temporarily immobilised in a position that it may normally occupy during any phase of physiological movement (Haldeman 1992:623).

Biomechanics:
The study and knowledge of biological function from an application of mechanical principles (Gatterman 1990:406).

Cervical facet syndrome:
Dysfunction of the posterior joints in the neck with ligament shortening occurring in the wake of muscle hypertonicity, in which the contiguous parts of adjacent vertebrae are pulled together (Gatterman 1990:45).

Chronic:
Long standing (weeks, months or years) but not necessarily incurable. Symptoms may range from mild to severe (Gatterman 1990:406).

Contra-indication:
Any condition, rendering one particular treatment undesirable (Gatterman 1990:407).

End play (end feel):
Discrete, short-range movements of a joint independent of the action of voluntary muscles, determined by springing each vertebrae at the limit of its passive range of motion (Haldeman 1992:623).

Extension:
Increasing the angle between the body parts (Moore 1992:6).
Flexion:
Decreasing the angle between body parts (Moore 1992:6).

Goniometer:
An instrument for measuring the range of motion of a joint in degrees (Gatterman 1990:408).

Lateral flexion:
Bending to the side away from the midline (Gatterman 1990:410).

Manipulation:
Passive manoeuvre in which specifically directed manual forces are applied to vertebral articulations with the object of restoring mobility to restricted areas (Gatterman 1990:410).

Massage:
The systematic therapeutic friction, stroking and kneading of the body performed by the hands (Haldeman 1992:624).

Mobilisation:
Form of manual therapy applied within the physiological passive R.O.M., characterised by a non-thrust increase in passive joint play (Gatterman 1990:411).

Motion palpation:

Prone:
The patient will be lying face down (States 1991:13).
Range of motion:
The range of translation and rotation of a joint for each of its six degrees of freedom (Gatterman 1990:413).

Rotation:
Movement around the longitudinal axis (Moore 1992:6).

Spasm:
Shortening of a muscle due to non-voluntary motor nerve activity (Gatterman 1990:414).

Subluxation:
An aberrant relationship between two adjacent articular structures that may have functional or pathological sequelae, causing an alteration in the biomechanical and/or neurophysiological reflections of these articular structures (Haldeman 1992:627).

Supine:
The patient will be lying face up (States 1991:13).

Vertebral motion segment:
Two adjacent vertebral bodies and the disc between them, the two posterior joints and the ligamentous structures binding the two vertebrae (Gatterman 1990:416).
CHAPTER ONE

INTRODUCTION

1.1. The problem and its setting

Vernor, and Hu (1999:51) state that chronic or frequently recurring neck pain affects almost one third of the adult population. In Norway, the frequency of neck pain is 35%, with females reporting more incidences than males (Dvorak 1998:1774).

It is evident that chronic neck pain is common in the general population. This is due in part to the fact that the cervical spine forms a long lever, with the head, weighing approximately 10% of the body weight, balanced at the top. This makes the cervical spine especially vulnerable to trauma (Gatterman 1990:205).

Our modern day lifestyle, which encompasses so much stress, is a major factor in the etiology of chronic neck pain. According to Schafer and Faye (1990:26) the forms of stress are interrelated and cumulative, stress can disrupt proper bodily function leading to systemic overload and loss of resistance that may predispose, contribute to, or cause overt pathology.

Cervical facet syndrome is essentially dysfunction of the posterior joints in the neck. Over time, muscle hypertonicity causes the ligaments to shorten which results in contiguous parts of adjacent vertebrae being pulled together (Gatterman 1990:45).

The art of manipulation of the spine is an old one. It has been practised since prehistoric times and was known to Hippocrates and the physicians of ancient Rome (Bourdillon 1973:1). Manipulation of the cervical spine is a common treatment modality used by chiropractors, in a variety of applications (Carrick 1997:529). The aim of chiropractic treatment in chronic neck pain is to restore lost motion to the affected part by choosing an appropriate adjustment (Gatterman 1990:222).
According to Schafer and Faye (1990:7), normal muscle function is dependent on normal joint function. There is overwhelming evidence that manipulation increases joint mobility and reduces pain through proprioceptive reflex stimulation (Haldeman 1992:218).

There is a common cause of persistence of pain in spite of proper manipulative treatment. This is the existence and persistence of secondary areas of painful muscle spasm. Failure to achieve success in these patients’ is due to lack of proper evaluation, and therefore appropriate treatment (Travell and Simons 1983:vii).

The use of the hands in the treatment of fellow human beings is one of the earliest recorded forms of medical intervention. Many cultures used massage to treat a variety of musculo-skeletal conditions with techniques first used by the Chinese in 2007 b.c. Massage means 'to knead,' it is the manipulation of soft tissue using the hands to produce effects on circulatory, musculo-skeletal and nervous systems (Grieve 1994:809).

According to Jaskoviak and Schafer (1993:6), massage may be used in order to prepare for a chiropractic adjustment by relieving muscle spasm, dispersing edema or alleviating pain.

This study is an attempt to address the apparent gaps in the literature concerned with the role of massage therapy in the chiropractic management of neck pain.

1.2. Aims and objectives of the study

Aims:

The aim of this study is to evaluate the relative effectiveness of massage therapy in combination with high-velocity, low-amplitude spinal manipulative therapy, in terms of the patient’s perception and objective clinical findings, as compared to massage
therapy or spinal manipulative therapy alone, in the treatment of cervical facet syndrome, in order to determine the most effective treatment.

Objectives:

1) To evaluate the effectiveness of massage therapy, spinal manipulative therapy and massage therapy in combination with spinal manipulative therapy, in the treatment of cervical facet syndrome, in terms of the patient's perception.

2) To evaluate the effectiveness of massage therapy, spinal manipulative therapy and massage therapy in combination with spinal manipulative therapy, in the treatment of cervical facet syndrome, in terms of the patient’s objective clinical findings.

3) To integrate the results obtained from the above objectives to determine the most effective treatment.

1.3. Benefits of the study

Massage is often viewed as a 'therapeutic art' that lacks a scientific basis (Goats 1994:154). Jaskovik and Schafer (1993:6) state that massage may be used in order to prepare for a chiropractic adjustment.

The benefits of this study are that it should add to the current body of chiropractic knowledge, and provide information as to whether the use of massage therapy in preparation for the adjustment is beneficial.

1.4. Review of the related literature

1.4.1. Introduction

Neck pain is a very common complaint in Western Society and is highly prevalent in chiropractic practice (Vernon and Hu 1999:51).
This literature review aims to provide an outline of cervical spine dysfunction, its mechanisms and treatment, including the effects of massage therapy.

1.4.2. Incidence and prevalence of neck pain

With regard to the general population, the following was found. Chronic or frequently recurring neck pain affects almost one third of the adult population (Bovim et al. 1994: 1307 and Vernon and Hu 1999: 51).

Boden et al. (1996: 26) state that the one-year prevalence of neck pain in most industrialised countries is approximately 20%.

According to Bourghouts et al. (1999: 629), the prevalence of neck pain in the general population ranges from 10-15%.

With regard to age, Ellis (1998:38) states that chronic neck pain has a high prevalence in society, up to a quarter of middle aged patients’ in a population survey had experienced episodes of neck pain during the previous year.

In Spain 21.8% of 1964 adults rated neck pain as most troublesome (Bassols et al. 1999:9). In a study of 10 000 adults in Norway, 13.8% reported neck pain that continued for more than 6 months (Bovim et al. 1994:1307).

Boden et al. (1996:27) state that the prevalence of neck pain in the 25-74 age group is 8.2%, whilst rates among whites were higher than other racial groups.

With regard to the incidence and prevalence of neck pain between the sexes, Boden et al. (1996:71) state that neck pain is common in men and women, although some studies indicate a higher frequency in women.

A large study in the Netherlands reported a life-time prevalence of neck pain in 30% of the male and 43% of the female participants (Bourghouts et al. 1998:1).

Scandinavian studies have reported a one-year prevalence rate of 16% in men and 18-20% in women (Boden et al. 1996:26).

In Finland, 10% of males and 14% of females suffer from neck pain. In Norway, the overall frequency of troublesome neck pain is 35%, with females reporting more incidences than males (Dvorak 1998:1774).

Ektor-Anderson et al. (1999:289) state that 5.8% of men and 6.1% of women
experienced neck and shoulder pain out of 15 000 subjects in Malmo, Sweden.

Although occupational neck pain represents less than 2% of all workplace injuries (Boden et al. 1996:27), neck pain costs society a considerable fraction of total health spending and is a major cause of morbidity and disability (Leone et al. 1998:1). Neck pain can result in substantial medical consumption and absenteeism from work. The total cost of neck pain in the Netherlands in 1996 was estimated to be U.S.$ 686 million (Bourghouts et al. 1999:629).

1.4.3. Anatomy of the cervical spine

The cervical spine is an area in which stability has been sacrificed for mobility, making it particularly vulnerable to injury (Magee 1997:101). Gatterman (1990:205) states that the cervical spine is vulnerable to trauma due to the fact that the cervical spine forms a long lever, with the head, weighing approximately 10% of the body weight, balanced at the top.

1.4.3.1. Musculature

Because the cervical spine is the most mobile section of the spine, it contains the most elaborate and specialised muscular system of the spine (Boden et al. 1996:13). Humans make head movements by using more than twenty pairs of neck muscles, many of which cross two or more joints. Neck muscles must stabilise the head, neck and thoracic segments relative to each other to maintain posture and resist undesirable disturbances (Kamibaynshi and Richmond 1998:1314).

The posterior muscles of the neck are divided into a superficial, intermediate and deep group. Trapezius is the most superficial muscle of the region (Boden et al. 1996:13). Trapezius extends in the midline from the occiput to T12 and reaches laterally to the clavical in front, to the acromion, and to the spine of the scapular behind. Trapezius elevates the shoulders and rotates the glenoid fossa upwards, it also retracts the
scapula. Trapezius is innervated by the spinal accessory nerve, which supplies mainly motor fibres, and by the second to fourth cervical nerves, which supply mainly sensory fibres to the muscle (Travell and Simons 1983:183).

The intermediate group function primarily as extensors of the spine:- Splenius Capitis and Splenius Cervicis (Boden et al. 1996:13). Levator Scapulae also forms part of the intermediate layer, attaching to the transverse processes of C1 to C4 above, and to the superior angle of the scapula below. Levator Scapulae elevates the scapula, rotates the glenoid fossa downwards, assists neck rotation to the same side, and can assist neck extension. It is innervated by the third, fourth and fifth cervical spinal nerves (Travell and Simons 1983:334-335).

The deep muscles include Longissimus Cervicis, Longissimus Capitis, Spinalis Cervicis, Semispinalis Capitis and Semispinalis Cervicis. Beneath Semispinalis lies Multifidus and Rotatores that cross one segment of the spine. Posterior deep muscles are innervated segmentally by branches of primary dorsal rami of one or more cervical nerves. In the upper cervical spine, the suboccipital muscles consist of Rectus Capitis Posterior Major, Rectus Capitis Posterior Minor, Obliquus Capitis Inferior and Obliquus Capitis Superior (Boden et al. 1996:13). The actions of the suboccipital muscles are to extend, rotate and tilt the head to the same side. The suboccipital muscles are innervated by the first cervical spinal nerve. Except for Rectus Capitis Posterior Minor, the suboccipital muscles surround the exposed transverse loop of the vertebral artery - illustrating the anatomical significance of these muscles (Travell and Simons 1983:321).

1.4.3.2. Articulations

The cervical spine is composed of two functionally distinct but interacting components. The upper cervical spine, consisting of the articulations between the occiput, atlas and axis, and the lower cervical spine consisting of the articulations from C2-C3 through C7-T1 (Haldeman 1992:137).
The suboccipital joints between C0-C1 and C1-C2 differ from others in the vertebral column in that they are synovial only, there are no intervertebral discs or zygapophyseal (facet) joints (Moore 1992:348-349).

The articulation between the occipital condyles (C0) and C1 permit flexion and extension of the neck, whilst at C1-C2, the movement allowed is rotation (Moore 1992:350).

Rotation of the atlas (C1) around the odontoid process of C2 is the major motion of the upper cervical region and constitutes 45-50% of the total range of motion in the cervical spine (Gatterman 1990:216).

Movement of the lower cervical spine is more typical of the rest of the spine than that of the specialised upper cervical segments (Gatterman 1990:218).

The functional unit of the spine is the three-joint vertebral motion segment. Each segment is comprised of an intervertebral disc and two posterior spinal joints (Gatterman 1990:12).

The intervertebral disc is a fibrocartilaginous coupling that forms the articulation between the bodies of the vertebrae. It serves both to unite the adjacent vertebral bodies and to hold them apart (Gatterman 1990:13).

The posterior spinal articulations, commonly referred to as the zygapophyseal joints, have articular cartilage, a loose capsule lined with synovial membrane, reinforcing ligaments and related muscles (Gatterman 1990:13). The sensory innervation of these joints is derived from the medial branch of the posterior primary division at both the level of the joint and the levels immediately above and below (Fuhr and Colloca et al. 1997:26). The zygapophyseal joints are well supplied with sensory nerve fibres and can be a source of referred pain as well as considerable proprioceptive information (Gatterman 1990:14).
The meniscoids or invaginations of the synovial fold, smoothen irregularities of the joint surfaces, particularly in the cervical spine. These meniscoids are vascularised and innervated (Dvorak and Dvorak 1991:22).

Synovial joints are composite tissues, specialised to bear loads and allow motion through specific, well-defined areas. Their separate components have evolved to provide painless range of motion while maintaining joint stability (Mc Lain 1994:497).

