

A STUDY OF THE EFFICACY OF MANIPULATION AS OPPOSED  
TO CRYOTHERAPY AND MANIPULATION IN THE TREATMENT OF  
TENSION-TYPE HEADACHE.

by

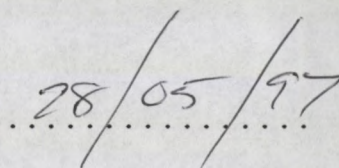
ANTONY KEITH ANGUS

A dissertation submitted in partial compliance with the  
requirements for a Master's Degree in Technology in the  
Department of Chiropractic at Technikon Natal.

I, Antony Keith Angus, do hereby declare that this work is  
my own, both in conception and execution, except where  
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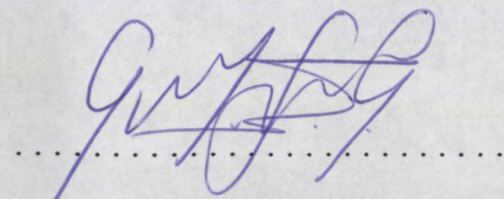


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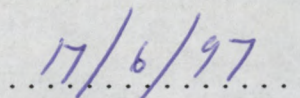


DATE

Approved for final examination



Dr. G.F. Parkin-Smith  
M. Tech: Chiropractic, C.F.I., MCASA



DATE

## DEDICATION

This dissertation is dedicated to my family and parents, Malcolm and Wilma Angus, who have given me continued support and encouragement. It was because of their shared magnanimity that I have completed my studies and this dissertation, a work which has provided a foundation for my chiropractic career.

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## ABSTRACT

### PURPOSE

The purpose of this investigation, was to determine what role cryotherapy plays in conjunction with manipulation in the treatment of tension-type headaches.

The researcher postulates that in order to deliver a beneficial manipulation i.e. one valuable enough to alleviate for instance, a tension-type headache, there must be adequate relaxation of cervical musculature prior to the delivery of the manipulation. Consequently it is hypothesised that the use of cryotherapy will allow the necessary muscle relaxation, and as a result permit a more satisfactory adjustment and ultimately response to treatment.

## METHODS

This is a randomised controlled study consisting of two groups. Group A received chiropractic manipulation only, while group B received chiropractic manipulation and cryotherapy.

Each group consisted of 15 subjects, between the ages of 15 and 75 years, selected from the general population, and randomly allocated to the treatment groups.

Each subject was assessed by means of the CMCC Neck Disability Index, Short-Form McGill Pain Questionnaire and the Numerical Rating Scale; as well as recordings of ranges of motion by means of a cervical goniometer (CROM).

Statistical analysis was completed using the non-parametric Wilcoxon signed-rank test and the Mann Whitney U-test comparing intra-group and inter-group data respectively.

## RESULTS

Patients in both groups responded favourably to their respective treatments in terms of:

- a) pain perception,
- b) disability.

However, results did not exhibit enough statistical significance to warrant interest, yet there was a slight indication that patients in both groups had a favourable clinical response to their respective forms of treatment.

Patients in both group A and B demonstrated an overall improvement in terms of a reduction in pain and disability intensity, irrespective of whether they received chiropractic manipulation alone or in combination with cryotherapy.

A clinically significant difference was noted between the two groups in terms of pain perception and disability, where group B displayed a more favourable long term response to treatment, and was therefore more

likely to maintain that response without return of the symptoms.

### CONCLUSIONS

There was no statistically significant difference present between the two groups to be of concern as regarding the outcome of this research, except for the clinical long term improvement as indicated above.

It is suggested that spinal manipulation is a reliable intervention for the treatment of tension-type headache. Further studies with a larger sample size are needed to clearly evaluate the use of combined therapy with cryotherapy.

Alternatively, spinal manipulation alone would seem to be the treatment of choice in the management of tension-type headache within the present context.

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## LIST OF ABBREVIATIONS

GRP-A: Group A

GRP-B: Group B

SD: Standard deviation

P: P-Value

S: Significant

NS: Non-significant

Tx1: Treatment one

TxF: Final treatment

1Mnth: One month follow up treatment

M: Means

AOI: Average overall improvement

AAP: Average amount of pain experienced

AR: Average ranges of motion

EMG: Electromyography

IVD: Intervertebral Disc

IVF: Intervertebral Foramina

## DEFINITION OF TERMS

MANIPULATION- a manual procedure involving a directed thrust which moves a joint past the physiological range of motion without exceeding its anatomic limit (Gattermen 1995: 12).

ADJUSTMENT- a chiropractic procedure utilising controlled force, leverage, direction, amplitude, and velocity which is directed at specific joints or anatomical regions (Gatterman 1995: 12).

ICE MASSAGE- refers to the slow, careful application of a singular ice cube to the area involved, characterised by a sensation of cooling then burning, followed by aching, relative skin analgesia\anaesthesia.

SUBJECTIVE CLINICAL FINDINGS- refers to the pain questionnaires that subjectively assess the patients condition.

OBJECTIVE CLINICAL FINDINGS- refers to procedures utilised by the practitioner that objectively assess the patients condition.



## 1. CHAPTER ONE

### INTRODUCTION

Many therapies offer relief from headache, yet one that has been most overlooked as a treatment modality is manipulation (Gatterman, 1990: 253). However there is appropriate evidence that supports the use of manipulation as a valid treatment of headache (Vernon, 1982).

Associated muscle tension may be a common finding in many types of headaches (Bogduk, 1992), especially tension-type headaches (Schafer and Faye, 1990: 122), and to ensure that an appropriate and effective adjustment is achieved it is necessary to manipulate through any protective secondary muscle spasm present (Schafer and Faye, 1990: 38); i.e. the rigid neck musculature may hinder proper ranges of motion (Schafer and Faye, 1990: 98), thus reducing the chances of the chiropractor delivering a suitable manipulation.

Much of the past research has been undertaken to determine whether muscle tension is a cause of, or a result of tension-type headache. It has only recently been accepted that tension is the result of tension-type headache and not a cause thereof (Lacroix and Corbett, 1990). The reason for the conflicting evidence is due to the fact that published studies have contrasting results. This may be due to inconsistent study protocols and techniques utilised by the researchers (Kunkel, 1991).

The physiological effects of cryotherapy are numerous: (Schafer and Faye, 1990: 63):

1. Decreases cellular metabolism.
2. Reduces the inflammatory reaction.
3. Diminishes muscle spasm.
4. Controls pain by:
  - decreasing nerve conduction
  - enkephalin production
5. Causes local vasoconstriction.
6. Decreases oedema.

Cryotherapy when applied to the surface of normally innervated skin is known to produce sensory stimulus that may be useful in treating spasm and painful muscles (Wells et al, 1988: 178). Thus, the physiological effect of the ice application on the affected muscles reduces the hypertonicity and intensity of pain that the patient perceives, as well as facilitating the reduction of joint inflammation (Schafer and Faye, 1990: 64), which in turn favours the execution of a controlled, specific manipulation.

#### BENEFITS OF THIS STUDY

This study will attempt to provide a more effective, cost effective, simple and integrated treatment approach in the treatment of tension-type headache. Cryotherapy as an adjunct to manipulation in the treatment of headaches may possibly be constructive, in not only the direct treatment of tension-type headache, but also as a pre-manipulative approach. Removal of

excess muscle spasm and pain that may be present in patients who are treated by chiropractors, be it for tension-type headaches or any other condition that produces excess muscle hypertonicity is likely to facilitate a more speedy recovery.

## 2. CHAPTER TWO

### THE REVIEW OF THE RELATED LITERATURE.

#### 2.1. INTRODUCTION

This chapter will address how the current literature relates to the treatment of tension-type headaches, as well as the properties of cryotherapy, therefore providing a rationale for this study.

It has been found that the most common headaches treated by health practitioners are the tension-type headache, making up approximately 80% of all headache complaints (Dalessio 1987: 172). The chiropractic profession is able to offer a wide variety of treatments for headaches, for example, soft tissue therapy and T.E.N.S., yet one of the most effective modalities that could be used by the chiropractor is the adjustment of the cervical spine (Vernon, 1988:

152). This research project may outline a more effective way of augmenting the treatment of tension-type headaches, via the use of cryotherapy.

#### 2.1.1 Classification of Tension-Type Headache

The headache classification committee of the International Headache Society, currently divides the classification of tension-type headache into episodic and chronic tension-type headache (Headache Classification Committee, 1988).

Part of the diagnostic criteria used to separate the two types of tension-type headache include frequency and duration, and association of tension-type headache with or without pericranial muscle disorders. These occur as follows:

1. Episodic tension-type headache requires a minimum of 10 previous episodes with less than 15 days per month frequency (less than 180 days per year), and may last from 30 minutes to 7 days. It may or may

not be associated with disorder of the pericranial muscles as determined by manual palpation, pressure algometer and EMG recordings.

2. Chronic tension-type headache is present for at least 15 days per month (180 days per year) for at least 6 months duration and as with episodic tension-type headache may or may not be associated with pericranial muscle disorders.

#### 2.1.2 Mechanisms of Tension-Type Headache

Due to the various causes of tension-type headaches it is difficult to attribute a single distinct causative factor for this type of headache (Lacroix and Corbett, 1990). Previously used terms such as "Muscle-contraction" headache, Tension headache, psychomyogenic headache, stress headache, essential headache, idiopathic headache, psychogenic headache, and ordinary headache, (Headache Classification Committee, 1988) refer to a similar symptom picture encountered in this type of headache (Sheftell, 1992).

## VASCULAR CONSIDERATIONS

Studies of the effects of vasodilators, e.g. amyl nitrate, ethyl alcohol, and nicotinic acid on constricted intramuscular arteries; (Ostfield et al, 1957) found that the drugs caused vasodilatation and subsequent relief of the headache, whereas the administration of vasoconstrictors, such as noradrenaline and ergotamine aggravated the tension-type headache.

More recent studies have shown that the temporal arteries in tension-type headache patients fail to dilate normally during exercise, thus reinforcing the belief that tension-type headache is associated with some traces of vasoconstriction, making the effect of the state of blood vessels an integral part of the aetiology of tension-type headache, perhaps more so than muscular changes (Drummond and Lance, 1981).



Cryotherapy effects the tone of blood vessels by initial vasoconstriction, followed by a series of dilation and constriction (*Lewis's hunting reaction*).

During the phases of the hunting reaction the capillary membrane is effected resulting in an increase in blood and metabolic exchange, and ultimately decreasing swelling and tissue damage (Forster and Palastagna, 1985: 200).

#### MUSCULAR FACTORS

For a number of years it has been presumed that constant scalp and neck musculature contraction are the cause of tension-type headache, yet recent studies show that this is not the case (Lacroix and Corbett, 1990). Kunkel (1991) makes note of the probability that the muscle spasm is as a result of the headache rather than the cause. Other authors feel that this issue cannot be resolved without further investigation (Kidd and Nelson, 1993), and that the aetiology of tension-type headache is multifactoral (Lacroix and Corbett, 1990).

Electromyographic (EMG) studies of pericranial muscle tenderness have been associated as a cause of tension-type headache as well as a diagnostic standard (Gobel et al, 1991). Studies done by Langemark and Oleson (1987) showed significant muscular tenderness in association with tension-type headache on digital palpation, yet control patients without headache also complained of increased muscle tenderness. These findings make it likely that central control mechanisms may be blocking pain perception (Langemark and Oleson, 1987). Other studies have refuted this evidence showing little correlation between EMG findings and tension-type headache (Lacroix and Corbett, 1990).

#### PSYCHOLOGICAL

Friedman et al. (1954) observed that in a study of 1000 patients with tension-type headache, that 100% of these patients had some form of contributing emotional factor, such as resentment, aggression, or hostility.

More recent studies by Murphy and Lehrer (1990) indicate that shoulder and neck tension, as well as emotional provocation, will contribute to tension-type headaches.

Dallessio (1987: 177) notes that approximately 84% of depressed patients evaluated mentioned headache as the only complaint or combined with other clinical features. It is believed that the aetiology of depression is possibly associated with lack of brain monoamine neurotransmitters like serotonin and norepinephrine (Dallessio, 1987: 178).

Hatch et al. (1991), in a study of 47 episodic tension-type headache sufferers, showed higher levels of depression, anger and hostility.

Cerbo et al. (1991), found that the usage of amitriptyline (AMT), an antidepressant, on tension-type headache sufferers was effective even though the patients had no anxiety or depression symptoms. It was also noted by Cerbo et al. (1991) that depression is in fact a secondary finding of tension-type headache and would be likely to improve if the headache improved.

## CERVICOGENIC

Although controversy exists concerning the role of the cervical spine in the production of head pain (Vernon, 1988: 143), there is evidence that suggests the possible effects neck pain has on headache aetiologies:

Edmeads (1988) postulates that the following possible conditions must exist for cervicogenic head pain:

1. presence of pain perceptive structures, these include:

- Vertebral periosteum,
- spinal ligaments,
- annulus fibrosis of the IVD's,
- synovial joints of occipito-atlanto and atlanto-axial junctions,
- apophyseal joints,
- cervical musculature and their attachments,
- cervical nerve roots, and
- vertebral arteries.

2. sufficient pain receptors within the cervical structures that can receive stimulus from pathological causes or physiological dysfunction.

Pathological causes such as:

- Inflammation/subluxation of apophyseal and synovial joints due to arthritic processes, trauma or infection.
- Disc herniation and/or trauma may impinge on cervical nerves and nerve roots.
- Trauma/inflammation of cervical muscles and ligaments.
- Infection, tumour or trauma to the periosteum.
- Spontaneous dissection, occlusion or irritation to the vertebral artery.