Synovial joints possess a dual pattern of innervation. Primary articular nerves specifically supply the joint capsule and ligaments, whereas accessory articular nerves reach the joint after passing through muscular or cutaneous tissues to which they provide primary innervation. These primary and accessory articular nerves terminate in a variety of encapsulated and unencapsulated nerve endings sensitive to mechanical, chemical and thermal stimuli (Mc Lean and Pickar 1998:168).

1.4.3.3. Kinematics

The maintenance of posture and coordination of neck movement is a result of the combination of many joint movements and muscle actions which is predominantly automatic (Gatterman 1996:260).

The cervical facet joints contain a consistently greater population of receptors than either the thoracic or lumbar tissues. This is consistent with the greater mobility of the cervical segments and the demands of positioning and protecting the head in space (Mc Lean and Pickar 1998:172).

Activity from the cervical articular receptors exerts significant facilitatory and inhibitory reflex effects on the musculature of the neck and both upper and lower extremities (Jaskoviak and Schafer 1993:81).

The transverso-spinal muscles that extend between adjacent vertebrae act as dynamic ligaments and adjust small movements of the vertebral column. It is thought that these deep muscles function as postural muscles and ensure efficient action of the
long, superficial muscles (Gatterman 1990:16).

Proprioceptors receive impulses from muscles, tendons, joint capsules, ligaments and other fibrous membranes. Proprioceptors include the muscle spindle, golgi tendon organs and pacinian corpuscles (Gatterman 1990:261).

Muscle spindles are found in higher abundance in the muscle belly (Hamill and Knutzen 1995:126). These highly specialised sense organs are sensitive to a change in muscle length and respond to both constant length and changing length (Gatterman 1990:261), i.e. responds to stretch of the muscle fibre (Hamill and Knutzen 1995:126).

Guyton and Hall (1996:604) state that muscle spindles are very important in helping to control movement. It is not surprising that Hamill and Knutzen (1995:126) report that the upper back and neck muscles contain hundreds of spindles compared to other muscles.

The suboccipital muscles also have a large number of spindles per unit mass, therefore the proprioceptive function of these muscles must have a high level of significance (Greenman 1996:177).

Golgi tendon organs consist of nerve endings enclosed in a connective tissue capsule embedded in the musculotendinous junction (Gatterman 1990:263). The golgi tendon organ monitors tension in a muscle, its response is more sensitive in a contraction situation than in a stretch (Hamill and Knutzen 1995:128).

Pacinian corpuscles are found in the ligaments, muscle fascia and fibrous capsules surrounding the joints (Gatterman 1990:263). They are stimulated only by rapid movement of the tissues and are particularly important for detecting rapid changes in the mechanical state of the tissues (Guyton 1996:596), and changes in joint position (Gatterman 1990:263).

The apophyseal joints of the spine contain 3 of the 4 types of sensory mechanoreceptors that are stimulated by tissue tension. Jaskoviak and Schafer (1993:80) present the 4 types of articular receptors shown in table i.1 (overleaf).
### Table 1.1. Articular receptors

<table>
<thead>
<tr>
<th>Type</th>
<th>Morphology</th>
<th>Location</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Thinly encapsulated, globular corpuscles in clusters of 3-8.</td>
<td>Outer layers of joint capsule.</td>
<td>Low threshold, slowly adapting. Degree of activity proportional to and signals the velocity, direction and amplitude of joint movement (i.e. tissue stretch).</td>
</tr>
<tr>
<td>III</td>
<td>Thinly encapsulated, fusiform receptors. Found individually or in clusters of 2-3 corpuscles.</td>
<td>Surface of joint ligaments.</td>
<td>High threshold, slowly adapting dynamic mechanoreceptors.</td>
</tr>
<tr>
<td>IV</td>
<td>Nociceptive receptors of 2 types:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>Unmyelinated nerve fibres.</td>
<td>Articular fat pads and outer coat of articular blood vessels.</td>
<td>Both types are high threshold, non-adapting nociceptive receptors, which are activated by joint motion or inflammation—thus providing the major source of joint pain.</td>
</tr>
<tr>
<td>b)</td>
<td>Free unmyelinated nerve endings.</td>
<td>Joint ligaments.</td>
<td></td>
</tr>
</tbody>
</table>
1.4.4. Facet Syndrome

The lumbar zygapophyseal joints were first identified as a source of pain in 1911. In 1933 the term ‘facet syndrome’ was coined, referring to the symptom complex associated with pain emanating from these joints. Subsequently, various types of localised, pseudo-radicular and sclerotogenous referred pain have been described from these joints in the lumbar and later in the cervical spine (Lennard 1994:206). Cervical spine facet joint pain has been diagnosed by anaesthetising a symptomatic joint with subsequent relief of pain, therefore identifying that joint as the source of pain (Bogduk and Aprill 1993:214).

According to Gatterman (1990:161), facet syndrome pertains to posterior joint dysfunction, characterised by an overriding of the facets of adjacent vertebrae, whereby the intervertebral foramina are narrowed.

The terms subluxation and fixation need to be defined as they fall under the collective term 'facet dysfunction'.

A subluxation has been defined by Haldeman (1992:627), as an aberrant relationship between two adjacent articular structures that may have functional or pathological sequelae, causing an alteration in the biomechanical and/or neurophysiological reflections of these articular structures.

An articular fixation has been defined by Haldeman (1992:623), as a dynamic fault in which an articulation has become temporarily immobilised in a position that it may normally occupy during any phase of physiological movement.

Many theories have been proposed to explain joint dysfunction. These include the alteration of the relationship of opposing joint surfaces, articular capsules and associated meniscoids upon neural mechanisms from the articular mechanoreceptors and nociceptors and the resultant effect on segmentally related muscle (Greenman 1996:101).
Not only does the central nervous system depend on optimum mechanical function, it needs regular, appropriate movement in order to function at a physiological optimum. The vertebral motion segment has an enormous impact on neural mechanics. If a normally mobile joint becomes stiff (i.e. fixated), neural dynamics will logically change. These changes may be a result of the inability of the motion segment to 'keep up' with neural movement, causing an unaccustomed increase in relative neural movement, which could irritate the local neural structures (Grieve 1994:34-36). Thus, altered mechanics may effect changes in the central nervous system and ultimately the target tissues which the central nervous system innervates (Grieve 1994:21).

Greenman (1996:177) adds that cervical spine dysfunction can result in altered afferent stimulation by mechanoreceptors and nociceptors and influence the integrated function of the musculoskeletal system, as well as contribute to local and regional symptoms.

1.4.4.1. Etiology of facet syndrome

Cervical complaints may be of sudden traumatic onset and related to falls, athletic injuries or motor vehicle accidents. The onset may, however, be more gradual and insidious and be related to postural defects, inadequate work situations or repetitive strain (Fuhr and Colloca et al. 1997:412). Limitation of movement of the neck due to adaptive shortening of the ligaments, discs, facets and myofascial components is often the result (Gatterman 1990:162).

1.4.4.1.1. Direct trauma

Trauma to the joint itself as in a direct blow, leads to inflammation of the joint capsule, an increase in intra-articular pressure and subsequent acute pain (Gatterman 1990:161). Pain from muscle pathology results in local muscle spasm, which produces a loss of movement in the affected joint.
Head trauma such as a fall from a horse, car accident, or diving into the bottom of a pool commonly produces forceful neck flexion and muscle strain, thereby activating trigger points in these muscles (Travell and Simons 1983:310).

Fibrous adhesions may result from trauma and following immobilisation as a result of trauma. Adhesions due to trauma, results from inflammation and subsequent repair, leading to the formation of scar tissue or fibrosis. Articular adhesions that follow immobilisation are due to a reduction in glycosaminoglycans, a decrease in water content, and an increase in the cross-links in the collagen fibres (Gatterman 1990:45).

1.4.4.1.2. Overuse

When cervical complaints are of gradual onset, postural or occupational factors may contribute to cumulative microtrauma to the cervical spine (Fuhr and Colloca 1997:414).

The neck normally moves more than 600 times each hour whether a person is awake or asleep. Normal function of the cervical spine requires both flexibility to move the head and endurance of the cervical musculature (Boden et al. 1996:21).

The notion of increased loading on cervical joints encompasses the influence of a number of intrinsic factors. These include the interrelationship of jaw position with the position of the skull on the neck, age, range of neck movement and endurance and strength of the cervical musculature (Grimmer et al. 1999:512).

Neck pain is associated with occupations in which flexed cervical postures, static postures and repetitious work involving lifting of objects occurs. These factors involve the musculature and other connective tissue of the cervical spine and as such have been implicated in mechanical neck pain syndromes (Jordem et al. 1997:468). Boden et al. (1996:71) state that occupations involving vibration or exposure to a smoke-filled environment may also predispose workers to mechanical neck pain.
Poor posture is a major cause of cervical facet syndrome. Normal motion undertaken with this poor posture produces abnormal muscle strain on the posterior cervical musculature which causes pain and reduced range of motion of the neck (Dreyer and Boden 1998:2777).

As much as 50% of the population may be functional and asymptomatic with head postures that are abnormally deviated from the axis of gravity. A more anterior resting head posture predisposes individuals towards pathological cervical changes (Hanten et al. 2000:62). Connective tissue stretches through slow, constant loading, which causes microtrauma to the joint capsule (Scully and Barnes 1989:163). The effects of postural adaptation are cumulative and gradual. If the head weighs ten pounds, for every inch of anterior weight bearing of the head, a 10-fold increase in muscle effort of the posterior cervical musculature is required to offset this load leading to fibrous infiltration, reduced motion and pain (Fuhr and Colloca et al. 1997:415).

1.4.4.1.3. Mechanical

One of the most common causes of neck pain is mechanical dysfunction of the cervical spine. The exact nature of this pathology remains obscure. Most patients will improve with time, but as many as 20% can suffer recurring pain for up to 15 years later (Pikula 1999:112).

Theories involving joint surfaces include ‘lack of tracking’ of opposing joint surfaces and ‘hitching within the joint’ (Greenman 1996:101).

Asymmetry of facet joint surfaces causes diminished mechanical efficiency of the joint. Intra-articular jamming may be caused by a small fragment of incarcerated villi of synovial membrane, a meniscoid or a fragment of articular cartilage (Gatterman 1990:46).

The innervated synovial folds may interfere mechanically with joint movement, causing pain and muscle spasm as a result of entrapment between the facet
surfaces (Haldeman 1992:206). Aberrant joint receptor feedback further contributes to muscle spasm via the arthrogenic reflex (Gatterman 1990:46).

It has been demonstrated that meniscoids present in the facet joints are innervated by nociceptive fibres. It seems reasonable that they too might become entrapped between the opposing joint surfaces (Greenman 1996:101).

It has been suggested by Greenman (1996:101), that a change in the thixotropic property of the synovial fluid might make it more ‘sticky’, which could also adversely affect the mechanical efficiency of the joint.

Dysfunction may also affect the dura mater surrounding the nerve root, thereby impairing the mobility of the nerve root in the intervertebral foramen (Grant 1988:274), leading to minor sensory changes with subjective numbness accompanying the pain (Gatterman 1990:162).

Due to the diversity and richness of the cervical spine innervation, mechanical lesions of the cervical spine have a profound effect on muscle tone in the neck, trunk and limbs. The variability of the vertebro-basilar vascular system makes the cervical spine particularly vulnerable to mechanical aberrations, which can produce bizarre and widespread clinical features involving cranial and facial areas in addition to the trunk and all four limbs (Gatterman 1990:253).

1.4.4.1.4. Reflex changes

Intersegmental muscle spasm and joint fixation can be attributed to aberrant muscle spindle activity. As the coordinator of muscle activity, the muscle spindle may increase or decrease muscle contraction. If the vertebral attachments of the short spinal muscles are approximated by unguarded spinal movement and silence annulospiral receptor activity, the lack of input to the central nervous system then results in a turning up of the gamma motoneuron ‘gain’, increasing the intensity of the muscle contraction producing the muscle spasm. Due to this contraction, the vertebral attachments cannot resume their normal position and the muscle spasm is
perpetuated. It is hypothesised that manipulation can reduce the muscle spasm and restore normal joint motion by activating the golgi tendon organ which inhibits muscle activity (Gatterman 1990:44).

In summary, it is evident from the literature that the causes of facet syndrome may be isolated, such as direct trauma or reflex changes, or one factor, such as poor posture may contribute to the development of another, such as a mechanical cause, or vice versa.

1.4.4.2. Presentation and diagnosis of cervical facet syndrome

Neck pain and stiffness are common complaints of chiropractic patients' Many patients' have related complaints of headache, shoulder or arm pain or upper back and interscapular discomfort directly or indirectly associated with problems of the cervical spine (Fuhr and Colloca et al. 1997:412).

The presentation of cervical facet syndrome is typically unilateral, dull, aching neck pain with occasional referral into the interscapular region (Dreyer and Boden 1998:2777), possibly in the arm and is sometimes associated with a headache (Hertling and Kessler 1990:533). Dizziness, ataxia, nystagmus, visual disturbances and vertigo are further symptoms and signs associated with dysfunction of the cervical facet joints (Bolton 1998:553). The multi-level sensory innervation of cervical spine facet joints is probably the reason that pain from these joints has a broad referral pattern (Fuhr and Colloca et al. 1997:26).

Upper cervical dysfunction (between C0-C1 and C1-C2) is manifested in cervical stiffness, a tired neck, headache and restricted movement (Lennard 1994:238).

Pain is typically aggravated by hyperextension of the neck and sleeping on the abdomen and is relieved by flexion of the neck (Gatterman 1990:162).
Clinically, facet joint pain is suspected when axial pain is greater than extremity pain, extremity pain is in a vague distribution, there are no neurological changes and pain is greatest with extension (Lennard 1994:238).