3. recognisable neurological pathways and mechanisms through which pain can be conveyed from cervical segments to the head:

- To the back of the head by compression, irritation or inflammation of C2 sensory root.

- Orbito-frontal-vertex pain through the C1 sensory root.
- Pain referral to the V1 dermatome via tentorial nerves which when stimulated activate the trigeminal nerve.
- Stimulation of the upper cervical nerve roots (C2-C4) will effect the trigeminal nerve and thus effect the V1 (ophthalmic division of trigeminal) dermatome.
- Scalp musculature can be effected due to myofascial and aponeurotic connections.

Edmeads (1988) was the first to describe the role of cervical joints in the production and radiation of pain, which occurs through several mechanisms involving sensory nerve roots in the cervical spine, as well as the neurological processes associated with the relevant anatomy.

Bogduk (1992), states that cervicogenic headache may arise as a result of cervical synovial joint dysfunction, confirmed by abnormal motion palpation

findings and reduction of headache after the administration of anaesthetic into the affected joint.

Vernon et al. (1992), found that joint dysfunction and myofascial syndromes within tension-type headache and migraine sufferers follow a pattern much the same that is used to describe the cervicogenic model, thus posing the question whether or not the headaches of tension-type and migraine arise solely from the neck.

Many occupations require tremendous overuse of the neck, i.e. static muscle load and awkward working environment, all of which result in disturbances within the joints and musculature, (Gatterman, 1990: 253). Proposed disturbances in posture, whether affecting the joint or muscles, may also result in degeneration and joint instability, myofascial trigger points and rheumatoid arthritis (Vernon, 1988: 152).

Myofascial trigger points occur as hyperirritable sites in a taut skeletal muscle band that has the ability to refer pain away from its point of origin. Active trigger points are those that cause the patient pain, whereas latent trigger points are those that exhibit

few clinical signs and symptoms except for weakness and restriction of muscular movement (Travell and Simons, 1983: 12). It is recognised by Travell and Simons (1983: 13) that active trigger points are more likely to be encountered in muscles involving posture, those being the neck, shoulder, pelvic and masticatory muscles. The upper trapezius, levator scapulae, sternocleidomastoid frequently exhibit myofascial tendencies causing headache (Travell and Simons, 1983: 166).

#### 2.1.3 Aetiology of Tension-Type Headache

Vernon (1988: 170) has constructed an anatomical model to explain the causes of pain arising in the head as a result of the cervical spine. The model is as follows:

Within the first category:

a) Extrasegmental- the large muscles found within the cervical region, i.e.

- Trapezius.
- Sternocleidomastoid.



- Levator scapula.
- Splenius.
- Occipitofrontalis.
- Semispinalis capitus.

He states that these muscles are prone to various low-level, intensifying stresses, e.g.

- Postural strain.
- Occupational strain (typists).
- Trauma (whiplash injuries).
- Myofascial component known as 'trigger points' which is covered extensively in the literature by Travell and Simons (1983).

The muscle hypertonicity or tension may cause secondary entrapment of neurovascular structures, such as the greater occipital nerve as it exits through the upper borders of the trapezius musculature, thus possibly creating referred head pain (Vernon, 1988: 171).

The second category:

b) Intersegmental- encompasses the joints, i.e.

- Intervertebral joints,
- apophyseal joints,
- uncovertebral joints,
- deeper, short, segmental muscles.

Boake (1972) states that pain is caused due to a locking of the joint as a result of an impinged synovium, or cartilage fibril obstructing proper movement, contributing to pain and muscle spasm. According to Bogduk (1979), Bogduk (1992), Bogduk et al. (1985), as well as other authors (Edmeads, 1988; Boake, 1972), it is an anatomical finding that the joints and ligaments of the first three cervical vertebrae are supplied by branches of C1, C2 and C3 spinal nerves. The nerve supply of these nerves congregate at the spinal nucleus of the trigeminal nerve, which is the fundamental nociceptive nucleus of the upper neck and head, making this nucleus the medium through which stimuli from the cervical structures is registered.

The third category:

c) Infrasegmental- described by Vernon (1988: 175) as a low-pitched concentrated disturbance of nerve roots, dorsal root ganglia and sympathetic nerve fibres as they become intruded upon by structural deformities, degeneration (osteophytes) or irritated by inflammation.

The fourth category:

d) Intrasegmental- is primarily concerned with the influence that sensory input has on the transmission of pain in the central nervous system.

Diamond and Dalessio (1992: 124) attribute the mechanism of tension-type headache to chronic muscle contraction anywhere in the body as a result of muscle spasm linked to the central nervous system involving neural pathways and reflex arcs. The mechanisms by which the muscle becomes involuntarily spasmed or induced to remain contracted, can be explained via the pathways involved (Diamond and Dalessio, 1992: 124).

Gatterman (1990: 252) discusses the arthrokinetic reflex which involves the intraarticular nociceptors: When intraarticular nociceptors are irritated by mechanical or chemical stimulus produced by joint pain, there begins an arthrogenic muscle spasm with referred pain due to the activation of convergent neurones. This arthrokinetic reflex may also be initiated by joint fixation or hypomobility. Cervical manipulation, may bring about a change in the abnormal cervical biomechanics, to the extent that the clinical features of tension-type headache are diminished (Gatterman, 1990: 253).

Pain is produced through several pathways in the nervous system, (Faucet et al, 1980) i.e. via chemical substances. However, this study is only concerned with those caused by bony disrelationships and nervous stimuli.

The mechanism is as follows:

1. A bony disrelationship will cause stretching of muscle tendons and ligaments which activate nervous

stimuli in the dorsal roots of a specific spinal nerve (Faucret et al, 1980).

2. The stimuli then travel via the posterior funiculus up the dorsal columns to the *nucleus ventralis posterolateralis* (VPL) of the thalamus (crude awareness of pain) and the somesthetic cortex where the stimulus registers as pain (Tan and Wong, 1990: 208).
3. A subluxation also induces nervous stimuli, which, via the dorsal roots of the spinal nerves at the effected level, transmit impulses through the posterior horns via the association neurones and then upwards through the spinoreticular tracts to the reticular activating system (Faucret et al, 1980).
4. At this point the impulse is able to affect several different structures e.g. any stimuli that proceeds to the limbic lobe may cause mental and behavioural changes leading to anxiety and headache (Faucret et al, 1980).
5. Any conduction of impulses to the cerebral cortex will then run through the corticoreticular tracts

down the medial and lateral reticulospinal tracts which synapse with the anterior horns and lower motor neurones to cause alteration of muscle tone leading to muscle spasticity and ultimately pain (Faucret et al, 1980).

#### 2.1.4 Pathomechanics of tension-type headache

- AGE:

It is suggested (Dalessio 1987: 172) that this type of headache may occur at any age, but is more commonly found in adults, which is about the time that individuals experience an increase stress in life.

Table 2.1 Age of onset of Tension headache in 466 patients. (Lance et al 1965)

Age (years)	Percentage of patients
0-10	16
10-20	24
20-30	19
30-40	17
40-50	15
50-60	6
60-70	2
70-80	1

- SEX DISTRIBUTION:

Tension-type headaches within the general population show a predilection for women (Diamond and Dalessio 1992: 124). Lance (1982: 102) states that approximately 75% of chronic tension-type headache patients are women, whereas it is indicated by Diamond and Dalessio (1992: 124) that a 77% family history of chronic tension-type headache has been reported.

- PREVALENCE:

The prevalence of tension type headaches in a given population seems to remain somewhat unclear. For instance it was found that of 1152 patients referred to a medical clinic with complaint of headache symptoms, of which approximately one third suffered from tension-type headache (Lance et al. 1965).

Other authors found the prevalence to be some what higher. Up to 80% of patients seen by a physician or general practitioner, will suffer from tension-type or muscle contraction headaches (Dalessio 1987: 172).



- CLINICAL SIGNS AND SYMPTOMS:

A tension-type headache commonly presents as a bilateral headache in approximately 90% of cases researched (Lance, 1982: 102), yet Kunkel (1991) states that the headache may be unilateral and can be localised to a specific area such as the occipital or frontal area. Diamond and Dalessio (1992: 122) state that tension-type headache whether unilateral or bilateral, can still encompass a singular muscle, whether:

- Temporal,
- occipital,
- parietal, or
- frontal,
- as well as in association with each other.

The pain is described as dull and persistent, and fluctuates in intensity during the day (Lance, 1982: 103; Raskin, 1988: 215; Kunkel, 1991). The patient may describe the pain as a pressure or 'hat-band' tightness that encircles the head (Lance, 1982: 103; Kunkel,

1991; Diamond and Dalessio 1992: 122), as well as a feeling of stiffness and tightness in the trapezius and upper back muscles (Kunkel, 1991), or what Diamond and Dalessio (1992: 122) describe as a "cast-like" feeling over the neck and upper back, possibly with a cramping sensation.

Associated visual symptoms as experienced in migraine are lacking (Kunkel 1991). Nausea, vomiting, and anorexia are features that are rarely present, with dizziness, fatigue, tiredness and depression being frequently present in the tension-type headache sufferer (Dalessio, 1987: 173; Kunkel, 1991: 596; Lance, 1982: 104; Diamond and Dalessio, 1992: 122).

Activities that aggravate the headache include:

- Excess amounts of sensory input, like noise, glare, as well as tension and trepidation (Lance, 1982: 104).
- It has been noted that administration of vasoconstrictor drugs will likewise aggravate the headache (Ostfeld et al, 1957).

Relieving factors include:

- Vasodilators (Ostfeld et al, 1957), alcohol, aspirin and various combinations of caffeine and analgesics (Lance, 1982: 105).

#### 2.1.5 Available Treatments and Their Efficacy

It is essential that prior to any form of treatment that any underlying pathology is excluded e.g. space occupying lesions (Lance, 1982: 110). It is also essential to ascertain that the patient is not suffering from dental or ophthalmic pathologies which may be contributing to the patients condition (Lance, 1982: 110).

Psychological treatments may include:

1. Spinal manipulative therapy,
2. Psychiatric counselling,
3. Use of sedatives,
4. Vasodilators (combination of 2. And 3. showed no response any different from placebo),

5. Muscle relaxants (both without results),
6. Results have been obtained with certain antidepressants,
7. Tranquillisers,
8. Alternative therapy, e.g.
  - Homeopathy.
  - Naturopathy.
  - Acupuncture.
  - Diet therapy.
  - Reflexology.
  - Aromatherapy.

## 2.2 MANIPULATION

### 2.2.1 Pertinent Biomechanics and Anatomy of the Cervical Spine in Relation to Headaches.

#### PAIN PRODUCED VIA NERVE STRUCTURE INVOLVEMENT

It is possible that pain arising in the head as a result of a cervical aetiology has its origins through any structure innervated by the nociceptive nerve endings of the first four cervical nerves (Curl, 1994: 55), some examples of some of these structures are (Edmeads, 1988):

- Apophyseal joints.
- Synovial joints of the occipito-atlanto and atlanto-axial junctions.
- Annulus fibrosis of the intervertebral discs (IVD).
- Spinal ligaments.
- Vertebral periosteum.
- Cervical muscles and their bony attachments.

- Cervical nerve roots.
- Vertebral arteries.

The particular nerves that will elicit pain within the cervical spine are (Curl, 1994: 55):

1. Dorsal rami (posterior primary division)

These rami innervate:

- Deep back muscles.
- Zygapophyseal joints and interspinous ligaments (both supplied via the medial branch of the dorsal ramus).
- The lateral branch of the dorsal ramus will innervate (excluding C1) the following muscles, the erector spinae, splenius capitis, and cervicis muscles as well as the sensory supply to the skin at the back of the neck.
- C1 dorsal ramus terminates in the suboccipital region, and may give rise to orbital, frontal and vertex pain (Edmeads, 1988).
- C2 dorsal ramus and its medial branch encompass the suboccipital area as well as the posterior occiput

up to the vertex. This nerve root is important because it can produce posterior occiput pain if snared between a posterior cervical muscle (Curl, 1994: 57).

## 2. Ventral rami (anterior primary division)

These rami innervate:

- Longus capitis.
- Longus coli.
- Rectus capitis anterior.
- Lateralis muscles.
- Vertebral bodies.
- Anterior longitudinal ligament.
- Anterior aspect of the IVD's.
- Are a components of the cervical and brachial plexuses which innervate the upper extremities.

## 3. The recurrent meningeal nerve

These nerves in the cervical spine are formed by the ventral rami and the sympathetic nerves in conjunction with the vertebral artery (Curl, 1994: 58).

The fibres of these nerves supply:

- Posterior aspects of the IVD's.
- Posterior longitudinal ligament.
- Anterior spinal dura mater.
- Posterior vertebral bodies.
- Uncovertebral joints.

C1-C3 recurrent meningeal nerves supply:

- The atlantoaxial joints.
- Tectorial membrane.
- Parts of the cruciate ligament.
- Alar ligaments.

Within the posterior cranial fossa:

- Cranial dura mater.
- Region of the clivus associated with C3.

#### 4. Sensory nerves and their relationship with the cervical autonomic chain.

It has been noted (Edmeads 1988), that the posterior cervical sympathetic chain in association with irritation by osteophytes may cause headaches and other



sensory disturbances. An increase in sympathetic output, may increase smooth muscle tone and with it cause vasoconstriction leading to ischaemia, spasticity and ultimately pain (Faucet et al. 1980).

#### PAIN PATHWAYS

See relevant sections on spinothalamic pathways which have already been discussed in an earlier section.

#### THE TRIGEMINAL SYSTEM

The trigeminocervical nucleus within the grey matter of the spinal cord and is known to extend as far as the upper 3 to 4 spinal cord segments. Sensory axons terminate within these spinal cord segments but also have collateral's to adjacent segments, and all stimuli from structures in the upper neck, head and throat will be interceded within the trigeminocervical nucleus (Bogduk 1992).

## PAIN REFERRAL

It is possible for pain to be referred away from its source even to great distances (Curl, 1994: 69).

Somatic referred pain is produced by a skeletal related structure e.g. joints, ligaments, muscles, is often described as dull and aching (Curl, 1994: 70).

Radicular pain is pain originating via activation of sensory fibres at the level of the involved root or it's ganglion e.g. IVD disc protrusion, joint arthrosis

### 2.2.2 Mechanical and Physiological Effects of the Adjustment

Spinal joint manipulation is an assisted passive motion applied to spinal apophyseal joints (Curl, 1994: 293).

Leach (1986: 15), defines a manipulation as "*the forceful passive movement of a joint beyond its active limit of motion*", but the term adjustment is considered unique as a term to describe Chiropractic manipulation

in that it entails use of short-lever, specific, high-velocity, controlled forceful thrusts by hand aimed at individual articulations (Gatterman, 1995: 12). Directly after an adjustment there is a temporary increase in active and passive ranges of motion into the paraphysiological space (Sandoz, 1976) (Cassidy. et al. 1992).

Sandoz (1976) notes that because of this swift action that occurs into the paraphysiological space, together with the stretching of the articular capsule up to the point of compromising the anatomical integrity, an adjustment can be representative of a concentrated arousal of joint proprioceptors.

The vertebral zygapophyseal (facet) joints and facet syndrome has been described as a common source of spinal pain and dysfunction. Fortunately the application of spinal manipulative techniques has been shown to be the treatment of choice for facet syndrome, (Gatterman, 1990: 399).

The specific effects of spinal adjustment can be narrowed down to certain mechanical and reflex mechanisms (Curl, 1994: 297):

Mechanical mechanisms	Reflex mechanisms
1. Mechanoreceptor stimulation	Inhibition of pain
2. Stretching of muscle spindles	Inhibition of muscle spasm
3. Increase in active and passive joint motion	Stimulation of autonomic nervous system

Gatterman (1995: 106) refers to the following possible mechanical changes that can be noted as a result of manual therapy:

- Produce changes in the alignment of the joints.
- Influence any motion dysfunction.
- Effect the dynamics of the spinal curvature.

Haldeman (1991: 3) draws the following conclusions as concerning the effect of manipulation on pain relief:

- An increase in local pain threshold levels and thus a greater pain tolerance,
- muscle spasm release,
- increased range of motion,
- certain psychological effects as a result of the manipulation improve sense of well being,
- decrease the chances of disc protrusion.

### 2.2.3 Contraindications and Indications to Manipulation

The following pathological findings have been noted as contraindications (Curl, 1994: 298):

- Osteoporosis\osteomalacia (esp. Post menopausal females, and those on long-term corticosteroid therapy).
- Bleeding disorders.
- Certain spondyloarthropathies e.g. rheumatoid arthritis, psoriatic arthritis, Reiter's syndrome, ankylosing spondylitis.
- Atlanto-axial instability.
- Advanced spondylotic changes.
- Degenerative disc disease.

Anatomical variants e.g. fused segments or block vertebra.

- Destructive spinal lesions e.g. fractures, dislocations.
- Segmental instability esp. craniocervical transition.

- Cervical disc herniations with neurological deficit.
- Any spinal cord pathology.
- Spinal cord compression.

The risk of cerebrovascular accidents can be reduced by

a) Reducing use of extension with rotation. (Gatterman, 1990: 67) .

b) Use of excessive force during the adjustment.

c) Prior to treatment, the neck should be held in extension and rotation on both sides for at least 45 seconds, if the patient complains of dizziness or nausea and nystagmus is observed then manipulation is contraindicated.

Indications of manipulation are (Schafer and Faye, 1990: 40)

- Increasing spinal mobility.
- Freeing entrapped or stretched nerves.
- Returning IVD's and IVF's to their normal boundaries.
- Extend shortened tendons and ligaments.
- Break adhesions.

## 2.3 THE EFFECTS OF CRYOTHERAPY

### 2.3.1 Physical Principles.

Ice has certain properties which are more advantageous than just the use of cold water i.e. it requires notably more energy; 491 Joules to raise the temperature of ice at 0 degrees centigrade to 37 degrees centigrade than it takes to raise the temperature of water to 37 degrees centigrade: 155 Joules, thus making ice a more appropriate medium for effective cooling of tissues (Forster and Palastagna, 1985: 199).

### 2.3.2 Physiological Effects

According to Schafer and Faye, (1990: 61) cooling of tissue will:

1. Decrease local cellular metabolism,
2. initially constrict blood vessels,
3. decrease nerve excitability and



4. conduction including muscle afferent response,
5. blood histamine release is curbed (Schafer and Faye, 1990: 61).

### 2.3.3 Therapeutic Uses

Ice has these known therapeutic effects (Forster and Palastanga, 1985: 199):

1. Reduction of pain,
2. spasticity,
3. muscle spasm,
4. swelling,
5. as well as repair recovery and excitatory stimulus on inhibited muscles.

### 2.3.4 The Use of Cryotherapy with Respect to Tension-type Headache.

As a response to pain from any type of mechanical disorder or disease process, muscle spasm occurs which protects and immobilises the injured area. The nature

of this spasm is an involuntary sustained contraction, that employs large amounts of nutrients as well as creating ischaemia (Wells et al, 1988: 178). Due to the compression of the intramuscular blood vessels, this action ultimately results in tissue damage and excess pain and muscle spasm (Wells et al, 1988: 178). Although ice has all these physiological effects on tissues, of major concern in this study is the effect the ice will have on the neuromusculoskeletal component of a tension-type headache sufferer, as concerns the effects ice may have on the tension-type headache itself are of secondary concern.

Of interest is the neural response obtained by cryotherapy, in particular the use of ice in reducing muscle spasm. Spasm is defined as a normal muscular response to injury or pain (Forster and Palastagna, 1985:201), causing the muscle to restrict motion so to prevent any deleterious damage to itself. Pain is probably as a result of accumulation of metabolites within the muscle, and this would explain one of the vascular theories of why ice is effective as it

provides intervals of vasodilatation (Lewis's Hunting reaction) when there is increased blood flow through the capillaries, decreased inflammation, and facilitating repair of damaged tissues (Wells et al, 1988: 177), (Forster and Palastagna, 1985: 200).

The effects of the ice are immediate, that is, there is a decrease in spasm within 30 seconds, the manner in which this occurs is due to inhibitory changes at the anterior horn cells which reduce muscle tone (Forster and Palastagna, 1985: 202).

The length the ice is kept on the skin will ensure cooling of deeper structures like ligaments, capsules, muscles and musculotendinous structures (Schafer and Faye, 1990: 63). Superficial cooling will cause a drop in temperature of about 15 degrees Celsius within 2-5 minutes, whereas deeper tissues such as muscle will take up to 20 minutes to drop 5 degrees Celsius, or longer if there is significant subcutaneous fat deposits (Wells et al, 1988: 176).

Although ice acts as a spasmodic inhibitor and therefore a direct therapeutic tool, it can also reduce

the levels of pain, and act as a analgesic affecting the central nervous system, and be used as a adjunct to pain control (Wells et al, 1988: 178).

#### 2.3.5 Validity of Cryotherapy in the Treatment of Tension-Type Headache

The use of ice as a therapy for pain has existed in medicine for numerous years, although certain applications have changed the principles still remain the same (Wells et al, 1988: 176).

The use of cryotherapy is an integral means to control pain and inflammation, this has always been of great therapeutic concern especially during the early stages of treatment (Schafer and Faye, 1990: 64)

2.3.6 Indications and Contraindications. (Schafer and Faye, 1990: 64.).

INDICATIONS	CONTRAINDICATIONS
1. Reduces circulation to inflamed areas.	Chilblains.
2. Diminishes post-traumatic bleeding.	Coma.
3. Attenuates spasm and spasticity.	Cryesthesia.
4. Closed pressure sores.	Paroxysmal cold hemoglobinuria.
5. Decreases swelling.	Raynaud's phenomenon/disease.
6. Alleviates pain and reflex muscle spasm.	Rheumatoid or Gouty arthritis.
7. Sprains and strains.	
8. Varicose ulcers.	

It has been recognised that the use of ice may deteriorate muscle spasm therefore care must be taken when applying ice in acute cases (Wells et al, 1988: 179), (Schafer and Faye, 1990: 64).

#### 2.4 CONCLUSION

The literature reflects that tension-type headache is a universal condition which can be treated with various modalities and methods, one of which is chiropractic and the other being cryotherapy. The therapeutic effects of ice on it's own and manipulative therapy are well known, yet it seems that not much literature contains information of ice as a additional therapy in the treatment of tension-type headache. This study may provide additional evidence to support the use of combined spinal manipulative technique and cryotherapy for the relief of tension-type headache.

## CHAPTER THREE

### 3.1 INTRODUCTION

This is an outline of the procedures followed in the execution of this dissertation with respect to the following aspects:

- Measurements and observations,
- study design and protocol,
- statistical analysis.

### 3.2. MEASUREMENTS AND OBSERVATIONS

#### 3.2.1 The data

The data required in this study consists of two types: primary and secondary data.

#### 3.2.1.1 The primary data.

The response of patients subjected to chiropractic treatment in terms of:

1. CMCC Neck Disability index.
2. Short form McGill pain questionnaire.
3. Numerical Pain Rating Scale 101.
4. Range of motion with the cervical goniometer CROM.

#### 3.2.1.2 The secondary data.

Data obtained from current literature involving chiropractic, tension-type headache and cryotherapy.

### 3.2.2 Method of measurement

#### 3.2.2.1 Subjective Data

- The CMCC Neck Disability Index (appendix 4):



The purpose of this questionnaire is to indicate to the researcher how neck pain affects the patients ability to cope with everyday activities.

There are 10 questions, each question scores a minimum of 0 and a maximum of 5 points, making a maximum accumulated total of 50. The questionnaire is scored as a percentage.

The CMCC Neck Disability Index has been found to have a high degree of reliability, (Vernon and Mior, 1991: 409) as well as consistency. The questionnaire has also shown acuteness to changes in disability and severity throughout the period of treatment.

Vernon and Mior (1991: 414), have found that the questionnaire is applicable to a wide age range, does not seem to be effected by gender, and has a adequate level of validity.

- The Short-Form McGill Pain Questionnaire (appendix 5):

The purpose of this questionnaire is used to depict the sensory aspect of the pain experience, the questionnaire consists of 15 descriptive words (descriptors), each of which are ranked according to an intensity scale: 0=None, 1=Mild, 2=Moderate, 3=Severe (Melzack, 1975).

- The Numerical Pain Rating Scale 101 (appendix 6):

This questionnaire is used to indicate by means of percentages the intensity of the pain experience before treatment when the pain is at its worst, and when it is at its least. An average between these two will produce an indication of the experienced pain intensity.

Jensen et al. (1986: 117) conducted a study where 6 different methods to judge pain intensity were matched, these methods were appraised according to 5 principles:

1. Ease of scoring.

2. Relative rates of incorrect response.
3. Sensitivity as defined by the number of available response categories.
4. Sensitivity as defined by statistical power.
5. Magnitude of the relationship between each scale and a linear combination of pain intensity indices.

It has been confirmed by Jensen et al. (1992) that the Numerical Pain Rating Scale 101 has more practical advantages over other procedures, as it was simple to score, can be dealt with in a written or verbal form, does not seem to be associated with age.

#### 3.2.2.2 Objective Data

- Cervical range of motion (appendix 8)

The CROM, or cervical range of motion instrument manufactured by Performance Attainment Associates, was used to measure neck motion. Ranges of motion utilised

were flexion, extension, lateral flexion to the right, lateral flexion to the left, rotation to the right, rotation to the left, and were all measured in degrees.

A study was carried out by Youdas et al. (1991: 81) to ascertain the reliability of the Cervical Range of Motion Instrument as compared to two other similar instruments. The Cervical Range of Motion Instrument demonstrated a high degree of reliability.

It was also observed that the instrument had a good inter-examiner reliability, and did not aggravate the subjects pain while being used.

### 3.3 STUDY DESIGN AND PROTOCOL

#### 3.3.1 Object of the Study

The object of the study was to determine the effectiveness of each respective treatment method in terms of objective and subjective measurement. The study would attempt to ascertain whether there existed

a more effective treatment method for the chiropractic management of tension-type headache.

### 3.3.2 The Subjects

This study was a randomised comparative study in which 30 patients between the ages of 16 and 70 were recruited by means of advertising and the general patient pool that made use of the services provided at the Technikon Natal Chiropractic Day Clinic.

### 3.3.3 Allocation of patients

On presentation at the clinic a prospective patient was evaluated in terms of:

- Complete case history (appendix 1).
- Complete physical examination (appendix 2).
- Regional examination of the cervical spine (appendix 3).

On collation of this information it was then decided by the researcher if the patient would be included or

excluded according to the criteria set out in this study (refer to criteria list). If the patient was accepted into the study they would be required to complete a patient consent form and subsequently randomly allocated to either Group A or Group B.