Further indications of facet dysfunction are pain at the extremes of rotation and lateral flexion to the involved side (Hertling and Kessler 1990:533) and a positive Kemp’s test, which involves passive rotation, lateral flexion and extension of the spine which reproduces the pain (Fuhr and Colloca et al. 1997:252).

In its least severe form, cervical spine joint dysfunction may exhibit little impairment of global movement. Recognition of dysfunction then depends on joint play assessment:- a search for hypomobility, and palpation:- a search for localised muscle hypertonicity. The examiner is dependent upon joint play assessment and muscle hypertonicity for segmental localisation (Hutson 1993:88).

1.4.5. Effects of the adjustment

Spinal manipulative therapy is a form of manual therapy that is used in an effort to reduce pain and improve range of motion. Manipulation of the spine is used in the treatment of patients’ with head and neck disorders, including neck pain and stiffness and muscle tension headache (Di Fabio 1999:51). According to Haswell (1996:153), manipulation is arguably the most efficacious and cost-effective management for the patients’ limitation of function due to neck pain and stiffness.

Adjustive techniques are nothing more and nothing less than tools designed to achieve a desired neuro-biomechanical effect. It is a common assumption that manipulation increases the quality and quantity of joint motion (Broome 2000:6).

Manipulation of cervical spine fixations normalises disturbed function and may bring relief from a wide spectrum of pain syndromes and symptom complexes (Gatterman 1990:253).
The model (Dvorak and Dvorak 1991:25) below demonstrates the effect of the adjustment when the vertebrae are in an abnormal position i.e. segmental dysfunction.

Figure 1.1. Effects of the adjustment on segmental dysfunction.

Segmental dysfunction → Irritation of fibrous joint capsule → Stimulation of type I mechanoreceptors → Tonic-reflexogenic influence on motor neurons of the neck, limb, jaw and eye muscles

Additional impulses (mechanical, chemical) → Stimulation of nociceptors → Spinothalamic tract

Adjustment / SMT → Pain Perception

Correction of segmental dysfunction

Stimulation of type II mechanoreceptors
- inhibition of afferent fibres
- release of enkephalins

Less pain, normalisation of receptor activity and a change towards normal muscle tone
1.4.5.1. Mechanical effects

The goal of manual therapy is the restoration of function of the individual spinal segments (Dvorak and Dvorak 1991:128). The biomechanical objective of a specific chiropractic adjustment is to restore motion through the active, passive and paraphysiological ranges of motion (Haldeman 1992:460).

Sandoz (1976) describes four stages of range of motion in diarthrodial joints in the model below.

Figure 1.2. Range of motion in diarthrodial joints.

Stage 1-4

- Active ROM
- Mobilisation
- Manipulation
- Joint sprain

Stage 1) Active range of motion, produced by muscular action.
Stage 2) Passive range of motion, joint play or mobilisation up to the elastic barrier of resistance.
Stage 3) Paraphysiological range of motion. Motion beyond the elastic barrier up to the limit of anatomical integrity which is produced by manipulation and accompanied by an audible release or cavitation.
Stage 4) Pathological movement, which is motion beyond the limit of normal anatomical integrity, which damages ligaments and capsule (joint sprain), resulting in joint hypermobility.
Manipulation involves use of the minimal amount of force required to gap the joint, or move it beyond the elastic barrier, which produces a cracking noise. This cracking noise is thought to be the result of a sudden liberation of dissolved synovial gas and is referred to as cavitation (Catterman 1990:49-51).

According to Greenman (1996:100), any successful high-velocity, low-amplitude thrust results in joint gapping and distraction which coincides with an audible joint pop or click, suggesting that the synovial fluid changes from liquid to a gaseous state.

Thiel and Cassidy (1994:294) state that when the joint surfaces are forced apart, beyond the initial barrier of resistance, the intra-articular pressure drops to a point where it reaches the partial pressure of carbon dioxide. Carbon dioxide and other gases are suddenly released from the synovial fluid to form a gas bubble within the centre of the joint space. A subsequent net flow of fluid into this low-pressure region collapses the gas bubble, which releases energy, perceived as an audible crack i.e. cavitation. If tension is maintained across the joint space, the gas will reform, this has been demonstrated radiographically in the metacarpophalangeal joint of the middle finger in 1947. A refractory period of about 20 minutes is required before the joint can be 'recracked'. It corresponds to the amount of time required for the resorption of the liberated gases by the joint fluid. During the refractory period, the joint is somewhat unstable and cannot be remanipulated safely.

The phenomenon of cavitation is central to the effect and definition of spinal manipulation. Manipulation temporarily decreases the articular coaptive forces, thereby allowing greater joint separation and an increase in the passive range of motion into the paraphysiological space (Thiel and Cassidy 1994:295).

It has been proposed that manipulation moves or frees the impediment to normal joint function, such as a loose body, disc material, synovial fringe or trapped meniscoid. Manipulation therefore permits normal movement and halts
nociceptive input and associated reflex muscle spasm (Grieve 1994:651).

In some cases of chronic joint dysfunction, shortening of periarticular connective tissue can occur and intra-articular adhesions may form. Spinal manipulative therapy could break or stretch these adhesions (Thiel and Cassidy 1994:297).

1.4.5.2. Reflexogenic effects

Spinal manipulative therapy is thought to exert a reflex effect on pain and muscle tension. It has been thought that mechanical stimulation of the joint capsule proprioceptors and muscle spindles can result in reflex inhibition of pain, reflex muscle relaxation and improved segmental kinematics (Pikula 1999:112).

1.4.5.3. Pain

The following sub-section deals with the basic principles of pain and the effect of the chiropractic adjustment in pain control.

The peripheral nervous system contains a wide range of nerve fibres which are either myelinated or unmyelinated. Myelinated somatic nerves (A-fibres) are subdivided into four groups according to decreasing size: alpha, beta, gamma and delta. The unmyelinated C-fibres transmit nociceptive impulses (Boden et al. 1996:34).

Receptors in muscles, tendons, ligaments and joints participate in spinal reflexes, they also provide subconscious proprioception to the cerebellum and conscious proprioception or kinaesthesia to the cerebrum (Wilkinson 1992:43).

Mechanoreceptors are larger myelinated fibres (A-alpha and A-beta) that rapidly transmit information about innocuous mechanical stimuli to the cerebral cortex. Nociceptors respond only to stimuli associated with tissue damage and their impulses are carried by A-delta fibres and smaller, unmyelinated C-fibres (Boden et al. 1996:34).
There are said to be two types of pain. Fast pain is a sharp, well-localised pricking sensation involving A-delta fibres, while slow pain is poorly localised, burning and mediated by C-fibres (Wilkinson 1992:41).

Nociceptive A-delta and C-fibres with nerve endings in the periphery and their cell bodies in the dorsal root ganglion have destination points in the dorsal horn of the spinal cord. Laminae I, II and V of nerve endings in the dorsal horn receive nociceptive fibres. Laminae III and IV receive primary afferent input from large fibre mechanoreceptors (Boden et al. 1996:34).

A peptide, substance P, appears in the central terminals of nociceptive fibres as one of the primary transmitters in the pathway.

Modulation of incoming information from these nociceptors occurs at several levels in the spinal cord able to produce inhibition of its transmission. An explanation of such inhibition was proposed in the ‘gate theory’. This transmission from spinal nerves to higher brain centres is dependent upon the relative activities in large and small diameter afferents. Activity in the large diameter, low threshold fibres inhibits nociceptive transmission via activation of inhibitory interneurons of the substantia gelatinosa – these ‘close the gate’.

Nociceptive fibres de-activate these inhibitory interneurons and ‘open the gate’.

In the spinal cord, receptors and enkephalins occur in the substantia gelatinosa (lamina II) and act as pain suppressors (Wilkinson 1992:66-68).

The cortex and midbrain have descending pathways that modulate pain input at the level of the dorsal horn. Serotonin is the neurotransmitter for this descending pathway and it acts to inhibit substance P (Boden et al. 1996:41).

This complex descending pathway is a system that can profoundly affect the rostral transmission of nociceptive information (Wilkinson 1992:68).

The adjustment stimulates the individual mechanoreceptors which presynaptically inhibits pain conduction at the level of the substantia gelatinosa in the spinal cord (Dvorak and Dvorak 1991:131). This is possible due to type I, II and III receptors containing fibres in the dorsal roots that enter the posterior horns of the cord. They synapse with neurons of the apical spinal nucleus that connect with presynaptic
terminals of the nociceptive afferent fibres located in the basal nuclei. Because the apical interneurons release an inhibitory transmitter substance at the synapse, nociceptive impulses are inhibited (Jaskoviak and Schafer 1993:81).

1.4.5.4. Muscle spasm

Facet joint capsules contain mechanoreceptors and nociceptors (Mc Lain 1994:495). Changes in tension and pressure of the joint capsule, monitored by the mechanoreceptors, will reflexly alter not only paravertebral muscle tone, but also extremity muscles (Dvorak and Dvorak 1991:22).

Mechanoreceptor reflex effects on muscle tone are exerted by afferent discharges from type I and type II receptors. Arthrokinetic reflexes are mutually coordinated between the different functional muscle groups operating over a joint. Loss of normal arthrokinetic reflexes from the mechanoreceptors in a joint results in disturbance of postural and kinesthetic sensation (Oliver and Middleditch 1991:219).

The afferent nerve fibres of articular receptors transmit polysynaptically with motorneurons in the central nervous system. The circuits contribute to the activity messages produced at the muscle spindle receptors, thus affecting muscle tone and the stretch reflexes of voluntary muscle. Specific joint manipulation affects muscle activity both locally and remotely because the afferent nerve fibres from the mechanoreceptors involved, give off collateral branches that are distributed both segmentally and intersegmentally. Thus joint manipulation produces reflex muscle tone changes via motor unit facilitation and inhibition (Jaskoviak and Schafer 1993:81). Vleeming and Mooney (1997:82) add that joint manipulation re-establishes the normal arthrokinetic reflex by restoring normal muscle tone and joint kinematics.

After the adjustment, there is temporary electrical silence of the segmentally related muscle, with a refractory period before normal electrical activity returns. It is hypothesised that the segmentally related muscle returns to a more normal
function after the adjustment and contributes to the positive therapeutic response (Greenman 1996:100).

The tissue most affected by manipulation is the muscle of the functional unit. If the functional spinal unit (F.S.U.) is inflamed by abnormal movement or position, it may become splinted by muscle spasm. During manipulation, the muscle is placed on the stretch, thus stretching the spindle fibres, which releases the spasm and movement of the F.S.U. returns (Cailliet 1989:137).

1.4.6. Manual thrust studies

Spinal manipulative therapy, or the adjustment, has been the subject of numerous studies with varying conclusions regarding its efficacy (Pikula 1999:112). Its effectiveness in terms of restoring range of motion, alleviating pain and affecting muscle tone and proprioception will be discussed.

1.4.6.1. Range of motion

Measurement of cervical range of motion is considered an appropriate and objective method of assessing cervical function. It’s used in rating impairment or disability, and in monitoring treatment progress and effectiveness (Christensen and Nilsson 1998:341).

Hviid (1971:32), in a study of 92 patients’ who each received 5 treatments of manipulation to the cervical spine, demonstrated a 15-20% increase in cervical rotation in 78% of patients’.

Howe (1983:574) conducted a study of 52 patients’ with neck pain and restricted range of motion. Eighty-one percent of these patients’ had a history of previous attacks of neck pain. Group 1 received manipulation and azapropazone (26 patients’), while group 2 received azapropazone only (26 patients’). Group 1 received 1 to 3 treatments in a week, which were administered by a medical doctor. The experimental group, who received a single manipulation and
azapropazone, showed statistically significant increases in cervical range of motion at one and three weeks after treatment, compared to the control group.

Grice and Tschumi (1985:150) observed that of 26 patients' who received spinal manipulative therapy, 96% showed an increased range of motion post treatment, by means of functional radiography.

Lewit (1985:83) demonstrated that manipulation can increase intersegmental joint play and restore spinal mobility.

A study by Cassidy and Quon et al. (1992:495), in which 50 patients' received a single manipulation, demonstrated an increase in cervical rotation and lateral flexion.

Koes et al. (1992:28) showed that manipulation and/or mobilisation improved the range of motion in 13 patients' more than exercise, massage or physiotherapeutic modalities did in 20 patients' after a 12-week follow-up.

A pilot study in patients' with acute, unilateral neck pain by Pikula (1999:118), showed that spinal manipulative therapy at the side of neck pain led to statistically significant increases in lateral flexion to both sides.

1.4.6.2. Pain

A study by Sloop et al. (1982:532) compared diazepam and manipulation (group 1), to diazepam alone (group 2), in 39 patients' with non-specific neck pain of greater than one year's duration. Fifty-seven percent of group 1 compared to 28% of group 2 thought the treatment was 'helpful' after 3 weeks.

In a similar study by Howe (1983:574), as mentioned previously, 68% of group 1 (manipulation and azapropazone), compared to 6% of group 2 (azapropazone), reported subjective pain improvement immediately.
Vernon et al. (1990:13) compared pressure pain thresholds around joint fixations. Nine patients' with mechanical neck pain of between 2 weeks and 8 years duration, were divided into 2 groups. Group 1 received manipulation and group 2 received mobilisation, with results showing a 50% rise in pressure pain thresholds immediately in group 1, group 2 however showed no change.

Koes et al. (1992:28), as previously described, demonstrated that manipulation and/or mobilisation resulted in greater pain improvement at 1 year compared to exercise, massage or physiotherapeutic modalities.