Each patient was required to complete the following documents:

- Patient information (appendix 1).
- CMCC Neck Disability Index (appendix 4).
- Short-Form McGill Pain Questionnaire (appendix 5).
- Numerical Pain Rating Scale 101 questionnaire (appendix 6).

Group A received chiropractic treatment only, whereas Group B received cryotherapy and chiropractic treatment.

Where indicated patients would undergo radiographic examination of the cervical spine prior to treatment, to exclude possible pathology such as fracture, tumour or advanced degeneration.

#### 3.3.4 Inclusion and Exclusion Criteria of Patients

1. Only those subjects diagnosed as suffering from tension-type headaches according to the Headache Classification Committee of the International Headache Society (1988), and who presented with no additional pathology contraindicating spinal manipulative therapy were accepted into the study. Patients who had other conditions as well as tension-type headaches were accepted, however only the tension-type headaches will be treated.
2. Any patients developing secondary illness contributing to their tension type headache during the period of proposed study were excluded.
3. Patients will be asked to refrain from using muscle relaxant, anti-inflammatory and/or analgesic medication that may influence the results of the study. However usage of any pain relieving drug may be permissible if the headache is severe, and then

must report to the researcher as to the type and dosage of the drug being used.

4. Patients with hard neurological signs were excluded from the study.
5. Patients presenting with evidence of vascular insufficiency of the neck or cranial structures were not accepted into the study.



#### 3.3.5 Admissibility of the Data

Only data obtained from the CMCC Neck Disability Index, the Short Form McGill Pain Questionnaire , and the NRS Pain Rating Scale that were correctly completed under supervision were used.

Data used, was only that data taken from subjects that were admitted into the study.

Both groups completed the same data and received the tests all except for the manner of treatment.

#### 3.3.6 Interventions

Those 15 patients that were selected for group A received adjustment of the pertinent levels only, while those that fell into group B received ice massage prior to the manipulation of the relevant levels.

Group A participants prior to treatment were assessed for ranges of motion using the cervical goniometer through all ranges of motion (flexion, extension, lateral flexion to the right and left, and rotation to

the right and left). Then the relevant segments to receive Chiropractic adjustment were determined through motion palpation of the cervical spine based on the objectives set forth by Schafer and Faye (1990: 98), which include:

1. normal and abnormal movement of vertebral segments
2. motion restrictions, "jumps", irregular gliding, and smoothness of motion
3. quality and quantity of bilateral motion

Each cervical motion unit was assessed through flexion, extension, lateral flexion, and rotation to determine mobility and joint end feel.

The fixated segments revealed via motion palpation were then manipulated using one or more of the following techniques as set out in Szaraz (1990).

1. For rotational occipito-atlantal restriction; the occiput rotation (mastoid contact) technique:

The patient is supine, with the headpiece level. The doctor assumes a low squatting position at the patient's head, on the lesion side. The contact hand rotates the head onto the indifferent hand, with the

fingers firmly secured against the rim of the occiput to provide traction. The palmar surface of the contact hand is positioned over the zygomatic arch. A single, pectoral, short amplitude impulse is given under traction along the occipital condyles.

2. For lateral flexion restriction of the occipito-atlantal junction; the occiput lateral flexion (zygomatic contact) technique:

The patient is supine, with the headpiece level. The doctor assumes a high squatting position at the head of the patient facing caudal, slightly on the side of the lesion. The hand is cupped in the indifferent hand with the fingers under the rim of the occiput, with the arms close to the body, the palmar aspect of the contact hand is placed across the zygomatic arch with the fingers slightly oblique to clear the neck area, and making sure the fingers are off the mandible. The thrust is a single, short amplitude impulse under traction conducted into the palm of the indifferent hand, across the occipital condyles.

3. Lateral atlanto-axial restrictions; lateral atlas (index contact) technique:

The patient is supine, the headpiece is horizontal. The doctor assumes a squatting position at the patients head facing approximately 45 degrees caudal, on the lesion side. The head is deviated away from the lesion side to locate the atlas TVP, the index of the contact hand is placed against the TVP of the atlas, the wrist in line with the forearm in slight ulnar deviation. The thrust is a single, pectoral, impulse type, very high velocity, short amplitude, under traction. The line of drive is slightly cephalad, and is achieved by stepping caudal and directing the forearm along congruent joint surfaces, with no occipital rotation.

4. Rotary atlanto-axial restrictions: rotary atlas (Index contact) technique:

The patient is supine, with the headpiece slightly above horizontal. The patient assumes a squatting position at the head of the patient, the index of the contact hand is placed on the posterior arch of

the atlas, the wrist is straight, the thumb is placed on the zygomatic arch for guiding, as the contact is taken the doctor steps to the side of contact, but remains in the squatting stance. The doctor's sternal notch must be centred over the contact hand. The indifferent hand cups the patients ear with fingers against the occipital rim. The thrust is a single, short amplitude, moderate velocity impulse with mild ulnar deviation of the wrist. The atlas is rotated with the occiput to the point of atlas restriction, slight occipital extension is used to lock the occiput-atlas articulation, the line of drive is in a rotary direction.

5. Rotation restriction from atlas to C7; rotary cervical (index contact) technique:

The patient is supine, the headpiece angle is determined by the location of the lesion, the lower the lesion the higher the headpiece. The doctor assumes a squatting position at the lesion side of the head, when contact is made the doctor steps to

the lesion side, keeping the low squatting position. An index contact is taken over the articular process of the involved vertebra, the wrist is held straight, hand is relaxed, with a firm but hard contact. The indifferent hand cups the ear with the fingers hooked against the rim of the occiput to elicit rotation and traction. The thrust is a sudden, short amplitude, pectoral thrust given at the point of segmental restriction in a rotary manner, there is only slight ulnar deviation of the contact hand, the line of drive is achieved by rotating the segment until restriction, combined with sufficient cephalad traction.

Group B participants prior to treatment were also assessed by cervical range of motion goniometer and motion palpation techniques. Through the use of ice prepared within a polystyrene container, ice-cube massage was applied directly to the upper cervical musculature (excluding anterior muscle groups such as the sternocleidomastoid), as well as the upper division of trapezius. With the patient seated or prone the

application of ice to the exposed area was carried out in a circular manner with the least pressure applied to the part. The maximum duration of massage was 10 minutes, although the desired effect of spasm reduction could be attained within a few minutes (Forster and Palastagna, 1985: 206).

Immediately following the cryotherapy the previously noted motion palpation lesions were manipulated accordingly.

The same procedures were repeated for both groups on subsequent follow-up treatments. On commencement of the final follow-up treatment the patient would once more complete the CMCC Neck Disability Index, Short-Form McGill Pain Questionnaire and Numerical Pain Rating Scale 101 questionnaire as well as having their ranges of motion measured.

Each patient was treated a maximum of 10 times over a period of up to 4 weeks or until clinically asymptotic, with a one month follow up period starting at the end of the 4 week intervention period. After 4 weeks had

passed the patient was once again evaluated with the above mentioned questionnaires and appropriate goniometric measurements, prior to their respective group treatment protocols.

### 3.3.7 Solving for the Subproblems

#### 3.3.7.1 The First Subproblem

The first subproblem was to assess the combination of cryotherapy and manipulation of the cervical spine in order to ascertain the efficacy of this approach in the management of tension-type headache in terms of the subjective clinical findings.

The hypotheses for group A and group B were:

**Ho:** There would be no difference in the subjective clinical findings on analysis of the intra-group data, showing that the treatment was ineffective.



**Ha:** There would be a difference in the subjective clinical findings on analysis of the intra-group data, showing that the treatment was effective.

#### 3.3.7.2 The Second Subproblem

The second subproblem was to assess the combination of cryotherapy and manipulation of the cervical spine in order to ascertain the efficacy of this approach in the management of tension-type headache in terms of the objective clinical findings.

The hypotheses for the group A and group B were:

**Ho:** There would be no difference in the objective clinical findings on analysis of the intra-group data, showing that the treatment was ineffective.

**Ha:** There would be a difference in the subjective clinical findings on analysis of the intra-group data, showing that the treatment was effective.

### 3.3.7.3 The Third Subproblem

The third subproblem was to determine if cryotherapy prior to manipulation of the cervical spine would be a more effective treatment approach than manipulation alone in the management of tension-type headaches in terms of the objective and subjective clinical findings.

By comparing group A with group B the hypotheses were:

**Ho:** There would be no difference in the subjective and objective clinical findings on analysis of the inter-group data, showing that the treatments were equally effective.

**Ha:** There would be a difference in the subjective and objective clinical findings on analysis of the inter-group data, indicating that the treatments showed a difference in treatment efficacy.

### 3.4 STATISTICAL ANALYSIS

#### 3.4.1 Treatment of the Data

The data obtained was treated using the following statistical methods:

- The Non Parametric Unpaired Hypothesis tests i.e. The Mann-Whitney U test to compare data between groups (inter group comparison).
- The Non Parametric Paired Hypothesis tests i.e. The Wilcoxon's Signed Rank test to compare data within the groups (intra group comparison).
- Summary statistics.

#### 3.4.1.1 Treatment of the Subjective Data

The subjective data being that from the CMCC Neck Disability Index, Short form McGill Pain Questionnaire, NRS Pain Rating Scale were collated by means of statistical methods via Statographics Plus version 6.0 and analysed using the Mann Whitney U-test in order to determine whether a significant difference existed between group A and group B.

The Wilcoxon Signed Rank test was used to determine whether a significant difference existed within each of the two groups.

Summary statistics were utilised to determine means between groups.

Analysis of the Standard Deviation will determine the reliability and predictability of the data.

#### 3.4.1.2 Treatment of the Objective Data

The cervical range of motion goniometer (CROM) readings were collated by means of statistical methods via Statgraphics Plus version 6.0, and treated in the same way as for the subjective data.

The ranges of motion are estimates and vary from patient to patient, the readings were recorded before the onset of treatment, these will serve as a baseline whereby further readings will be compared.

#### 3.4.2 Statistical Analysis of the Data

##### 3.4.2.1 The Subjective Data

Use of the Wilcoxon Signed Rank test will determine if there was significant improvement within the two groups. The data compared was taken from:

- The first treatment and the final treatment.
- The first treatment and the one month follow-up.

- The final treatment and the one month follow-up.

i.e.: GROUP A

- 1ST TREATMENT <-----> FINAL TREATMENT
- 1ST TREATMENT <-----> 1 MONTH FOLLOW-UP
- FINAL TREATMENT <-----> ONE MONTH FOLLOW-UP

i.e.: GROUP B

- 1ST TREATMENT <-----> FINAL TREATMENT
- 1ST TREATMENT <-----> 1 MONTH FOLLOW-UP
- FINAL TREATMENT <-----> ONE MONTH FOLLOW-UP

The figures were compared to determine standard deviation and level of significance.

All subjective data collected and assessed using the Mann Whitney U-test will determine if there is a significant difference between the two groups at the first treatment, final treatment and one month follow-up. The data compared was taken from:

- The first treatments (trx.1) of group A and group B.
- The final treatments (final trx) of group A and group B.

- The one month follow-up (1 month f/u) of group A and group B.

i.e.:

- GROUP A (trx. 1) <-----> GROUP B (trx. 1)
- GROUP A (final trx) <-----> GROUP B (final trx)
- GROUP A(1 month f/u) <-----> GROUP B (1 month f/u)

The figures were compared to determine standard deviation and level of significance.

#### 3.4.2.2 The Objective Data

Use of the Wilcoxon Signed Rank test will determine if there was significant improvement within the two groups. The degrees compared for each plane of movement were taken from:

- The first treatment and the final treatment.
- The first treatment and the one month follow-up.
- The final treatment and the one month follow-up.

i.e.: GROUP A

- 1ST TREATMENT <-----> FINAL TREATMENT
- 1ST TREATMENT <-----> 1 MONTH FOLLOW-UP

- FINAL TREATMENT <-----> ONE MONTH FOLLOW-UP

i.e.: GROUP B

- 1ST TREATMENT <-----> FINAL TREATMENT
- 1ST TREATMENT <-----> 1 MONTH FOLLOW-UP
- FINAL TREATMENT <-----> ONE MONTH FOLLOW-UP

The figures were compared to determine standard deviation and level of significance.

All objective data collected and assessed using the Mann Whitney U-test will determine if there was a significant difference between the two groups at the first treatment, follow-up treatment and one month follow-up. The degrees compared for each plane of movement were taken from:

- The first treatments (trx.1) of group A and group B.
- The final treatments (final trx) of group A and group B.
- The one month follow-up (1 month f/u) of group A and group B.

i.e.:



- GROUP A (trx. 1) <-----> GROUP B (trx. 1)
- GROUP A (final trx) <-----> GROUP B (final trx)
- GROUP A(1 month f/u) <-----> GROUP B (1 month f/u)

The figures were compared to determine standard deviation and level of significance.

### 3.5 GENERAL REMARKS

This dissertation was completed using the following software programs:

- Microsoft Word 6.0
- Microsoft Excel 5.0
- Statographics Plus 6.0

#### 4. CHAPTER FOUR

##### THE RESULTS

##### 4.0 INTRODUCTION

This study consisted of a sample size of 30 patients: 15 in group A (received spinal manipulation only), 15 in group B (received cryotherapy and spinal manipulation). The data was analysed at a 95% confidence level ( $p < 0.05$ ).

This chapter will represent the data and attempt to analyse the data in tabular and graphic form in order to accept or reject the hypothesis stated on pages 58-60.

##### KEY FOR ABBREVIATIONS

GRP-A: Group A

GRP-B: Group B

SD: Standard deviation

P: P-Value

S: Significant

NS: Non-significant

Txl: Treatment one

TxF: Final treatment

1Mnth: One month follow up treatment

M: Means

AOI: Average overall improvement

AAP: Average amount of pain experienced

AR: Average ranges of motion

#### 4.1 TABULATED RESULTS

##### 4.1.1 Age and Gender of patients

Table 4.1: The age distribution of the patients:

Age (years)	Percentage of patients
10-20	6.6 %
20-30	30 %
30-40	33.4 %
40-50	20 %
50-60	10 %

Table 4.2: Gender distribution of patients:

Male	Female
5	25

#### 4.1.1.1 The Subjective Data

Table 4.3: The average initial pain recordings:

	GRP-A	GRP-B
CMCC Neck Disability Index	26.8 %	23.3 %
Short-Form McGill Questionnaire	24.7 %	24.1 %
Numerical Pain Rating Scale 101	47.8 %	47 %

Table 4.4: The average overall improvement in terms of pain intensity and disability: (Tx<sub>F</sub>-Tx<sub>1</sub>)

	GRP-A	GRP-B
CMCC Neck Disability Index	9.07%	8.5%
Short-Form McGill Questionnaire	5.48%	14.5%
Numerical Pain Rating Scale 101	4.5%	17.54%

Table 4.5: The average pain intensity and disability experienced over the treatment period:  
*(combined averages over all the treatment periods, Tx1-TrF-1Mnth)*

	GRP-A	GRP-B
CMCC Neck Disability Index	20.26%	16.13%
Short-Form McGill Questionnaire	19.94%	12.59%
Numerical Pain Rating Scale 101	43.59%	33.66%

The lower the unit the less pain or disability perceived by the patient.

#### 4.1.2 The Objective Data

Table 4.6: The average range of motion readings taken  
for each of the planes of movement:

RANGES OF MOTION	GROUP-A	GROUP-B
FLEXION	51.93'	52.8'
EXTENSION	72.83'	70.03'
LATERAL FLEXION R	46.16'	44.23'
LATERAL FLEXION L	50.06'	48.86'
ROTATION R	69.13'	65.19'
ROTATION L	70.23'	66.69'

## 4.2 THE NON PARAMETRIC PAIRED HYPOTHESIS TESTS

### 4.2.1 The results of the CMCC Neck Disability Index.

#### GROUP A

Table 4.7: The intra group treatment data readings of  
the CMCC Neck Disability Index for group A

	<b>Tx1-TxF</b>	<b>TxF-1Mnth</b>	<b>Tx1-1Mnth</b>
<b>AOI</b>	9.07%	1.47%	10.54%
<b>AAP</b>	22.2%	16.99%	21.53%
<b>P</b>	0.0306843 (S)	0.021654 (S)	0.0606675 (NS)

According to the above table there was a significant improvement within group A from the first to the final treatment and the final to one month follow up, yet no significant improvement from the first to the one month follow up treatment.



GROUP B

Table 4.8: The intra group treatment data readings of  
the CMCC Neck Disability Index for group B

	<b>Tx1-TxF</b>	<b>TxF-1Mnth</b>	<b>Tx1-1Mnth</b>
<b>AOI</b>	8.5%	4.5%	13.04%
<b>AAP</b>	19.05%	12.53%	13.04%
<b>P</b>	0.0306843 (S)	0.211338 (NS)	0.0016418 (S)

According to the above table there was significant improvement within group B from the first to the final treatment and the first to one month follow up, yet no significant improvement from the final to one month follow up treatment period.

4.2.2 The results of the Short-Form McGill Pain Questionnaire.

GROUP A

Table 4.9: The intra group treatment data readings of the Short-Form McGill Pain Questionnaire for group A

	<b>Tx1-TxF</b>	<b>TxF-1Mnth</b>	<b>Tx1-1Mnth</b>
<b>AOI</b>	5.48%	3.38%	8.86%
<b>AAP</b>	21.98%	17.55%	20.29%
<b>P</b>	0.0080785 (S)	0.0306843 (S)	0.0194335 (S)

According to the above table there was significant improvement within group A over all treatment periods.

GROUP B

Table 4.10: The intra group treatment data readings of  
the Short-Form McGill Pain Questionnaire  
for group B

	<b>Tx1-TxF</b>	<b>TxF-1Mnth</b>	<b>Tx1-1Mnth</b>
<b>AOI</b>	14.5%	5.75%	20.25%
<b>AAP</b>	16.93%	6.8%	14%
<b>P</b>	0.0194335 <b>(S)</b>	0.1138995 <b>(NS)</b>	0.0001503 <b>(S)</b>

According to the above table there was a significant improvement at the first to final, as well as the first to one month follow up period. No significant difference was noted at the final to one month follow up period.

4.2.3 The results of the Numerical Pain Rating Scale  
101.

GROUP A

Table 4.11: The intra group treatment data readings of  
the Numerical Pain Rating Scale 101 for  
group A

	<b>Tx1-TxF</b>	<b>TxF-1Mnth</b>	<b>Tx1-1Mnth</b>
<b>AOI</b>	4.5%	3.7%	8.2%
<b>AAP</b>	45.5%	41.45%	43.7%
<b>P</b>	0.1138995 (NS)	0.133628 (NS)	0.0306843 (S)

According to the above table there was a significant improvement at the first to one month follow up period, yet no significant difference was noted at the first to final and final to one month follow up treatment period.

GROUP B

Table 4.12: The intra group treatment data readings of  
the Numerical Pain Rating Scale 101 for  
group B

	<b>Tx1-TxF</b>	<b>TxF-1Mnth</b>	<b>Tx1-1Mnth</b>
<b>AOI</b>	17.54%	4.93%	22.47%
<b>AAP</b>	38.23%	26.99%	35.76%
<b>P</b>	0.0132501 (S)	0.133628 (NS)	0.000973 (S)

According to the above table there was a significant improvement at the first to final treatment period and the first to one month follow up period, yet no significant difference was noted at final to one month follow up treatment period.

#### 4.2.4 The results of cervical range of motion

##### **FLEXION:**

##### **GROUP A**

Table 4.13: The intra group treatment data readings of flexion for group A

	<b>Tx1-TxF</b>	<b>TxF-1Mnth</b>	<b>Tx1-1Mnth</b>
<b>AOI</b>	1.6%	1.93%	0.33%
<b>AR</b>	51.93'	51.76'	50.96'
<b>P</b>	0.386413 (NS)	0.5 (NS)	0.5 (NS)

According to the above table there was no significant improvement on range of motion for group A during any of the treatment periods.

GROUP B

Table 4.14: The intra group treatment data readings of  
flexion for group B

	Tx1-TxF	TxF-1Mnth	Tx1-1Mnth
AOI	0.8%	4.8%	4%
AR	52.8'	54.8'	55.2'
P	0.386413 (NS)	0.2895485 (NS)	0.2732455 (NS)

According to the above table there was no significant improvement on range of motion for group B during any of the treatment periods.

EXTENSION:

GROUP A

Table 4.15: The intra group treatment data readings of  
extension for group A

	Tx1-TxF	TxF-1Mnth	Tx1-1Mnth
AOI	0.6%	3.2%	2.6%
AR	72.83'	71.53'	71.23'
P	0.386413 (NS)	0.0606675 (NS)	0.1138995 (NS)

According to the above table there was no significant improvement on range of motion for group A during any of the treatment periods.



GROUP B

Table 4.16: The intra group treatment data readings of  
extension for group B

	Tx1-TxF	TxF-1Mnth	Tx1-1Mnth
AOI	7%	0.67%	7.67%
AR	70.03'	66.19'	69.69'
P	0.2895485 (NS)	0.133628 (NS)	0.048046 (S)

According to the above table there was no significant improvement in range of motion over the first to final and the final to one month follow up treatment period, yet a significant improvement was noted at the first to one month follow up period.

LATERAL FLEXION TO THE RIGHT:

GROUP A

Table 4.17: The intra group treatment data readings of lateral flexion to the right for group A

	Tx1-TxF	TxF-1Mnth	Tx1-1Mnth
AOI	1.67%	1.54%	0.13%
AR	46.16'	46.23'	45.39'
P	0.211338 (NS)	0.5 (NS)	0.5 (NS)

According to the above table there was no significant improvement on range of motion for group A during any of the treatment periods.

GROUP B

Table 4.18: The intra group treatment data readings of lateral flexion to the right for group B

	Tx1-TxF	TxF-1Mnth	Tx1-1Mnth
AOI	2.46%	2.73%	0.27%
AR	44.23'	44.36'	45.59'
P	0.2895485 (NS)	0.2895485 (NS)	0.394632 (NS)

According to the above table there was no significant improvement on range of motion for group A during any of the treatment periods.

LATERAL FLEXION TO THE LEFT:

GROUP A

Table 4.19: The intra group treatment data readings of lateral flexion to the left for group A

	Tx1-TxF	TxF-1Mnth	Tx1-1Mnth
AOI	1.2%	1.2%	0%
AR	50.06'	50.06'	49.46'
P	0.1138995 (NS)	0.5 (NS)	0.394632 (NS)

According to the above table there was no significant improvement on range of motion for group A during any of the treatment periods.

GROUP B

Table 4.20: The intra group treatment data readings of lateral flexion to the left for group B

	<b>Tx1-TxF</b>	<b>TxF-1Mnth</b>	<b>Tx1-1Mnth</b>
<b>AOI</b>	4.4%	2%	2.4%
<b>AR</b>	48.86'	50.06'	47.86'
<b>P</b>	0.0606675 (NS)	0.5 (NS)	0.193237 (NS)

According to the above table there was no significant improvement on range of motion for group B during any of the treatment periods.

ROTATION TO THE RIGHT:

GROUP A

Table 4.21: The intra group treatment data readings of  
rotation to the right for group A

	<b>Tx1-TxF</b>	<b>TxF-1Mnth</b>	<b>Tx1-1Mnth</b>
<b>AOI</b>	3.86%	0.4%	4.26%
<b>AR</b>	69.13'	71.26'	69.33'
<b>P</b>	0.0027729 (S)	0.2895485 (NS)	0.150849 (NS)

According to the above table there was no significant improvement in range of motion over the final to one month follow up and the first to one month follow up period, yet an improvement was recorded for the first to final treatment period.

GROUP B

Table 4.22: The intra group treatment data readings of rotation to the right for group B

	<b>Tx1-TxF</b>	<b>TxF-1Mnth</b>	<b>Tx1-1Mnth</b>
<b>AOI</b>	2.93%	3.2%	6.13%
<b>AR</b>	65.19'	68.26'	66.79'
<b>P</b>	0.211338 (NS)	0.0306843 (S)	0.0606675 (NS)

According to the above table there was no significant improvement in range of motion over the first to final and the first to one month follow up period, but a significant improvement is recorded over the final to one month follow up period.

ROTATION TO THE LEFT:

GROUP A

Table 4.23: The intra group treatment data readings of  
rotation to the left for group A

	Tx1-TxF	TxF-1Mnth	Tx1-1Mnth
AOI	0.34%	0.94%	0.6%
AR	70.23'	70.53'	70.7'
P	0.211338 (NS)	0.000973 (S)	0.0907245 (NS)

According to the above table there was no significant improvement in range of motion over the first to final and the first to one month follow up period, but a significant improvement is recorded over the final to one month follow up period.



GROUP B

Table 4.24: The intra group treatment data readings of rotation to the left for group B

	<b>Tx1-TxF</b>	<b>TxF-1Mnth</b>	<b>Tx1-1Mnth</b>
<b>AOI</b>	0.87%	1.73%	2.6%
<b>AR</b>	66.69'	67.99'	67.56'
<b>P</b>	0.2732455 (NS)	0.2732455 (NS)	0.133628 (NS)

According to the above table there was no significant improvement on range of motion for group B during any of the treatment periods.

#### 4.3 THE NON PARAMETRIC UNPAIRED HYPOTHESIS TESTS

##### 4.3.1 The results of the CMCC Neck Disability Index

The Mann Whitney U-test was carried out to compare the data of group A and group B in order to compare the values for the CMCC Neck Disability Index for the first, final and one month follow-up treatments.

Table 4.25: The inter group comparison of the CMCC Neck Disability Index

	Tx1		TxF		1Mnth	
	GRP-A	GRP-B	GRP-A	GRP-B	GRP-A	GRP-B
SD	14.33	12.08	11.15	8.87	10.97	9.52
P	0.30165 (NS)		0.272 (NS)		0.045 (S)	

A statistically significant difference between group A and group B was noted at the one month follow-up period. Therefore, the null hypothesis is rejected for that treatment period. Standard deviation revealed a

relative familiarity around the mean for both treatment groups over all treatment periods.

#### 4.3.2 The results of the Short-Form McGill Pain Questionnaire

The Mann Whitney U-test was carried out for group A and group B in order to compare the values for the Short-Form McGill Pain Questionnaire for the first, final and one month follow-up treatments.

Table 4.26: The inter group comparison of the Short-Form McGill Pain Questionnaire

	Tx1		TxF		1Mnth	
	GRP-A	GRP-B	GRP-A	GRP-B	GRP-A	GRP-B
SD	15.37	18.03	16.09	11.95	16.01	3.61
P	0.47518 (NS)		0.0095 (S)		0.0036 (S)	

A statistically significant difference between group A and group B was noted at the final treatment period. Therefore, the null hypothesis is rejected for those treatment periods. Standard deviation revealed a relative familiarity around the mean for both treatment

groups for the first and final treatment periods, however the one month follow up showed an apparent deviation between the two groups.