Cassidy and Lopez et al. (1992:570) claim that a single manipulation was more effective than mobilisation in decreasing pain in patients' with mechanical neck pain.

Pikula (1999:18) reported greater improvement in patients' perceived pain when ipsilateral spinal manipulative therapy was used, versus a control, in patients' with mechanical neck pain.

1.4.6.3. Muscle tone

Thabe (1986:53) reported spontaneous electrical activity in segmentally related muscle of 20 upper cervical joints with restricted motion, with the use of needle probe electromyography.

Manipulation of the involved joints produced immediate resolution of the spontaneous electrical activity, with Thabe concluding that normalisation of aberrant afferent input was responsible for the changes.

Shambaugh (1987:301) recorded a 25% reduction in spinal electromyographic activity in 20 patients' after one manipulation. There was no change in the control group, who did not receive manipulation.

A study by Hertzog et al. (1999:146) demonstrated that high-speed, low-amplitude spinal manipulative therapy elicited measureable and repeatable
electromyographic responses in a distinct area, that is specific to the treatment administered. It was shown that local muscle hypertonicity was largely abolished immediately after spinal manipulative therapy.

1.4.7. Effects of massage

Massage is often viewed as a 'therapeutic art' that lacks a scientific basis. Nevertheless, it promotes healing and enhances functional recovery after injury through a wide range of mechanisms (Goats 1994:153).

Massage aids proper elimination, promotes proper nutrition and affects the mental and emotional status of the patient in a constructive manner (Jaskovak and Schafer 1993:6). Massage represents the ultimate laying on of hands and produces all the physiological as well as psychological benefits associated (Bland 1994:308).

Effleurage is derived from the French word effleurer- 'to skim over' (Lace 1945:11). Effleurage is a stroking, superficial type of manipulation where the pressure from the hands is applied in a distal to proximal direction at a depth which is both comfortable yet effective (Grieve 1994:810). Kneading, a form of petrissage, is a deeper massage technique which consists of grasping and squeezing a portion of the muscle between the therapist's hands (Scully and Barnes 1989:983).

The muscles most effected by effleurage to the posterior neck and the upper back are the superficial Trapezius and slightly deeper Levator Scapulae muscles. Massage along and below the suboccipital ridge will also reduce tone in the suboccipital muscles (Holey and Cook 1997:33).

In a study of 21 females, each receiving ten sessions of upper body massage, significant improvement in range of motion, surface electromyographic changes and pain scores were observed (Holey and Cook 1997:33).
The effects of massage include reduction of muscle spasm and congestion, improvement of circulation, tissue mobility and tone (Greenman 1996:49). Massage offers primary kinetic effects with secondary actions of muscle and reflex stimulation (Jaskoviak and Schafer 1993:8).

1.4.7.1. Range of motion

Massage is a potent means of enhancing the mobility of muscles, tendons and ligaments by limiting discomfort and enhancing function (Goats 1994:154).

Massage will mobilise one tissue against adjacent tissues. In normal tissue this will serve to maintain their relative mobility. In tissues which have been immobile or damaged, massage is used to restore mobility by stretching the structures, or by stretching or breaking down adhesions between them (Grieve 1994:811). The deep, short muscles of the cervical spine often require massage for the fibrotic changes (Schafer and Faye 1990:98).

According to Chaitow (1988:208), massage causes a decrease in the sensitivity of the gamma efferent control of the muscle spindles, thereby reducing any shortening tendency of the muscles.

1.4.7.2. Pain

Pain can originate primarily from muscle tissue, or secondarily from contiguous tissue that has sustained injury, with secondary ‘protective muscle spasm.’ Sustained spasm is a cause of pain based on the concept that muscle tension causes intrinsic ischaemia, which in turn becomes the cause of nociceptive stimuli:- due to metabolite accumulation and a decreased arterial blood supply (Cailliet 1991:29).

The age-old remedy of ‘rubbing it better’ still operates in most cultures. Massage applied to the tissues causes stimulation of cutaneous mechanoreceptors. This
sensory information enters the central nervous system via the posterior root and has an inhibitory effect on pain transmission. The physical removal of extracellular fluid could reduce pressure on nociceptive endings in the tissues to a level where they are no longer stimulated thereby reducing pain. The physical removal of pain stimulating chemicals in the area of nociceptive endings could also reduce pain (Grieve 1994:811).

Massage can provide short-term relief of pain by activating the pain gate and for longer periods through the descending pain suppression mechanism. Massage can promote the release of opiates and thereby suppress pain (Goats 1994:154).

Following joint injury, massage provides fresh nutrition to the area removing inflammatory products, chemical irritants and toxins (Holey and Cook 1997:26). Thus massage assists repair of the joint by reducing pain and muscle wasting which reduces recovery time.

Grieve (1994:811) states that the physical contact involved during massage is bound to have a psychological effect. This may be perceived as the placebo effect, which is recognised as having a strong effect on the reduction of pain.

1.4.8. Massage in combination with the adjustment

The effects of two or more therapies given in combination are cumulative, thus indicating why multiple convergent therapy is increasingly becoming the standard approach to patients' problems (Jaskoviak and Schafer 1993:9).

When treating segmental dysfunction, possibly too much emphasis has been given to restoring normal joint motion, often neglecting the muscles (Grieve 1994:645). Jaskoviak and Schafer (1993:6) add that the structural adjustment of a patient cannot always be considered to effect adequate case management by itself.
Treating the target tissues alone, however, without considering mechanical treatment of the central nervous system, may lead to ineffective results (Grieve 1994:33).

It has become clear that many problems thought to arise principally within soft tissue do in fact owe more of their cause to joint disturbances of nervous system mobility and sensitivity. These problems then manifest secondarily in muscles and fascia (Wells et al. 1994:188).

Soft tissue manipulation may be used with chiropractic to great advantage (Chaitow 1988:10). Greenman (1996:49) states that massage can prepare the tissues for additional specific joint mobilisation.

Massage can enhance and augment the structural adjustment by means of physical agents and forces. Massage may be used in order to prepare for a chiropractic adjustment by relieving muscle spasm, dispersing edema or alleviating pain (Jaskoviak and Schafer 1993:6).

When massage is properly applied, the humeral, chemical and cellular elements of the body are more competently readied and conditioned to allow for a more effective response to the structural adjustment (Jaskoviak and Schafer 1993:6).

Dysfunction of the cervical facet joints, when associated with muscle hypertonicity, may respond to a combination of massage to the suboccipital muscles and gentle mobilisation (Hutson 1993:88).

When manipulation and massage are applied to any joint, changes in muscle, tendon, capsule and ligamentous tension stimulates mechanoreceptors embedded in the affected tissues (Jaskoviak and Schafer 1993:80). Scully and Barnes (1989:927) add that pain relief from massage and manipulation is related to the inhibitory function of the mechanoreceptors.
If the goal is to increase joint play and motion, the therapist must increase the tissue temperature, i.e. massage, before performing mobilisation. It is argued that an increase in the connective tissue temperature will allow the tissues to tolerate a high load if necessary, with less chance of causing trauma and thus initiating an inflammatory and reparative cycle (Scully and Barnes 1989:725).

1.4.9. Safety issues

1.4.9.1. Spinal manipulative therapy

The central features of the screening examinations involve patient history, orthopaedic testing and provocation of symptoms by testing for signs of vertebral artery compression.

There are sex-specific factors that are considered contraindications to cervical spinal manipulative therapy, namely females immediately post-partum, or taking the oral contraceptive pill, which is thought to bring about hormone-mediated ligamentous laxity, that might reduce the protective stability of the intervertebral articulations (Di Fabio 1999:52).

Haldeman (1992:588) adds that the most important risk factors to identify in the history are vertigo or ischaemic attacks.

The most commonly quoted risk factors for cerebrovascular accidents are hypertension, smoking and use of the oral contraceptive pill (Chapman-Smith 1999:2).

More than 110 cases of complications arising from cervical spine manipulation have been documented. The vast majority involved vertebro-basilar accidents with consequences such as brainstem and/or cerebellar infarction, Wallenberg’s syndrome (obstruction of the posterior-inferior cerebellar artery), and locked-in syndrome (basilar artery occlusion). Other reported complications include spinal cord compression, vertebral fracture, tracheal rupture, diaphragmatic paralysis, internal carotid haematoma and cardiac arrest.
The frequency of complications is difficult to estimate due to the uncertainty of caseload, and number of cervical spine manipulations that patients receive ever a given time. The risk of complications is estimated to be between 1 in 40 000 manipulations for mild complications and 1 in 400 000-1 000 000 for serious complications. No serious neurological complications were found during 1 year among 460 physicians and approximately 150 000 cervical manipulations in one large case series (Coulter 1996:13-14).

Complications are rare when the guidelines for appropriate manual therapy are followed. On the average, out of approximately 400 000 treatments to the cervical spine, one major complication can occur (Dvorak and Dvorak 1991:130).

Vertebral artery patency tests involve the patient’s head being held for a period in the pre-manipulative position (i.e. rotation and extension) and observed for any symptoms and signs of brainstem ischaemia. Dizziness is most common and may be unaccompanied by any other symptoms or signs (Haldeman 1992:592).

Extension-rotation tests, contrary to earlier beliefs, do not alter blood flow in the vertebral arteries in normal or compromised patients (Chapman-Smith 1999:6).

Haldeman (1992:594) states that there is no conclusive, foolproof screening procedure to eliminate patients’ at risk. Most victims are young, without osseous or vascular pathology, and do not present with vertebro-basilar symptoms. The screening procedure cannot detect those patients’ in whom spinal manipulative therapy may cause an injury.

A study by Licht et al. (1998:143) found no significant changes in peak flow velocity in the vertebral artery before, and shortly after, spinal manipulative therapy in otherwise healthy subjects with a biomechanical dysfunction of the cervical spine.

According to Haldeman et al. (1999:789), spinal manipulative therapy does not appear to be the precipitating cause in vertebro-basilar artery dissections.
Examination of the data fails to show a consistent position, neck movement or type of manipulation precipitating vertebro-basilar artery dissection or the identification of the patient at risk (Haldeman et al. 1999:785).

1.4.9.2. Massage therapy

According to Gatterman (1990:371) massage is very safe and has few, if any, complications. Vigorous massage of hyperirritable trigger points however, can cause an adverse reaction with marked increase in pain. Thus knowledge of active myofascial pain and dysfunction syndrome as well as conditions when massage is contra-indicated will ensure massage remains a safe and useful treatment for many conditions (Travell and Simons 1983:87).

1.4.10. Conclusion

The literature indicates that neck pain is highly prevalent in society and is a common condition treated in chiropractic practice. The use of any two therapies in combination has been postulated to have greater benefit than either therapy alone.

Manipulation has the benefit of the mechanical effects of paraphysiological movement. Massage, a very safe treatment by comparison, does not have this effect.

The major contribution of this study will be to assess the function of massage therapy in the chiropractic management of cervical facet syndrome, thereby addressing the apparent gaps in the literature.
CHAPTER TWO

MATERIALS AND METHODS

2.1. Introduction

This chapter is concerned with the study design, the subjects and their treatment, the data collected and the statistical procedures used.

Figure 2.1. Flow chart of experimental chronology

- Patient to clinic for neck pain.
- Suitability assessed for trial.
- Patient consent.
- Randomly assigned.
- Baseline observation.
- Treatment.
- Final observation and treatment.
- Two-week follow up observation.
2.2. Study design

This was designed to be a randomised, controlled, comparative pilot study.

2.2.1. Object of the study

The object of this study was to identify the effectiveness of three types of treatment on neck pain through objective and subjective measurements, and in so doing, to aid chiropractors in their treatment of cervical facet syndrome.

2.2.2. Selection of subjects

Posters were placed on notice boards in surrounding neighbourhoods and on campus and space permitting, local papers carried details of the study in their editorial. These forms of advertising invited anyone between the ages of 18-50 with neck pain for longer than two weeks to participate in the study.

Initially, the respondents were screened by the clinician on duty for signs and symptoms of cervical facet syndrome. Subsequently, a case history (appendix A) was taken and a cervical spine regional examination (appendix B) was performed. Those patients’ who, on history and examination were contraindicated to massage therapy or spinal manipulative therapy, were excluded from participating in the study.

According to Gatterman (1990:371), the conditions which contra-indicate massage therapy are:

- Acute circulatory disturbances.
- Acute inflammation.
- Malignancy.
- Edema secondary to – heart decompensation, kidney disease, embolus, lymphatic obstruction and thrombus.
- Skin conditions – acne, eczema, furuncles, ulceration, acute burns, wounds and hyperesthesia.
- Communicable disease.
According to Gatterman (1990:55-66), the conditions which contra-indicate S.M.T. include:

- Vascular complications – vertebro-basilar insufficiency, atherosclerosis of major blood vessels and aneurysm.
- Tumours – lung, thyroid, breast, prostate and bone.
- Bone infections – tuberculosis and bacterial infection.
- Trauma -- fractures and joint instability.
- Arthritis – rheumatoid arthritis, ankylosing spondylitis, psoriatic arthritis and osteoarthritis in an unstable phase.
- Metabolic – clotting disorders, osteopenia (osteoporosis and osteomalacia).
- Neurological – space occupying lesions and disc lesions in the presence of advancing neurological deficit.

2.2.3. Allocation of subjects

After signing the patient consent form (appendix C), the patient was asked to choose a letter, either A, B or C, and in so doing was randomly assigned to one of three possible treatment groups.

2.3. The data

2.3.1. The primary data

The primary data consisted of the following:
The Vernon-Mior Neck Disability Index (appendix D) – a questionnaire designed to indicate the effect of the neck pain on the patient’s everyday life.
The short-form McGill Pain Questionnaire (appendix E) – which provides information about the pain characteristics –what it feels like (Grieve 1994:310-311), thus giving an indication of progression or improvement of pain.
The C.R.O.M. Goniometer (appendix F) – provides a measure of the patient’s cervical range of motion.

2.3.2. The secondary data

The secondary data consisted of a review of current literature i.e. with regard to neck pain, spinal manipulative therapy and massage therapy.

2.4. Methods of measurement

2.4.1. Subjective measurements

The Vernon-Mior Neck Disability Index

The Neck Disability Index was specifically developed to assess how neck pain in individuals affects activities of daily living (Hains et al. 1998:75). Conceived by Vernon and Mior, the Neck Disability Index is a self-report, 10-item, condition-specific, functional status measure intended for persons with neck pain (Stratford et al. 1999:108).

Stratford et al. (1999:108) further state that the Neck Disability Index is the most frequently cited and studied measure applied to persons with neck pain. Vernon and Mior reported internal consistency and test-retest reliability estimates for the Neck Disability Index of 0.80 and 0.89 respectively.

The Neck Disability Index is scored as follows: 7 items assess functional activities while the other 3 address concentration, headache and pain intensity. Each item is rated on a 6-point scale (0-5). Neck Disability Index scores vary from 0-50 with lower scores representing a more desirable health status (Stratford 1999:108). The total percentage score is calculated by adding the individual item scores, multiplying by 2 and expressing the result as a percentage (Hains and Mior 1998:75).
The short-form McGill Pain Questionnaire

The short-form McGill Pain Questionnaire was developed for use in specific research settings when the time to obtain information from patients’ is limited and when more information than simply the intensity of pain is required (Melzack and Wall 1994:344).

The benefits of the McGill Pain Questionnaire are seen as follows: it incorporates an extensive list of words which people use to describe different aspects of their pain experience. It measures the sensory, affective and evaluative dimensions of the pain experience. It is a reliable and valid measure of present pain intensity and can demonstrate the effect of treatment on pain (Hawthorn and Redmond 1998:115).

The short-form McGill Pain Questionnaire consists of 15 representative words from the sensory (n = 11) and affective (n = 4) categories of the standard long-form questionnaire. Each descriptor is ranked by the patient on an intensity scale of 0 = none, 1 = mild, 2 = moderate and 3 = severe. The total score is reflected as a percentage of the maximum, 45 (Melzack and Wall 1994: 345).

2.4.2. Objective measurements

Cervical spine range of motion

Measurement of cervical range of motion is considered an appropriate and objective method of assessing cervical function. It is used in rating impairment/disability and in monitoring treatment progress and effectiveness (Christensen and Nilsson 1998:341).

The C.R.O.M. goniometer is simple, easy to use and has a high inter and intra-examiner reliability (Love, Gringmuth et al. 1998:225).

A C.R.O.M. goniometer was used to measure the patient’s extent of cervical flexion, extension, rotation and lateral flexion. These measures were recorded in degrees and were carried out according to the manufacturers instructions.
2.5. The location of the data

The primary data was obtained from the Vernon-Mior Neck Disability Index, the short-form McGill Pain Questionnaire and the C.R.O.M. goniometer readings. The above data was collected prior to the initial and final treatments as well as at the 2-week follow up.

The secondary data was obtained from books and journals.

2.6. Interventions

The patients' were treated with their randomly selected technique. The treatment protocol involved 5 treatment sessions over a 2-week period. A follow-up assessment 2 weeks after the final treatment was undertaken.

2.6.1. Group A – Massage therapy

The patients' in this group received effleurage, petrissage and kneading of the upper back and neck musculature. Arnica massage oil was used for each session, which lasted 5 minutes. Patients' were treated in the prone position on an examination table with their head placed in a breathing hole i.e. in a neutral position.

2.6.2. Group B – Spinal manipulative therapy

The patients' in this group received manual chiropractic adjustments of the cervical spine. The levels treated were identified by motion palpation and confirmed by Kemp's test and local tenderness. With these manual adjustment techniques, a specific contact at the dysfunctional level was taken, joint slack was taken out to the elastic barrier of resistance and a high-velocity, low-amplitude thrust was delivered in the direction of the fixation.
The diversified techniques employed from States (1985: 56; 62; 79) are summarised below:

Cervical break

This technique is indicated for rotary or lateral flexion fixations of the entire cervical spine. The supine patient’s head is placed on a level headpiece. The indifferent hand is the cephalad hand, which cups the ear with the palm, chiropractic index and index fingers splitting the sternocleidomastoid muscle. The contact hand assumes an index contact with the skin slack removed posterior to anterior for rotary restrictions and anterior to posterior for lateral flexion restrictions. The forearm is parallel to the floor. Joint slack is removed by cephalad traction of the indifferent hand and lateral flexion with the contact hand, before the break technique is applied.

Thumb cervical extension

This technique is indicated for rotary fixations of the entire cervical spine. The supine patient’s head is rotated 45 degrees away from the listing. The indifferent hand is the cephalad hand with the palm cupping the ear, chiropractic index and index fingers splitting the sternocleidomastoid muscle, the other fingers wrapping around the occiput. Contact is made by the thumb on the articular pillar of cervicals C2-C7 or the posterior aspect of the transverse process of C1, fifth digit under the mandible, other fingers obliquely across the face and the forearm in the midsternal line.

The indifferent hand is inactive, the contact hand fingers induce further rotation, the wrist and forearm are locked and the break technique is straight across with the thumb.

Thumb movement: bench TM

This technique is indicated for rotary and lateral flexion fixations from C5-T3. The patient is prone with the headpiece lowered and the patient’s head turned
away from the contact. The doctor’s position is a fencer’s stance, the indifferent hand is the caudal hand which cups the ear and the contact hand’s thumb pad is placed on the lateral aspect of the spinous process of the listed segment. The indifferent hand tractions cephalad and into further rotation, the thrust from the contact hand is straight across.

2.6.3. Group C – Massage in combination with spinal manipulative therapy

The patients’ in this group received a 5 minute massage (as described in 3.6.1.) followed by cervical spinal manipulative therapy (as described in 3.6.2.).

2.7. Treatment of the data

2.7.1. The objective data

Cervical range of motion in flexion, extension, right and left rotation and right and left lateral flexion were recorded for all patients’ with the Cervical Range of Motion goniometer. The difference between the initial and fifth treatment, initial and follow-up and fifth treatment and follow-up goniometer readings were recorded and this data was statistically analysed.

2.7.2. The subjective data

Scores for the McGill Pain Questionnaire and Vernon-Mior Neck Pain and Disability Index were converted to a percentage and recorded for all patients’. The difference between the initial and fifth treatment, initial and follow-up and fifth treatment and follow-up scores were recorded and this data was statistically analysed.

2.8. Statistical analysis of the data

The statistical analysis was conducted on a 95% confidence level using two non-parametric tests. Due to the small sample groups (3 groups of 15 patients’ each),
statistical results would not be representative of the population, therefore no assumptions with regard to the general population could be made.

2.8.1. Non-parametric paired hypothesis tests

The objective data

Cervical ranges of motion were statistically analysed using the Wilcoxon Signed Rank test on each treatment group.
Readings were taken as follows:

1) prior to the initial and fifth treatments.
2) prior to the initial treatment and at the follow-up consultation.
3) prior to the fifth treatment and at the follow-up consultation.

The subjective data

The results for the McGill Pain Questionnaire and Neck Pain and Disability Index were analysed using the Wilcoxon Signed Rank test on each treatment group as follows:

1) prior to the initial and fifth treatments.
2) prior to the initial treatment and at the follow-up consultation.
3) prior to the fifth treatment and at the follow-up consultation.

Both the objective and subjective results were compared to determine the level of significance.

2.8.2. Non-parametric unpaired hypothesis tests

The objective data

Cervical ranges of motion were statistically analysed using the Mann-Whitney
Rank Sum test to compare the three groups. Comparison of the degrees of change in range of motion were as follows:

1) prior to the initial treatment between all groups.
2) prior to the fifth treatment between all groups.
3) at the follow-up consultation between all groups.

The subjective data

The percentages of pain and disability on the questionnaires were statistically analysed using the Mann-Whitney Rank Sum test to compare the three groups as follows:

1) prior to the initial treatment between all groups.
2) prior to the fifth treatment between all groups.
3) at the follow-up consultation between all groups.

The objective and subjective data were compared to determine the level of significance.

2.9. Column statistics

The statistical analysis for both objective and subjective data was performed on Jandel Scientific Sigmasstat and Sigmaplot version 2.02.
CHAPTER THREE

RESULTS

3.1. THE OBJECTIVE DATA

3.1.1. Column statistics

TABLE 3.1. DEGREES OF CERVICAL RANGE OF MOTION
OF THE MASSAGE THERAPY GROUP

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### TABLE 3.3. DEGREES OF CERVICAL RANGE OF MOTION OF THE MASSAGE THERAPY & S.M.T. (COMBINATION) GROUP

<table>
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<tr>
<th>R.O.M.</th>
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<th>Standard Deviation</th>
<th>95% conf. level</th>
<th>Min.</th>
<th>Max.</th>
<th>Median</th>
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<td>58</td>
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<tr>
<td>fu</td>
<td>61.3</td>
<td>10.46</td>
<td>5.79</td>
<td>40</td>
<td>78</td>
<td>60</td>
</tr>
<tr>
<td><strong>Extension</strong></td>
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<td>4.63</td>
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<td>40</td>
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<tr>
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<td>4.68</td>
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3.1.2. Non-parametric paired hypothesis tests

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<tr>
<th></th>
<th>R.O.M.</th>
<th>M.T.</th>
<th>S.M.T.</th>
<th>M.T. &amp; S.M.T.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flexion</strong></td>
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<td>0.952</td>
<td>0.0554</td>
<td>0.426</td>
</tr>
<tr>
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<td>between 1st. Rx &amp; fu</td>
<td>0.808</td>
<td>0.216</td>
<td>0.952</td>
</tr>
<tr>
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<td>between 5th. Rx &amp; fu</td>
<td>0.85</td>
<td>0.064</td>
<td>0.414</td>
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<tr>
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<td>0.502</td>
<td>0.583</td>
<td>0.455</td>
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<tr>
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<td>0.173</td>
<td>0.598</td>
<td>0.266</td>
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</tr>
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<td>between 5th. Rx &amp; fu</td>
<td>0.391</td>
<td>0.277</td>
<td>0.577</td>
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<td><strong>Left Rotation</strong></td>
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<td>0.831</td>
<td>0.524</td>
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<td>0.638</td>
<td>0.67</td>
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<td><strong>Right Lat. Flex.</strong></td>
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<td>0.173</td>
<td>0.326</td>
<td>0.457</td>
</tr>
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<td>0.147</td>
<td>0.0494</td>
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<td>between 5th. Rx &amp; fu</td>
<td>0.204</td>
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<td><strong>Left Lat. Flex.</strong></td>
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<td>0.588</td>
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<td>0.326</td>
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<tr>
<td></td>
<td>between 5th. Rx &amp; fu</td>
<td>0.566</td>
<td>0.639</td>
<td>0.391</td>
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</table>

Note: Statistically significant values in bold.
3.1.3. Non-parametric unpaired hypothesis tests

**TABLE 3.6. P-VALUES OF THE MANN-WHITNEY RANK SUM TEST ON THE DEGREES OF CERVICAL RANGE OF MOTION PRIOR TO THE FIRST TREATMENT BETWEEN THE GROUPS**

<table>
<thead>
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</thead>
<tbody>
<tr>
<td>Flexion</td>
<td>0.0213</td>
<td>0.431</td>
<td>0.407</td>
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<td>Extension</td>
<td>0.141</td>
<td>0.983</td>
<td>0.146</td>
</tr>
<tr>
<td>Right rotation</td>
<td>0.281</td>
<td>0.351</td>
<td>0.0326</td>
</tr>
<tr>
<td>Left Rotation</td>
<td>0.29</td>
<td>0.983</td>
<td>0.272</td>
</tr>
<tr>
<td>Right Lat. Flexion</td>
<td>0.184</td>
<td>0.82</td>
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<td>Left Lat. Flexion</td>
<td>0.191</td>
<td>0.361</td>
<td>0.724</td>
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**TABLE 3.6. P-VALUES OF THE MANN-WHITNEY RANK SUM TEST ON THE DEGREES OF CERVICAL RANGE OF MOTION PRIOR TO THE FIFTH TREATMENT BETWEEN THE GROUPS**

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<tbody>
<tr>
<td>Flexion</td>
<td>0.983</td>
<td>0.237</td>
<td>0.171</td>
</tr>
<tr>
<td>Extension</td>
<td>0.171</td>
<td>0.534</td>
<td>0.0814</td>
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<tr>
<td>Right rotation</td>
<td>0.709</td>
<td>0.281</td>
<td>0.198</td>
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<td>Left Rotation</td>
<td>0.071</td>
<td>0.604</td>
<td>0.272</td>
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<td>Right Lat. Flexion</td>
<td>0.281</td>
<td>0.885</td>
<td>0.171</td>
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<td>Left Lat. Flexion</td>
<td>0.59</td>
<td>0.74</td>
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**TABLE 3.7. P-VALUES OF THE MANN-WHITNEY RANK SUM TEST ON THE DEGREES OF CERVICAL RANGE OF MOTION AT THE FOLLOW-UP BETWEEN THE GROUPS**

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<tbody>
<tr>
<td>Flexion</td>
<td>0.418</td>
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<td>Extension</td>
<td>0.481</td>
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<td>Right rotation</td>
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<td>0.165</td>
<td>0.135</td>
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<td>Left Rotation</td>
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<td>Right Lat. Flexion</td>
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<td>0.803</td>
<td>0.917</td>
</tr>
<tr>
<td>Left Lat. Flexion</td>
<td>0.561</td>
<td>0.693</td>
<td>0.885</td>
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</table>

48
3.1.4. Graphical representation of the data

![Graphical representation of data]

**Figure 3.1.** Change in degrees of cervical range of motion in flexion of all groups.
Figure 3.2. Change in degrees of cervical range of motion in extension of all groups.
Figure 3.3. Change in degrees of cervical range of motion in right rotation of all groups.
Figure 3.4. Change in degrees of cervical range of motion in left rotation of all groups.
Figure 3.6. Change in degrees of cervical range of motion in left lateral flexion of all groups.
3.1.5. Explanation of the data

3.1.5.1. Cervical range of motion in flexion

**Inter-group:** When comparing the range of motion of all three groups prior to the first treatment, there was a statistically significant difference between the massage therapy and adjustment groups (P-value = 0.0213).