#### 4.3.3 The results of the Numerical Pain Rating Scale

101

Table 4.27: The inter group comparison of the Numerical Pain Rating Scale 101

	Tx1		TxF		1Mnth	
	GRP-A	GRP-B	GRP-A	GRP-B	GRP-A	GRP-B
SD	16.06	9.25	18.34	14.49	16.52	15.38
P	0.28645 (NS)		0.01779 (S)		0.0073 (S)	

A statistically significant difference between group A and group B was noted at the final and one month follow up treatment period. Therefore, the null hypothesis is rejected for those treatment periods. Standard deviation revealed a relative familiarity around the mean for both treatment groups over all treatment periods.

4.3.4 The results of flexion measured with the cervical range of motion goniometer.

The Mann Whitney U-test was carried out for group A versus group B in order to compare the values for flexion for the first, final and one month follow-up treatments.

Table 4.28: The inter group comparison of flexion

	Tx1		TxF		1Mnth	
	GRP-A	GRP-B	GRP-A	GRP-B	GRP-A	GRP-B
SD	19.63	12.71	18.61	14.98	18.80	12.34
P	0.647505 (NS)		0.4586 (NS)		0.113735 (NS)	

There was no statistically significant difference between group A and group B for flexion at any of the treatment periods. Therefore, the hypothesis is accepted for those treatment periods. Standard deviation revealed a relative familiarity around the mean for both treatment groups over all treatment periods.

4.3.5 The results of extension measured with the cervical range of motion goniometer.

The Mann Whitney U-test was carried out for group A versus group B in order to compare values for extension for the first, final and one month follow-up treatments.

Table 4.29: The inter group comparison of extension

	Tx1		TxF		1Mnth	
	GRP-A	GRP-B	GRP-A	GRP-B	GRP-A	GRP-B
SD	16.70	10.17	13.80	11.62	12.03	9.78
P	0.316244 (NS)		0.105434 (NS)		0.201416 (NS)	

There was no statistically significant difference between group A and group B for extension at any of the treatment periods. Therefore, the hypothesis is accepted for those treatment periods. Standard deviation revealed a relative familiarity around the mean for both treatment groups over all treatment periods.

4.3.6 The results of lateral flexion to the right measured with the cervical range of motion goniometer.

The Mann Whitney U-test was carried out for group A versus group B in order to compare values for lateral flexion to the right for the first, final and one month follow-up treatments.

Table 4.30: The inter group comparison of lateral flexion to the right

	Tx1		TxF		1Mnth	
	GRP-A	GRP-B	GRP-A	GRP-B	GRP-A	GRP-B
SD	9.81	9.27	6.46	10.85	8.43	9.00
P	0.377443 (NS)		0.184448 (NS)		0.5 (NS)	

There was no statistically significant difference between group A and group B for lateral flexion to the right at any of the treatment periods. Therefore, the hypothesis is accepted for those treatment periods. Standard deviation revealed a relative familiarity around the mean for both treatment groups over all treatment periods.

4.3.7 The results of lateral flexion to the left measured with the cervical range of motion goniometer.

The Mann Whitney U-test was carried out for group A versus group B in order to compare values for lateral flexion to the left for the first, final and one month follow-up treatments.

Table 4.31: The inter group comparison of lateral flexion to the left

	Tx1		TxF		1Mnth	
	GRP-A	GRP-B	GRP-A	GRP-B	GRP-A	GRP-B
SD	10.12	8.29	9.09	5.79	8.50	6.40
P	0.21277 (NS)		0.337311 (NS)		0.44992 (NS)	

There was no statistically significant difference between group A and group B for lateral flexion to the left at any of the treatment periods. Therefore, the hypothesis is accepted for those treatment periods. Standard deviation revealed a relative familiarity around the mean for both treatment groups over all treatment periods.



4.3.8 The results of rotation to the right measured with the cervical range of motion goniometer.

The Mann Whitney U-test was carried out for group A versus group B in order to compare values for rotation to the right for the first, final and one month follow-up treatments.

Table 4.32: The inter group comparison of rotation to the right

	Tx1		TxF		1Mnth	
	GRP-A	GRP-B	GRP-A	GRP-B	GRP-A	GRP-B
SD	11.80	10.87	8.20	11.25	6.82	7.34
P	0.109959 (NS)		0.13956 (NS)		0.3534 (NS)	

There was no statistically significant difference between group A and group B for rotation to the right at any of the treatment periods. Therefore, the hypothesis is accepted for those treatment periods. Standard deviation revealed a relative familiarity around the mean for both treatment groups over all treatment periods.

4.3.9 The results of rotation to the left measured with the cervical range of motion goniometer.

The Mann Whitney U-test was carried out for group A versus group B in order to compare rotation to the left for the first, final and one month follow-up treatments.

Table 4.33: The inter group comparison of rotation to the left

	Tx1		TxF		1Mnth	
	GRP-A	GRP-B	GRP-A	GRP-B	GRP-A	GRP-B
SD	10.34	8.71	8.62	7.05	14.94	11.15
P	0.04918 (S)		0.19662 (NS)		0.19064 (NS)	

A statistically significant difference between group A and group B was noted at the first treatment period. Therefore, the null hypothesis is rejected for that treatment period. Standard deviation revealed a relative familiarity around the mean for both treatment groups over all treatment periods.

## 5. CHAPTER FIVE

### DISCUSSION

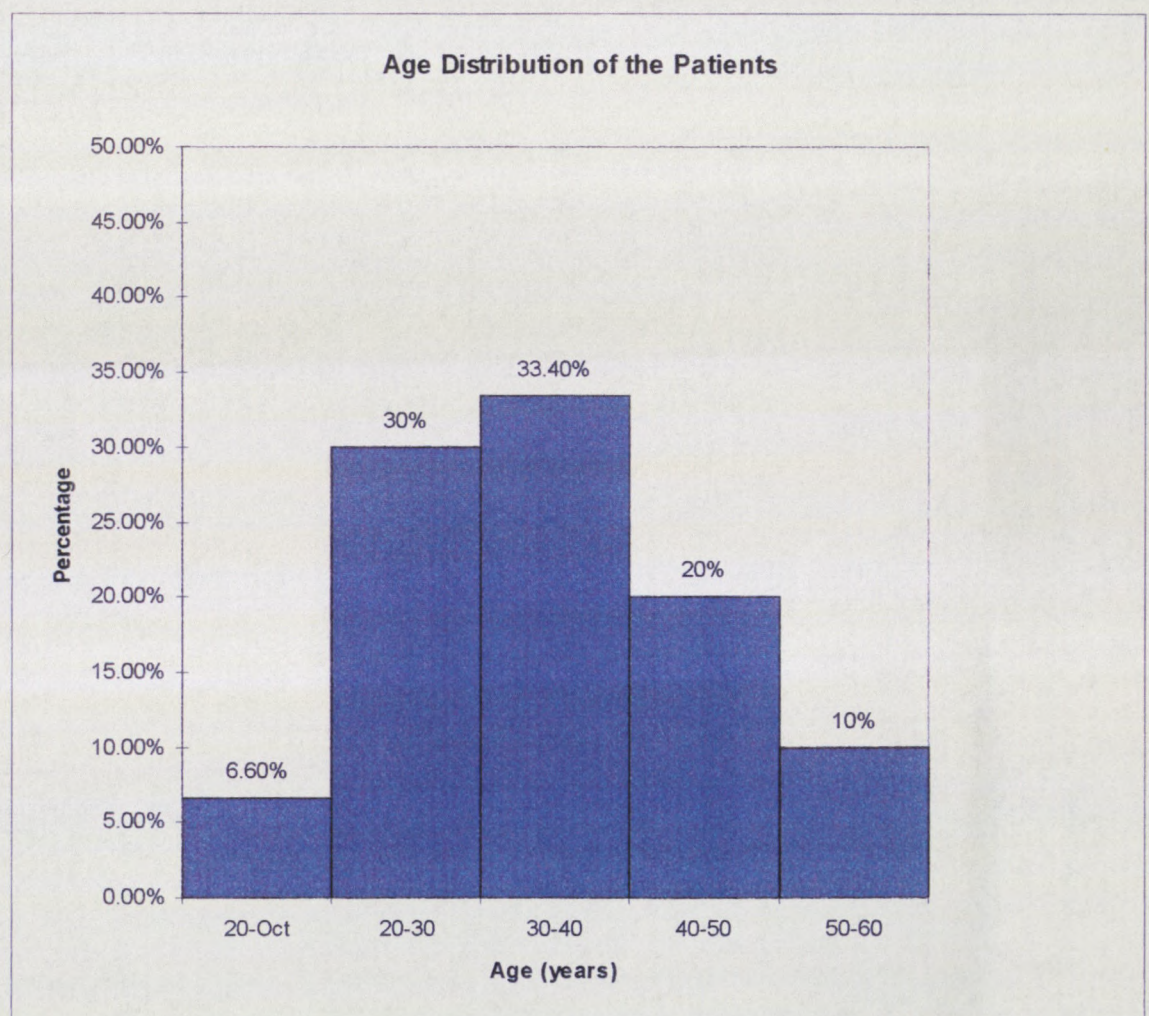
#### 5.1 INTRODUCTION

This chapter will discuss the results of the subjective and objective data in 2 sections:

1. Intra-treatment comparison: The assessment of the intra-treatment results of the first treatment to final treatment (i.e. the first treatment interval) represent the efficacy of the treatment regime. The comparison of the final to one month follow up treatments (the second treatment interval) indicate whether the treatment efficacy was maintained. The first to one month follow up treatment period indicates the long term efficacy and whether the problem has returned.
2. Inter-treatment comparison: The appraisal of the first treatment measurements, exhibits any variance in the subjective and objective findings between the two

groups in terms of their original signs and symptoms. The comparison of the final treatments confirms which treatment is more effective. Appraisal of the one month follow up treatment measurements represent which treatment method has maintained itself more effectively.

Figure 5.1: Age Distribution of the Patients



## 5.2 INTRA-GROUP COMPARISONS

### 5.2.1 The Subjective Data

#### 5.2.1.1 The CMCC Neck Disability Index

The paired analysis of the average measurements of the CMCC Neck Disability Index exhibited a minimal overall improvement in both groups in terms of a reduction in disability, considering that there were no significant improvements it can be said that these figures show no clinical significance as a result of either of the treatments, yet both treatment methods showed similarity in improvement rate (9.07%-group A; 8.5%-group B), (table 4.4, figure 5.2).

Both groups showed a decrease in pain intensity over the treatment periods in a similar fashion (table 4.5, figure 5.3), (20.26%-group A; 16.13%-group B), yet with no real significant difference between the two groups statistically.

Comparison of the first and final treatments (first treatment interval) revealed a statistically significant difference that is almost negligible due to the proximity of the figure to the 95% confidence level in treatment response comparison for both groups, whereas only group A showed a statistically significant change with comparison of the final and one month follow-up (second treatment interval) (see tables 4.7 and 4.8). This implies that the patients in group A maintained a more stable response to the treatment period, yet there is little clinical significance in terms of average overall improvement.

Group B showed a statistically significant term efficacy towards the treatment than group A, for the first to one month follow up treatment period, indicating that group B was more likely to maintain a favourable long term response to the treatment, but in terms of average overall improvement there is not much of a clinically significant difference.

#### 5.2.1.2 The Short-Form McGill Pain Questionnaire

Statistical assessment of the average measurements of the Short-Form McGill Pain Questionnaire depicted an improvement in both treatment groups of minimal percentage , yet group B proved to be slightly higher indicating a clinical difference between the two treatment methods (5.48%-group A; 14.5%-group B), (table 4.4, figure 5.2).

Pain perception did decrease in both groups yet not substantially enough to warrant discussion (table 4.5, figure 5.3), indicating no real difference with regards to the treatment methods (19.94%-group A; 12.59%-group B) .

Comparing the measurements of the first and final treatments (first treatment interval) disclosed an improvement in both groups especially in group A, and for this reason group A may have responded more favourably to treatment, as opposed to group B (tables 4.9 and 4.10), but group B revealed a clinical

difference as regards average overall improvement. The statistics for the final to one month follow up (second treatment interval) period indicated a significant difference in group A the figure is very close to the 95% confidence level and therefore there may be no clinical difference. Analysis of the first to one month follow up periods showed a significant improvement for group B in comparison to group A (clinically as well as statistically), suggesting that group B was more likely to maintain a favourable long term response to treatment without remission of the condition.

#### 5.2.1.3 The Numerical Pain Rating Scale 101

Comparative statistical analysis of the average overall improvement measurements (table 4.4) revealed a low percentage overall improvement especially for group A, from this it can be said that group B showed a clinical difference as regards response to treatment in comparison to group A (table 4.4, figure 5.2), (4.5%-group A; 17.54%-group B).



The average pain intensity and disability experienced did decrease favourably in both groups (table 4.5, figure 5.3), (43.59%-group A; 33.66%-group B).

Group B showed a small but significant improvement over the first to final treatment period (first treatment interval), indicating a slightly better clinical improvement. The final to one month follow up (second treatment interval), revealed no significant improvement clinically for both groups, whereas the first to one month follow up treatment period showed a significant clinical improvement for group B indicating that this group is more likely to maintain a favourable long term response to treatment without remission (table 4.11 and 4.12).