Prior to the fifth treatment, although not statistically significant, the biggest difference shown was between the massage and combination groups (P-value = 0.171).

At the follow-up consultation, the massage versus the adjustment group (P-value = 0.418) demonstrated the biggest difference, followed by the massage versus the combination group (P-value = 0.468). These differences were not however, statistically significant. At the follow-up consultation, there was little difference between the adjustment and combination groups (P-value = 0.917).

**Intra-group:** Although not statistically significant, the adjustment group demonstrated the greatest increase in range of motion between the first and fifth treatments (P-value = 0.0554), as well as between the first treatment and follow-up (P-value = 0.216).

The adjustment group (P-value = 0.064) also showed the greatest increase in range of motion between the fifth treatment and follow-up consultation, followed by the combination group (P-value = 0.414) and the massage therapy group (P-value = 0.85).

3.1.5.2. Cervical range of motion in extension

**Inter-group:** When comparing the three groups prior to the first treatment, there was no statistically significant difference between them.

Prior to the fifth treatment, although not statistically significant, the difference between the massage therapy and combination groups (P-value = 0.0814) showed the biggest difference, followed by the massage versus the adjustment group (P-value = 0.171). At the follow-up consultation, the biggest difference was between the massage and combination groups (P-value = 0.319), followed by the massage versus the adjustment group (P-value = 0.481), these were however not
statistically significant. The adjustment versus the combination group showed little difference prior to the fifth treatment (P-value = 0.534) or at the follow-up (P-value = 0.852).

**Intra-group:** There was no statistically significant difference from the first to the fifth treatment or follow-up consultation within any group. However, from the first treatment to the follow-up consultation, the combination group (P-value = 0.455) demonstrated the greatest improvement.

3.1.5.3. Cervical range of motion in right rotation

**Inter-group:** When comparing the range of motion prior to the first treatment, there was a statistically significant difference between the massage therapy and combination group (P-value = 0.0326).

Although not statistically significant, the difference between the massage therapy and combination groups remained greater prior to the fifth treatment (P-value = 0.198) and at the follow-up (P-value = 0.135) than between the other groups.

**Intra-group:** Although not statistically significant, the adjustment group (P-value = 0.217) showed the biggest increase in range of motion between the first treatment and follow-up consultation, this was also the case between the fifth treatment and follow-up consultation (P-value = 0.277).

3.1.5.4. Cervical range of motion in left rotation

**Inter-group:** When comparing the range of motion of the three groups prior to the first treatment, there was no statistically significant difference between them. Although not statistically significant, the difference prior to the fifth treatment between the massage therapy and adjustment groups was the most remarkable (P-value = 0.0711), followed by the difference between the massage and combination groups (P-value = 0.272). At the follow-up consultation, this trend continued as the massage versus the adjustment group (P-value = 0.59) demonstrated the biggest inter-group change. The difference prior to the fifth treatment (P-value =
0.604) and at the follow-up consultation (P-value = 0.787) between the adjustment and combination groups demonstrated the similarity between these groups.

**Intra-group:** There was a statistically significant increase in the range of motion in the combination group between the first and fifth treatments (P-value = 0.0398) as well as between the first treatment and follow-up consultation (P-value = 0.021).

3.1.5.5. Cervical range of motion in right lateral flexion

**Inter-group:** When comparing the range of motion of the three groups prior to the first treatment, there was no statistically significant difference between them.
In comparing the groups prior to the fifth treatment, the massage therapy and combination groups (P-value = 0.171) showed the biggest difference followed by the massage versus the adjustment group (P-value = 0.281). This was not however, statistically significant. The adjustment group showed little difference compared to the combination group prior to the fifth treatment (P-value = 0.885) and at the follow-up consultation (P-value = 0.803).

**Intra-group:** The adjustment group (P-value = 0.0494) demonstrated a statistically significant increase in range of motion between the first treatment and follow-up consultation.
Although not statistically significant, the combination group (P-value = 0.0522) showed a greater improvement between the first treatment and follow-up consultation than the massage therapy group (P-value = 0.147).
The improvement in range of motion between the fifth treatment and follow-up consultation was greatest for the combination group (P-value = 0.073) followed by the adjustment group (P-value = 0.084), the massage therapy group (P-value = 0.204) however, showed a slight decrease in range of motion between the fifth treatment and follow-up consultation.
3.1.5.6. Cervical range of motion in left lateral flexion

Inter-group: When comparing the range of motion of the three groups prior to the first treatment, there was no statistically significant difference between them. Prior to the fifth treatment, the massage versus the combination group (P-value = 0.33) showed the biggest difference followed by the massage versus the adjustment group (P-value = 0.59). At the follow-up consultation, the massage versus the adjustment group (P-value = 0.561) showed the biggest difference. The adjustment versus the combination group showed little difference prior to the fifth treatment (P-value = 0.74) and at the follow-up consultation (P-value = 0.693).

Intra-group: Although not statistically significant, the adjustment group (P-value = 0.296) showed the greatest improvement in range of motion between the first and fifth treatments, followed by the combination group (P-value = 0.465). The adjustment group (P-value = 0.326) also fared best in terms of range of motion improvement between the first treatment and follow-up consultation, this was not however, statistically significant.

Although not statistically significant, the combination group (P-value = 0.391) showed the greatest improvement in range of motion between the fifth treatment and follow-up consultation followed by the adjustment group (P-value = 0.639).
### 3.2. THE SUBJECTIVE DATA

#### 3.2.1. Column statistics

**TABLE 3.8. PERCENTAGE OF PAIN AND DISABILITY ON THE NECK PAIN AND DISABILITY INDEX AND THE MCGILL PAIN QUESTIONNAIRE OF THE MASSAGE THERAPY GROUP**

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Mean (Standard Deviation)</th>
<th>95% conf. level</th>
<th>Min.</th>
<th>Max.</th>
<th>Median</th>
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<td>5th. Rx</td>
<td>12.63 (8.16)</td>
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<td>14</td>
</tr>
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**TABLE 3.9. PERCENTAGE OF PAIN AND DISABILITY ON THE NECK PAIN AND DISABILITY INDEX AND THE MCGILL PAIN QUESTIONNAIRE OF THE S.M.T. (ADJUSTMENT) GROUP**

<table>
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<th>Max.</th>
<th>Median</th>
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<td></td>
<td></td>
</tr>
<tr>
<td>1st. Rx</td>
<td>23.73 (13.71)</td>
<td>7.59</td>
<td>6</td>
<td>58</td>
<td>22</td>
</tr>
<tr>
<td>5th. Rx</td>
<td>10.4 (6.01)</td>
<td>3.33</td>
<td>2</td>
<td>22</td>
<td>10</td>
</tr>
<tr>
<td>flu</td>
<td>8.67 (4.82)</td>
<td>2.67</td>
<td>2</td>
<td>18</td>
<td>8</td>
</tr>
<tr>
<td>McGill Pain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st. Rx</td>
<td>21.73 (19.14)</td>
<td>10.6</td>
<td>4.4</td>
<td>66.6</td>
<td>15.5</td>
</tr>
<tr>
<td>5th. Rx</td>
<td>8.55 (8.67)</td>
<td>4.8</td>
<td>0</td>
<td>28.8</td>
<td>6.6</td>
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<tr>
<td>flu</td>
<td>7.37 (6.29)</td>
<td>3.48</td>
<td>0</td>
<td>20</td>
<td>4.4</td>
</tr>
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</table>

**TABLE 3.10. PERCENTAGE OF PAIN AND DISABILITY ON THE NECK PAIN AND DISABILITY INDEX AND THE MCGILL PAIN QUESTIONNAIRE OF THE M.T. & S.M.T. (COMBINATION) GROUP**

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Mean (Standard Deviation)</th>
<th>95% conf. level</th>
<th>Min.</th>
<th>Max.</th>
<th>Median</th>
</tr>
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<tbody>
<tr>
<td>Pain &amp; Disability</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>1st. Rx</td>
<td>20.93 (10.69)</td>
<td>5.92</td>
<td>6</td>
<td>42</td>
<td>18</td>
</tr>
<tr>
<td>5th. Rx</td>
<td>9.07 (5.65)</td>
<td>3.13</td>
<td>0</td>
<td>18</td>
<td>8</td>
</tr>
<tr>
<td>flu</td>
<td>10.93 (8.34)</td>
<td>4.62</td>
<td>0</td>
<td>28</td>
<td>10</td>
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<tr>
<td>McGill Pain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st. Rx</td>
<td>20.09 (15.55)</td>
<td>8.61</td>
<td>2.2</td>
<td>68.8</td>
<td>17.7</td>
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<tr>
<td>5th. Rx</td>
<td>8.1 (6.48)</td>
<td>3.59</td>
<td>0</td>
<td>22.2</td>
<td>6.6</td>
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<tr>
<td>flu</td>
<td>6.49 (5.9)</td>
<td>3.27</td>
<td>0</td>
<td>20</td>
<td>4.4</td>
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</tbody>
</table>
3.2.2. Non-parametric paired hypothesis tests

**TABLE 3.11. P-VALUES OF THE WILCOXON SIGNED RANK TEST ON THE PERCENTAGE OF PAIN AND DISABILITY ON THE NECK PAIN AND DISABILITY INDEX AND THE MCGILL PAIN QUESTIONNAIRE OF ALL GROUPS.**

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>M.T.</th>
<th>S.M.T.</th>
<th>M.T. &amp; S.M.T.</th>
</tr>
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<tbody>
<tr>
<td>Neck Pain &amp; Disability</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>between 1st. &amp; 5th. Rx</td>
<td>0.0723</td>
<td>0.000122</td>
<td>0.000183</td>
</tr>
<tr>
<td>between 1st. Rx &amp; flu</td>
<td>0.0269</td>
<td>0.000061</td>
<td>0.000366</td>
</tr>
<tr>
<td>between 5th. Rx &amp; flu</td>
<td>0.82</td>
<td>0.194</td>
<td>0.365</td>
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<tr>
<td>McGill Pain</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>between 1st. &amp; 5th. Rx</td>
<td>0.0833</td>
<td>0.0103</td>
<td>0.00244</td>
</tr>
<tr>
<td>between 1st. Rx &amp; flu</td>
<td>0.083</td>
<td>0.00232</td>
<td>0.000244</td>
</tr>
<tr>
<td>between 5th. Rx &amp; flu</td>
<td>0.557</td>
<td>0.482</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Note: Statistically significant values in bold.
3.2.3 Non-parametric unpaired hypothesis tests

**TABLE 3.12.** P-VALUES OF THE MANN-WHITNEY RANK SUM TEST ON THE PERCENTAGE OF PAIN AND DISABILITY ON THE NECK PAIN AND DISABILITY INDEX AND MCGILL PAIN QUESTIONNAIRE PRIOR TO THE FIRST TREATMENT BETWEEN ALL GROUPS.

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>M.T. - S.M.T.</th>
<th>S.M.T. - M.T. &amp; S.M.T.</th>
<th>M.T. - M.T. &amp; S.M.T.</th>
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</thead>
<tbody>
<tr>
<td>Pain and Disability</td>
<td>0.0971</td>
<td>0.772</td>
<td>0.229</td>
</tr>
<tr>
<td>McGill Pain</td>
<td>0.407</td>
<td>0.868</td>
<td>0.13</td>
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</table>

**TABLE 3.13.** P-VALUES OF THE MANN-WHITNEY RANK SUM TEST ON THE PERCENTAGE OF PAIN AND DISABILITY ON THE NECK PAIN AND DISABILITY INDEX AND MCGILL PAIN QUESTIONNAIRE PRIOR TO THE FIFTH TREATMENT BETWEEN ALL GROUPS.

<table>
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<th>S.M.T. - M.T. &amp; S.M.T.</th>
<th>M.T. - M.T. &amp; S.M.T.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain and Disability</td>
<td>0.481</td>
<td>0.693</td>
<td>0.213</td>
</tr>
<tr>
<td>McGill Pain</td>
<td>0.724</td>
<td>0.868</td>
<td>0.868</td>
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</table>

**TABLE 3.14.** P-VALUES OF THE MANN-WHITNEY RANK SUM TEST ON THE PERCENTAGE OF PAIN AND DISABILITY ON THE NECK PAIN AND DISABILITY INDEX AND MCGILL PAIN QUESTIONNAIRE AT THE FOLLOW-UP BETWEEN ALL GROUPS.