#### 5.2.2 The Objective Data

Comparison of the first to final (first treatment interval) treatment period disclosed a significant difference only on rotation to the right for group A, (table 4.21) while the final to one month follow up

period (second treatment interval), indicated a significant difference in rotation to the right for group B, (table 4.22) but is not likely to be of any clinical significance due to the proximity of the value to the 95% confidence level. Rotation to the left for group A (table 4.23) indicated a considerable improvement indicating a favourable long term response to the treatment. Statistical evaluation of the six cervical range of motion parameters within the first to one month follow up period exhibited a significant difference only on extension in group B yet the statistics are very close to the 95% confidence level, and therefore unlikely to be of any clinical significance (table 4.16).

### 5.3 INTER-GROUP COMPARISONS

#### 5.3.1 The Subjective Data

##### 5.3.1.1 The CMCC Neck Disability Index

The results of the measurements of the CMCC Neck Disability Index disclosed no significant difference in the inceptive degree of disability caused by the tension-type headache. This implied that both treatment groups were related in character in terms of disability.

Examination of the measurements of the final and the one month follow-up indicated that only group A had a significantly more effective improvement over the one month follow up treatment period, but may be of negligible clinical significance due to it's proximity to the 95% confidence level (table 4.25).

Analysis of the standard deviation revealed in the above data showed a relative familiarity around the

mean therefore both groups may display a similar predictability and reliability over their respective treatment periods, and thus very little clinical difference.

#### 5.3.1.2 The Short-Form McGill Pain Questionnaire

Evaluation of the measurements of the first treatments indicated no significant difference in the original degree of pain intensity caused by the tension-type headache, this therefore suggests that both treatment groups were similar in nature.

Further comparison of the final and one month follow-up indicated that group B was significantly more effective over those treatment periods (table 4.26). Analysis of the standard deviation revealed in the above data showed a relative familiarity around the mean for the first and final treatment therefore indicating a similar predictability and reliability for those treatment periods, yet the one month follow up treatment period exhibited a marked clinical difference

suggesting that group B may be the more predictable and reliable treatment group of the two for the one month follow up treatment.

#### 5.3.1.3 Numerical Pain Rating Scale 101

Statistical comparison of the first treatments bore no difference in the inceptive degree of pain intensity, denoting a similarity in nature in terms of pain intensity.

Analysis of the final and one month follow up treatments suggested a statistically significant improvement in group B, possibly indicating a more effective treatment method. Analysis of the standard deviation revealed in the above data showed a relative familiarity around the mean therefore both groups may display a similar predictability and reliability over their respective treatment periods, indicating no clinical differences.

### 5.3.2 The Objective Data

Comparison of the cervical range of motion measurements with the goniometer presented no statistically significant difference, except during the first treatment period involving rotation to the left, in which a significant difference was indicated suggesting a higher range of motion for group A, yet closeness to the 95% confidence interval makes this result to be almost insignificant. Analysis of the standard deviation revealed in the data showed a relative familiarity around the mean therefore both groups may display a similar predictability and reliability over their respective treatment periods. Examination of table 4.6 of the average range of motion readings taken for each of the planes of movement showed no clinical difference due to the similarity of the figures.

Figure 5.2: Average overall improvement

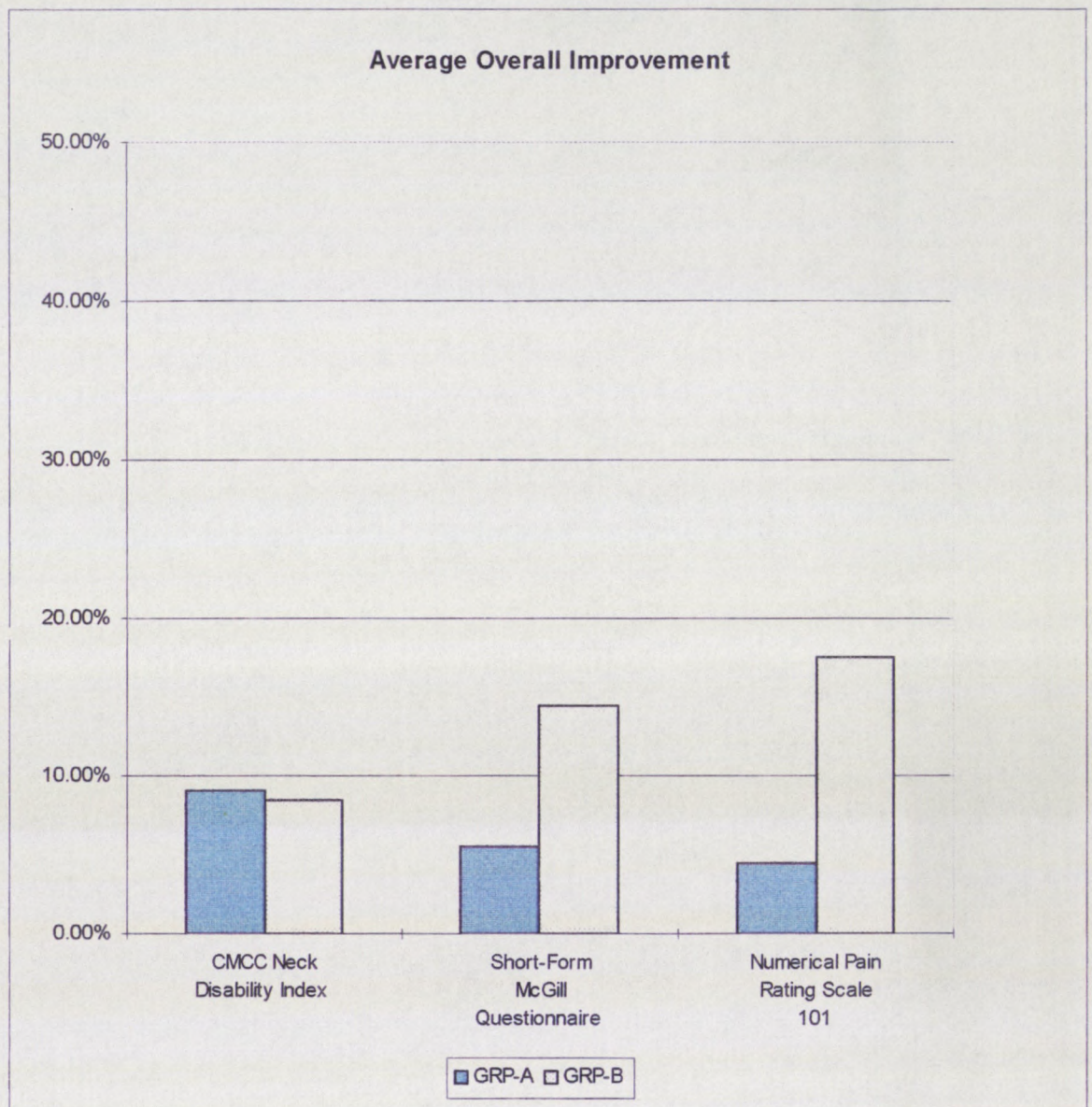
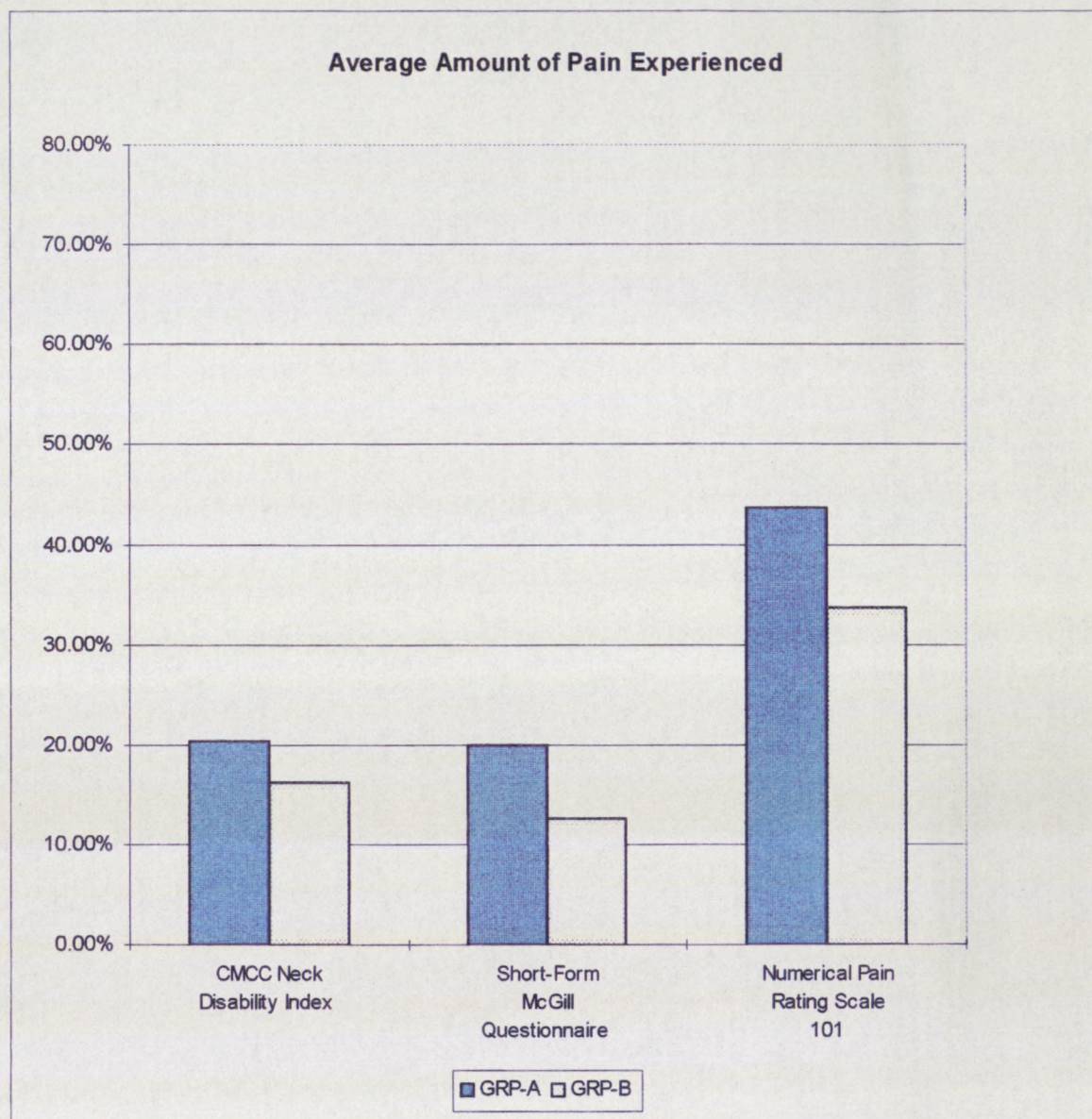




Figure 5.3: Average amount of pain experienced





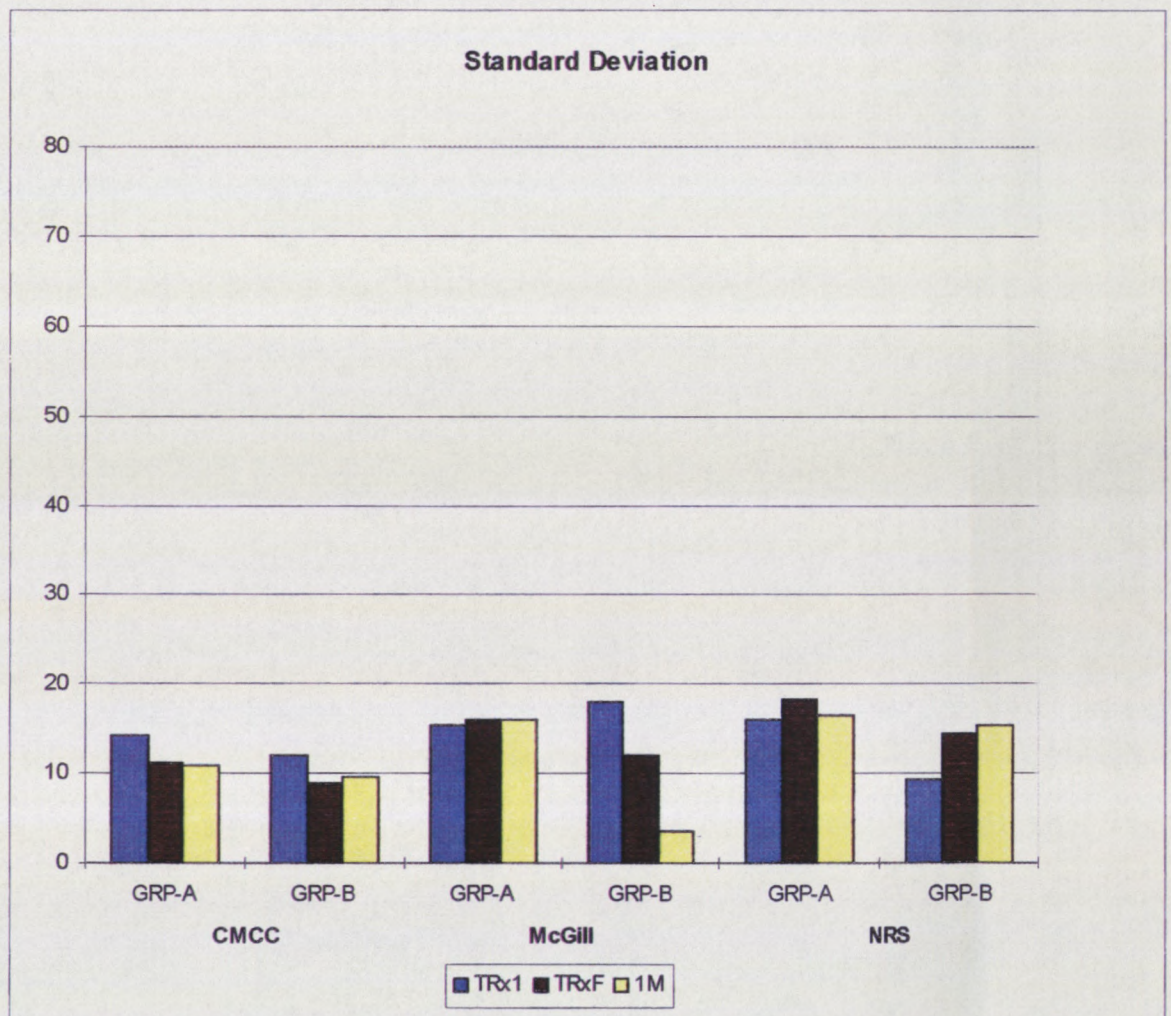
#### 5.4 GENERAL DISCUSSION OF THE SUBJECTIVE DATA

It was hypothesised that the two treatment groups would be similarly effective in terms of the subjective findings. It was also hypothesised that cryotherapy and manipulation may reveal a difference to manipulation alone in terms of subjective clinical findings.