<table>
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<th>S.M.T. - M.T. &amp; S.M.T.</th>
<th>M.T. - M.T. &amp; S.M.T.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain and Disability</td>
<td>0.319</td>
<td>0.59</td>
<td>0.663</td>
</tr>
<tr>
<td>McGill Pain</td>
<td>0.34</td>
<td>0.868</td>
<td>0.245</td>
</tr>
</tbody>
</table>
3.2.4. Graphical representation of the data

![Graph showing disability rating scores for different groups over time.](image)

**Figure 3.7.** Change in percentage of pain and disability on the neck pain and disability index of all groups.
Figure 3.8. Change in percentage of pain on the McGill Pain Questionnaire of all groups.
3.2.5. Explanation of the subjective data

3.2.5.1. Neck Pain and Disability Index (Vernon-Mior)

**Inter-group:** When comparing the three groups prior to the first treatment, there was no statistically significant difference between them in terms of percentage pain and disability.

Prior to the fifth treatment there was no statistically significant difference between the groups. However the massage group compared to the combination group (P-value = 0.213) demonstrated the most noticeable difference, followed by the massage versus the adjustment group (P-value = 0.481), whilst the adjustment compared to the combination group (P-value = 0.693) exhibited little difference.

At the follow-up consultation, the inter-group comparison revealed that the massage versus the adjustment group (P-value = 0.319) showed the greatest difference, although this was not statistically significant.

**Intra-group:** There was a statistically significant decrease in pain and disability between the first and fifth treatments in both the adjustment and combination groups. The adjustment group (P-value = 0.000122) showed a marginally greater improvement than the combination group (P-value = 0.000183).

All three groups showed a statistically significant decrease in pain and disability between the first treatment and follow-up consultation. The adjustment group (P-value = 0.0000610) fared best, followed by the combination group (P-value = 0.000366), with the massage therapy group (P-value = 0.0269) showing the least improvement.

Although not statistically significant, the adjustment group (P-value = 0.194) was the only group to demonstrate a decrease in pain and disability from the fifth treatment to the follow-up.
3.2.5.2. McGill Pain Questionnaire

**Inter-group:** When comparing the three groups prior to the first treatment, there was no statistically significant difference in the percentage of pain between the groups.

Prior to the fifth treatment, a comparison between the massage and adjustment groups (P-value = 0.724) exhibited the most noticeable difference, although it was not statistically significant.

At the follow-up consultation, the inter-group comparison demonstrated little difference between the adjustment and combination groups (P-value = 0.868). The massage versus the adjustment group (P-value = 0.34) and the massage versus the combination group (P-value = 0.245) however, showed more noticeable differences which were not statistically significant.

**Intra-group:** There was a statistically significant decrease in pain between the first and fifth treatments in the adjustment and combination groups, with the combination group (P-value = 0.00244) showing a greater improvement than the adjustment group (P-value = 0.0103).

There was a statistically significant decrease in pain between the first treatment and follow-up consultation in both the adjustment and combination groups, with the combination group (P-value = 0.000244) faring better than the adjustment group (P-value = 0.00232).

Although not statistically significant, the combination group (P-value = 0.32) demonstrated a slightly greater decrease in pain from the fifth treatment to the follow-up compared to the adjustment group (P-value = 0.492), while the massage therapy group (P-value = 0.557) showed a slight increase in pain.
CHAPTER FOUR

DISCUSSION

4.1. Introduction

This is a discussion of the results obtained from the statistical analysis of the objective and subjective data. The range of motion data constitutes the objective results, whilst the Neck Pain and Disability Index and the McGill Pain Questionnaire make up the subjective component.

The following hypotheses will be referred to:

1. It is hypothesised that patients’ receiving massage therapy alone will respond favourably in terms of the objective and subjective measurements.

2. It is hypothesised that patients’ receiving cervical S.M.T. alone will respond favourably in terms of the objective and subjective measurements.

3. It is hypothesised that patients’ receiving massage therapy in combination with cervical S.M.T. will respond most favourably in terms of the objective and subjective measurements.
4.2. The objective results

The only statistically significant improvements in range of motion were observed in the adjustment and combination groups.

In left rotation, the combination group improved significantly between the first and fifth treatments as well as between the first treatment and follow-up consultation.

In right lateral flexion, the adjustment group demonstrated a significant improvement between the first treatment and follow-up consultation. (refer to TABLE 3.4. & Figures 3.4. & 3.5.).

In comparing the range of motion difference between the first and fifth treatments, the combination group improved in right rotation, left rotation and right lateral flexion. The massage therapy group improved in extension, left rotation and right and left lateral flexion. The adjustment group however, increased its range of motion in all six movements.

In comparing the range of motion of the massage therapy group from the first treatment to the follow-up consultation, only right and left lateral flexion increased, the other four movements all showed a decrease in range of motion.

In contrast to the above, both the adjustment and combination groups demonstrated an increase in range of motion between the first treatment and follow-up consultation in all six movements.

In assessing the difference between the fifth treatment and follow-up consultation, the massage therapy group showed a decrease in range of motion in all movements except left lateral flexion.

The adjustment group showed a decrease in range of motion in all movements except right rotation and right lateral flexion.

The combination group however, demonstrated an increase in range of motion in all movements except left rotation.

(refer to TABLES 3.1., 3.2. & 3.3. & Figures 3.1. - 3.6.).
Although the results showed no statistically significant difference between the groups prior to the fifth treatment or at the follow-up consultation, the following inter-group trends emerged. Prior to the fifth treatment, the massage versus both the adjustment and combination groups demonstrated the most noticeable difference in all six movements. At the follow-up consultation, the massage therapy group as compared to both the adjustment and combination groups demonstrated the most noticeable difference in five of the six movements. It is evident that little difference exists between the adjustment and combination groups, whilst the massage therapy group compared relatively poorly to both of these groups. (refer to TABLES 3.6. & 3.7.).

These results are supported by Cassidy and Quon et al. (1992:495), in which fifty patients' received a single manipulation, with the results demonstrating an increase in cervical rotation and lateral flexion.

The results are further supported by Koes et al. (1992:28), in which it was shown that manipulation and/or mobilisation improved the range of motion in 13 patients’ more than exercise, massage or physiotherapeutic modalities did in 20 patients’ after a 12-week follow-up.

Jaskowiak and Schafer (1993:9) report that the effects of two or more therapies given in combination are cumulative. This may explain why the combination group demonstrated the best results from the fifth treatment to the follow-up consultation.

This is supported in a study by Holey and Cook (1997:33), in which 21 females received 10 sessions of massage therapy and showed a significant improvement in range of motion of the cervical spine. Goats (1994:154) adds weight to the evidence that the combination group demonstrated better fifth treatment to follow-up results by stating that, “massage is a potent means of enhancing the mobility of muscles, tendons and ligaments by limiting discomfort and enhancing function.”
No studies could be found in which massage therapy was compared to chiropractic manipulative therapy and a combination thereof in the treatment of cervical facet syndrome.

4.3. The subjective results

When considering the Neck Pain and Disability Index and the McGill Pain Questionnaire, the results showed that there was little to choose between the adjustment and combination groups. The results of the massage therapy group however, were relatively poor. (refer to Figures 3.7 & 3.8.).

The only statistically significant decrease in percentage pain and disability in the massage therapy group was on the Neck Pain and Disability Index between the first treatment and follow-up consultation. Although significant, this decrease did not compare favourably with either of the other groups.

The adjustment group demonstrated a statistically significant decrease in percentage pain and disability on the Neck Pain and Disability Index and the McGill Pain Questionnaire between the first and fifth treatments, as well as between the first treatment and follow-up consultation.

The combination group also demonstrated a statistically significant decrease in percentage pain and disability on both the Neck Pain and Disability Index and the McGill Pain Questionnaire between the first and fifth treatments, as well as between the first treatment and follow-up consultation.

Although there was no statistically significant difference between the fifth treatment and follow-up consultation, the three groups fared as follows. The massage therapy group stayed constant in terms of percentage pain and disability, but regressed slightly in terms of pain on the McGill Pain Questionnaire.
The adjustment group demonstrated an improvement on both the Neck Pain and Disability Index and the McGill Pain Questionnaire, while the combination group only improved on the McGill Pain Questionnaire, regressing slightly in terms of percentage disability on the Neck Pain and Disability Index. (refer to TABLES 3.8., 3.9. & 3.10.).

The results showed that there was no statistically significant difference between the groups prior to the fifth treatment or at the follow-up consultation. The results did indicate however, that on the Neck Pain and Disability Index prior to the fifth treatment the massage versus the combination group demonstrated the most remarkable difference, followed by the massage versus the adjustment group. On the McGill Pain Questionnaire, the massage versus the adjustment group showed the biggest difference. However, on both questionnaires the adjustment group compared to the combination group showed very little difference between them. It is evident that the massage therapy group fared relatively poorly compared to the adjustment and combination groups prior to the fifth treatment and at the follow-up consultation. (refer to TABLES 3.13. & 3.14.).

The results are supported by Koes et al. (1992:28), who demonstrated that manipulation and/or mobilisation resulted in greater pain improvement than exercise, massage or physiotherapeutic modalities.

Cassidy and Lopez et al. (1992:570) claim that a single manipulation was more effective than mobilisation in decreasing pain in patients' with mechanical neck pain.

Vernon et al. (1990:13) further support the results in their comparison of pressure pain thresholds around joint fixations in a manipulation and a mobilisation group. The manipulation group showed a 50% rise in pressure pain thresholds, the mobilisation group however, showed no change.
CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

Chiropractic manipulative therapy with and without massage therapy is effective in increasing cervical range of motion, as well as in decreasing neck pain and disability.

Massage therapy on its own however, did not compare favourably with either of the other two groups in terms of range of motion improvement or reduction of neck pain and disability.

Both the chiropractic manipulative therapy and combination groups treatment protocols were shown to be equally effective in increasing cervical range of motion from the initial assessment to the follow-up consultation.

The chiropractic manipulative therapy group fared better over the treatment period itself, with the combination group demonstrating better results from the fifth treatment to the follow-up consultation.

Although these results were not statistically significant, trends showed that in order to have potentially lasting increases in cervical range of motion, a combination of cervical spinal manipulative therapy and massage therapy should be the treatment of choice.

Based on the results of the study, trends indicate that the most effective treatment protocol for the treatment of chronic cervical facet syndrome is a combination of chiropractic manipulative therapy and massage therapy.

As a combined therapy, not only are the joints treated, but also the muscles that move them.

Although slightly more time consuming, the success of the combination treatment could be as a result of the added physiological and psychological benefits of a more hands on approach.
5.2. Recommendations

It is recommended that future studies dealing with similar treatment protocols use larger sample sizes which would make any trends in the results more apparent, as well as producing more statistically significant results.

Degenerative joint disease is more likely to affect older individuals. The 18-50 age group may well have contained some individuals with this condition, especially those nearer to the upper age limit. The impact of this condition was not considered here, but is an aspect which future studies could consider.

A future study should possibly lengthen the treatment time of the massage therapy group, which could possibly alter the obtained results, leading to a statistically significant difference between the cervical spinal manipulative therapy and combination groups.
REFERENCES


TECHNIKON WITWATERSRAND
CHIROPRACTIC DAY CLINIC

CASE HISTORY

Date: __________________

Patient: ____________________  File No: ____________________

Age: _____  Sex: _____  Occupation: ____________________

Intern: ____________________  Signature: ____________________

FOR CLINICIAN'S USE ONLY

Initial visit clinician: ____________________  Signature: ____________________

Case History: ____________________

Examination:
Previous: TWR  Other  Current: TWR  Other

X-ray Studies:
Previous: TWR  Other  Current: TWR  Other

Clinical path. lab.
Previous: TWR  Other  Current: TWR  Other

Case status:
PTT: Conditional  Signed off: Final sign out:

Recommendations:
Intern's case history

1. Source of history:

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

3. Present illness:
   
   Location
   
   Onset
   
   Duration
   
   Frequency
   
   Pain (character)
   
   Progression
   
   Aggravating factors
   
   Relieving factors
   
   Associated Sx's & Sg's
   
   Previous occurrences
   
   Past treatment and outcome

4. Other complaints:
Current medication

Tobacco

Alcohol

Social drugs

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

8. Psychosocial history:
   Home situation
   Daily life
   Important experiences
   Religious beliefs
APPENDIX B

TECHNIKON WITWATERSRAND
CHIROPRACTIC DAY CLINIC

REGIONAL EXAMINATION
CERVICAL SPINE

Date: ____________________
File No: ________________
Signature: ________________
Signature: ________________

Patient: ____________________
Clinician: ____________________
Intern: ____________________

OBSERVATION

- Posture
- Size
- Swellings
- Scars
- Discolouration
- Hairline
- Bony and soft tissue contours
- Shoulder level:
- Muscle spasm
- Facial expression

RANGE OF MOTION

Flexion = 45° - 90°
Extension = 55° - 70°
L/R Rotation = 70° - 90°
L/R Lateral flexion = 20° - 45°
Flexion

L. Rot  |  R. Rot.

L. lat flex  |  R. lat flex

Ext.

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

PALPATION

- Lymph nodes.
- Trachea.
- Thyroid gland.
- Pulses / thrills.
- Tenderness.
- Muscle Tone.
- Active MF Trigger Points: SCM.
  - Trapezius.
  - Scaleni.
  - Levator Scapulae.
  - Posterior Cervical musculature.
**VASCULAR**

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**CAROTIDS.**

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**SUBCLAVIAN ARTERIES.**

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**WALLENBERG'S TEST.**

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**COMMENTS:**

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**MOTION PALPATION**

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</table>
APPENDIX C

SUBJECT INFORMATION AND CONSENT FORM

You are suffering from posterior neck pain of more than 2 weeks duration. We are conducting research investigating an additional method of treatment for neck pain. We are asking you to participate in this study to help us determine the role of this additional method of treatment.

If you participate, you will be required to undergo a case history and regional examination of your neck. You will be asked to fill in certain questionnaires from time to time. You will be assigned randomly to one of three groups. You will receive 5 treatments over 2 weeks and a follow up consultation 2 weeks later.

All patients who participate in this study will contribute to chiropractic knowledge, resulting in selection of better methods of treatment for neck pain in the future.

Participation in this study is voluntary and you are free to refuse to participate or to withdraw your consent and discontinue participation at any time.

I have fully explained the procedures, identifying those which are investigational, and have explained their purpose. I have asked whether or not any questions have arisen regarding the procedures and have answered the questions to the best of my ability.

Date: ___________________  Researcher: ___________________

I have been fully informed as to the procedures to be followed, including those which are investigational and have been given a description of the attendant discomforts, risks and benefits to be expected and the appropriate alternative procedures. In signing this consent form I agree to this method of treatment and I understand that I am free to withdraw my consent and discontinue my participation in this study at any time. I understand also that if I have any questions at any time, they will be answered.

Date: _______________  Patient: _______________
APPENDIX D
NECK PAIN AND DISABILITY INDEX (VERNON-MIORI)

Patient name: __________________ File number: ______ Date: ______

Please read instructions:
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 just mark the box which most closely describes your problem.

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<th>SECTION 1 - PAIN INTENSITY</th>
<th>SECTION 6 - CONCENTRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have no pain at the moment.</td>
<td>I can concentrate fully when I want to with no difficulty.</td>
</tr>
<tr>
<td>The pain is very mild at the moment.</td>
<td>I can concentrate fully when I want to with slight difficulty.</td>
</tr>
<tr>
<td>The pain is moderate at the moment.</td>
<td>I have a fair degree of difficulty in concentrating when I want to.</td>
</tr>
<tr>
<td>The pain is very severe at the moment.</td>
<td>I have a great deal of difficulty in concentrating when I want to.</td>
</tr>
<tr>
<td>The pain is the worst imaginable at the moment.</td>
<td>I cannot concentrate at all.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SECTION 2 - PERSONAL CARE (Washing, Dressing, etc)</th>
<th>SECTION 7 - WORK</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can look after myself normally without causing extra pain.</td>
<td>I can do as much work as I want to.</td>
</tr>
<tr>
<td>I can look after myself normally but it causes extra pain.</td>
<td>I can only do my usual work, but no more.</td>
</tr>
<tr>
<td>It is painful to look after myself and I am slow and careful.</td>
<td>I can do most of my usual work, but no more.</td>
</tr>
<tr>
<td>I need some help but manage most of my personal care.</td>
<td>I cannot do my usual work.</td>
</tr>
<tr>
<td>I need help every day in most aspects of self care.</td>
<td>I cannot do any work at all.</td>
</tr>
<tr>
<td>If I do not get dressed, I wash with difficulty and stay in bed.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SECTION 3 - LIFTING</th>
<th>SECTION 8 - DRIVING</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can lift heavy weights without extra pain.</td>
<td>I can drive my car without any neck pain.</td>
</tr>
<tr>
<td>I can lift heavy weights, but it gives extra pain.</td>
<td>I can drive my car as long as I want with slight pain in my neck.</td>
</tr>
<tr>
<td>Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently positioned, for example on a table.</td>
<td>I can drive my car as long as I want with moderate pain in my neck.</td>
</tr>
<tr>
<td>Pain prevents me from lifting heavy weights, but I can manage to lift medium weights if they are conveniently positioned.</td>
<td>I cannot drive my car as long as I want because of moderate pain in my neck.</td>
</tr>
<tr>
<td>I can lift very light weights.</td>
<td>I can hardly drive at all because of severe pain in my neck.</td>
</tr>
<tr>
<td>I cannot lift or carry anything at all.</td>
<td>I cannot drive my car at all.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SECTION 4 - READING</th>
<th>SECTION 9 - SLEEPING</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can read as much as I want to with no pain in my neck.</td>
<td>I have no trouble sleeping.</td>
</tr>
<tr>
<td>I can read as much as I want to with slight pain in my neck.</td>
<td>My sleep is slightly disturbed (less than 1 hour asleep).</td>
</tr>
<tr>
<td>I can read as much as I want with moderate pain in my neck.</td>
<td>My sleep is mildly disturbed (1-2 hrs. asleep).</td>
</tr>
<tr>
<td>I can't read as much as I want because of moderate pain in my neck.</td>
<td>My sleep is moderately disturbed (3-4 hrs. asleep).</td>
</tr>
<tr>
<td>I can hardly read at all because of severe pain in my neck.</td>
<td>My sleep is completely disturbed (5-7 hrs. asleep).</td>
</tr>
<tr>
<td>I cannot read at all.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SECTION 5 - HEADACHES</th>
<th>SECTION 10 - RECREATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have no headaches at all.</td>
<td>I am able to engage in all my recreation activities with no neck pain at all.</td>
</tr>
<tr>
<td>I have slight headaches which come infrequently.</td>
<td>I am able to engage in all my recreation activities with some pain in my neck.</td>
</tr>
<tr>
<td>I have moderate headaches which come infrequently.</td>
<td>I am able to engage in most, but not all of my usual recreation activities because of pain in my neck.</td>
</tr>
<tr>
<td>I have severe headaches which come frequently.</td>
<td>I am able to engage in a few of my usual recreation activities because of pain in my neck.</td>
</tr>
<tr>
<td>I have headaches almost all the time.</td>
<td>I can hardly do any recreation activities because of pain in my neck.</td>
</tr>
<tr>
<td>I cannot do any recreation activities at all.</td>
<td></td>
</tr>
</tbody>
</table>
### APPENDIX E

**McGILL PAIN QUESTIONNAIRE.**

Patient name: ____________________  File number: __________  Date: __________

<table>
<thead>
<tr>
<th></th>
<th>None</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throbbing</td>
<td>0)</td>
<td>1)</td>
<td>2)</td>
<td>3)</td>
</tr>
<tr>
<td>Shooting</td>
<td>0)</td>
<td>1)</td>
<td>2)</td>
<td>3)</td>
</tr>
<tr>
<td>Stabbing</td>
<td>0)</td>
<td>1)</td>
<td>2)</td>
<td>3)</td>
</tr>
<tr>
<td>Sharp</td>
<td>0)</td>
<td>1)</td>
<td>2)</td>
<td>3)</td>
</tr>
<tr>
<td>Cramping</td>
<td>0)</td>
<td>1)</td>
<td>2)</td>
<td>3)</td>
</tr>
<tr>
<td>Gnawing</td>
<td>0)</td>
<td>1)</td>
<td>2)</td>
<td>3)</td>
</tr>
<tr>
<td>Hot-burning</td>
<td>0)</td>
<td>1)</td>
<td>2)</td>
<td>3)</td>
</tr>
<tr>
<td>Aching</td>
<td>0)</td>
<td>1)</td>
<td>2)</td>
<td>3)</td>
</tr>
<tr>
<td>Heavy</td>
<td>0)</td>
<td>1)</td>
<td>2)</td>
<td>3)</td>
</tr>
<tr>
<td>Tender</td>
<td>0)</td>
<td>1)</td>
<td>2)</td>
<td>3)</td>
</tr>
<tr>
<td>Splitting</td>
<td>0)</td>
<td>1)</td>
<td>2)</td>
<td>3)</td>
</tr>
<tr>
<td>Exhausting</td>
<td>0)</td>
<td>1)</td>
<td>2)</td>
<td>3)</td>
</tr>
<tr>
<td>Sickening</td>
<td>0)</td>
<td>1)</td>
<td>2)</td>
<td>3)</td>
</tr>
<tr>
<td>Fearful</td>
<td>0)</td>
<td>1)</td>
<td>2)</td>
<td>3)</td>
</tr>
<tr>
<td>Punishing-cruel.</td>
<td>0)</td>
<td>1)</td>
<td>2)</td>
<td>3)</td>
</tr>
</tbody>
</table>
APPENDIX F

CROM Procedure Manual

Procedure for Measuring Neck Motion with the CROM

CROM (Cervical Range of Motion instrument) is a product of:

PERFORMANCE ATTAINMENT ASSOCIATES
3550 LaBore Road, Suite 8
St. Paul, MN 55110-5126
612-484-0004 or 800-835-2766
Introduction

Pain and loss of motion in the cervical region are common problems that increase with age. Over 40 million adult Americans suffer from some form of osteoarthritis or degenerative joint disease, and 50 to 85 percent of these people will experience debilitating back or neck pain of a temporary or chronic nature.

Accurate measurement of cervical motion during the course of a therapeutic regime can provide objective data on the benefits of the selected treatment. However, currently available measurement devices are time consuming, cumbersome, poorly standardized and poorly accepted by practitioners. In response to this lack of an acceptable means of measurement, existing devices were evaluated and the following design criteria established:

- easily applied
- quickly read
- standardized landmarks and positioning
- standardized protocol
- reproducibility
- simple design
- reasonable cost

Based on these criteria, the CROM instrument, accessories and protocol were developed. The CROM accurately and quickly measures the range of sagittal, coronal and horizontal movements that can be performed by the head and neck.

To perform and document accurate cervical measurements you will need the following items:

- CROM instrument, including the rotation arm and the forward head arm
- magnetic yoke
- vertebra locator
- tape measure
- recording sheets
- procedure manual
The CROM instrument is aligned on the nose bridge and ears and is fastened to the head by a Velcro strap (see figure 1).

Three dial angle meters are used to take most of the measurements. The sagittal plane meter and the lateral flexion meter are gravity meters. The rotation meter is magnetic and responds quickly to the shoulder-mounted magnetic yoke, accurately measuring cervical rotation. Because the rotation meter is controlled by the magnetic yoke, shoulder substitution is eliminated.

Two frequently observed problems seen in patients with cervical dysfunction are forward head (cervico-thoracic postures) and rounded shoulders (acromial protraction). Forward head is the anterior glide of the cervical spine and head with cervical hyperextension. The CROM instrument, with the forward head arm and the vertebra locator, accurately measures forward head (see figure 2).

Rounded shoulder is the anterior movement of the scapula (shoulder and upper extremity) on the thorax. Rounded shoulder measurements are taken with the tape measure.
Cervical Flexion and Extension

Instruct the subject to sit erect in a straight-back chair with the sacrum against the back of the chair, the thoracic spine away from the back of the chair, arms hanging at sides and feet flat on the floor. Next, instruct the subject to position the CROM instrument as if putting on a pair of glasses. Fasten the velcro straps snugly in line with the bows. You will not need the magnetic yoke, rotation arm, forward head arm or vertebra locator for these measurements.

To assure full flexion in this multi-joint area, first instruct the subject to "nod your head to make a double chin" (suboccipital flexion). Then encourage the subject to flex further until full cervical flexion is obtained (see figure 6). To take the reading on the sagittal plane meter, read through the meter’s beveled edge; from this angle the pointer will be magnified to the dial edge. Record this measurement in the appropriate space on the recording sheet.

Figure 6: Cervical flexion

To measure cervical extension, first instruct the subject to "nod your head back" (suboccipital extension). Then have the subject extend further until full extension is achieved (see figure 7). Record this measurement also.

Figure 7: Cervical extension
Lateral Flexion

Instruct the subject to sit erect in a straight-back chair with the sacrum against the back of the chair, the thoracic spine away from the back of the chair, arms hanging at sides and feet flat on the floor. Note: to eliminate rotation during lateral flexion the subject should focus on a point or a wall straight ahead. The sagittal plane meter will read zero if the subject is looking straight ahead. The lateral flexion meter will also read zero if the head is not laterally flexed. If the lateral flexion meter does not read zero, record the reading as lateral flexion at rest. You will not need the magnetic yoke, rotation arm, forward head arm nor vertebral locator for these measurements.

Instruct the subject to flex the head laterally to the left, keeping the shoulders level and without rotating the head (see figure 8). Monitor for shoulder elevation by lightly placing your hand on the right shoulder, and correct manually any head motion outside the coronal plane. Note and record the measurement from the lateral flexion meter.

Now instruct the subject to flex the head laterally to the right, again keeping the shoulders level without rotating the head (see figure 9). As before, monitor for left shoulder elevation and correct head motion.
Rotation

You will need to use the CROM instrument plus the magnetic yoke and rotation arm for these measurements. To obtain an accurate rotation measurement, first determine which direction is north.*

Next, place the magnetic yoke on the subject's shoulders with the arrow pointing north (see figure 10). Instruct the subject to sit erect in a straight-back chair with the sacrum against the back of the chair, the thoracic spine away from the back of the chair, arms hanging at sides and feet flat on the floor. The lateral flexion and sagittal plane meters must read zero for the rotation meter to be level; if necessary, assist the subject into the correct position. As the subject faces straight ahead, grasp the rotation meter between your thumb and index finger and turn the meter until one of the pointers is at zero.

Instruct the subject to focus on a horizontal line on the wall so the head is not tipped during rotation. Have the subject turn the head as far to the left as possible (see figure 11), and to ensure that no shoulder rotation occurs, lightly stabilize the right shoulder with your hand. (Note: if the head and shoulders are rotated together the pointer will not move because the magnetic yoke positioned on the shoulders eliminates shoulder substitution.) Record this measurement in the appropriate place on the recording sheet.

While you lightly stabilize the left shoulder, instruct the subject to turn the head as far as possible to the right (see figure 12). Record this measurement also.

*You can find magnetic (map) north by noting the direction of the red needle on the rotation meter when it is at least four feet from the magnetic yoke.