The results show that both treatment groups responded favourably to their respective treatments. Yet group B indicated a slightly more, but possibly insignificant efficacious clinical overall improvement, especially concerning the long term overall results to treatment (figure 6.1). The first hypothesis stating that there would be no difference in the efficacy of the respective treatments within the group is accepted, whereas the second hypothesis stating that cryotherapy and manipulation would be more effective is rejected. Yet the average amount of pain experienced within the groups favoured group B clinically, over all treatment periods (figure 6.2). The trend for the standard deviation showed a predominant similarity between the

figures of the two treatment groups over the treatment period, therefore it is likely that this is an indication that both groups exhibit approximately the same reliability and predictability.

Figure 5.4: Graph of Standard Deviations



## 5.5 PROBLEMS ENCOUNTERED WITH REGARDS TO THE SUBJECTIVE RESULTS

Inaccuracy of the questionnaires may have brought about a biased result due to human error, which could be largely prohibited by more strict supervision of the completion of the different questionnaires. Larger sample size may have resulted in elimination of any discrepancies concerning small changes in pain intensity and disability.

## 5.6 GENERAL DISCUSSION OF THE OBJECTIVE DATA

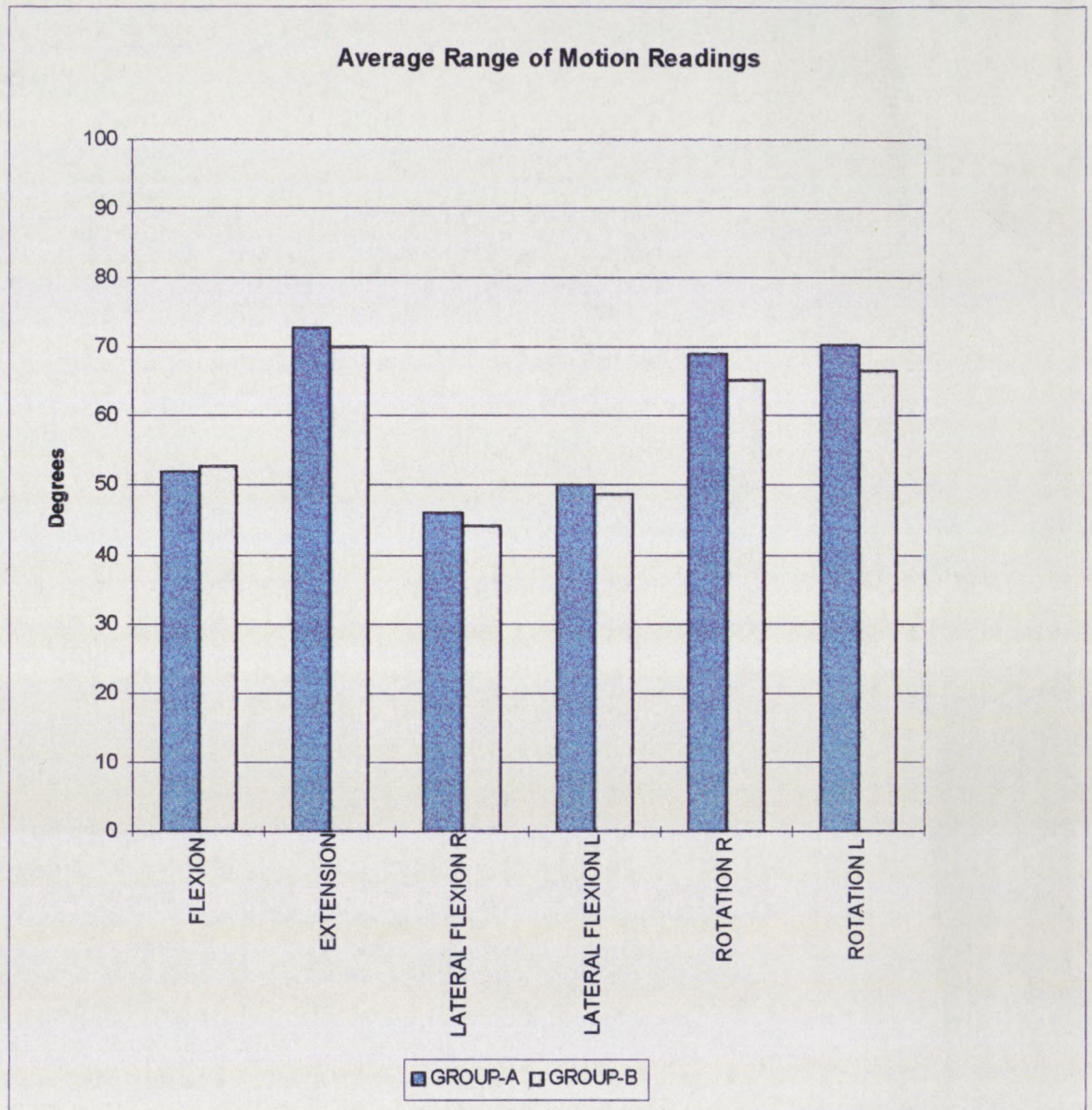
The hypothesis that there would be no difference in the efficacy of the respective treatment within the group is accepted, whereas the second hypothesis stating that cryotherapy and manipulation would be more effective is rejected, throughout the objective data there are no clinical differences.

## 5.7 PROBLEMS ENCOUNTERED WITH REGARDS TO THE OBJECTIVE RESULTS

Accuracy of the goniometer used combined with human error may decrease the efficacy of the result, these errors can be reduced by use of more technologically advanced equipment if available that is less likely to be subject to human error.



Figure 5.5: Objective comparison of Group A and Group B



## 5.8 LIMITATIONS OF THE STUDY

Thirty patients volunteered for the study and all 30 were found to be legible. During the course of the study eleven subjects were excluded:

- six participants were found to be non-compliant as concerns follow up treatments.
- Three participants presented with sinus related headaches.
- Two participants presented with contraindications to manipulation.

## 5.9 CONCLUSION

Although group B showed a slightly better improvement over group A clinically, it is almost negligible. Both treatments showed equal rate of improvement as well as degree of efficacy.

Concerning the use of cryotherapy in chiropractic practice this researcher would encourage the use of the modality as an adjunct to manipulation where deemed

necessary, especially when the patient has associated acute muscle spasm, whether it be for the treatment of tension-type headache or any other condition suitable for chiropractic treatment. The user of cryotherapy will do well to realise that not every individual will find this sort of treatment beneficial, owing to personal preferences for heat and cold, and this could inhibit or speed the recovery time either way.

## 6. CHAPTER SIX

### CONCLUSIONS AND RECOMMENDATIONS

#### 6.1 CONCLUSIONS

This study comprised of 30 patients all of which were diagnosed with tension-type headache, after extensive clinical and physical examination.

The patients were randomly placed in two groups of 15, group A received manipulation only; for the relief of tension-type headache, while group B received cryotherapy prior to manipulation for the relief of tension-type headache.

Each patient received an average of 5 treatments including a one month follow up treatment.

It is evident from the data that patients in both groups A and B responded favourably to their respective treatments in terms of:

a) pain perception.



Group B showed improvement between the first and one month follow up follow-up treatment in terms of:

a) pain perception,

b) disability.

These results did not exhibit enough statistical significance to warrant interest, yet there is a minimal connotation that patients in both groups had a favourable clinical response to their respective forms of treatment.

Patients in both group A and B demonstrated an overall improvement in terms of a reduction in pain and disability intensity, irrespective of whether they received chiropractic manipulation alone or in combination with cryotherapy. Therefore the hypothesis stating that there would be no difference in the efficacy of the respective treatments in the management of tension-type headache were accepted.

A clinically significant difference was noted between the two groups in terms of pain perception and disability, where group B displayed a more favourable long term response to treatment, and was therefore more

likely to maintain that response without return of the symptoms.

With the exception of the above there was no statistically significant difference present between the two groups to be of concern as regarding the outcome of this research.

Therefore the hypothesis that chiropractic manipulation in conjunction with cryotherapy would be more effective than chiropractic alone, was thus rejected.

From the above it is noted that spinal manipulation is a reliable intervention for the treatment of tension-type headache. Further larger studies are needed to more clearly evaluate the use of combined therapy with cryotherapy.

Alternatively, spinal manipulation alone would seem to be the treatment of choice in the management of tension-type headache within the present context.

Figure 6.1: The average overall improvement

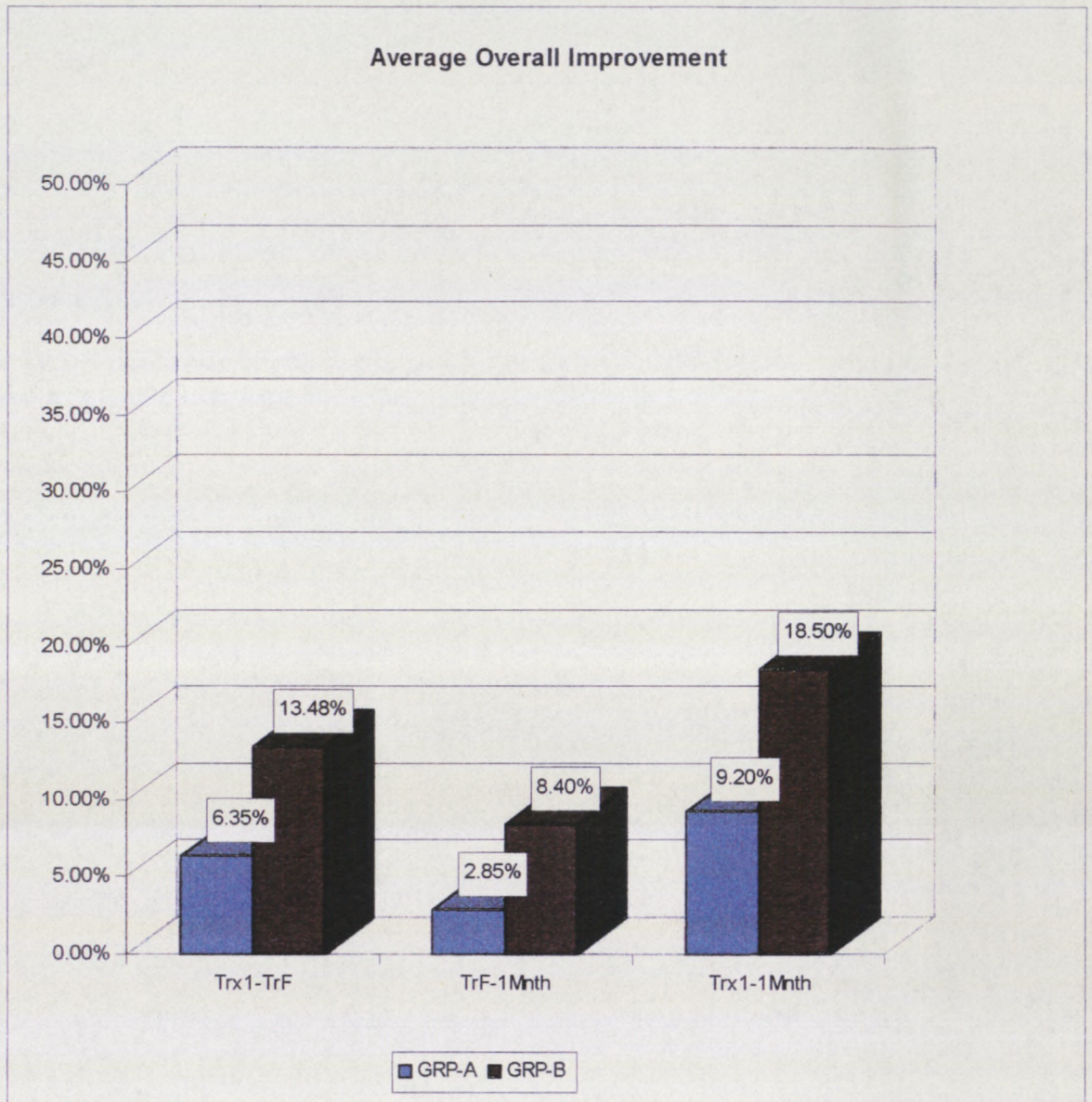
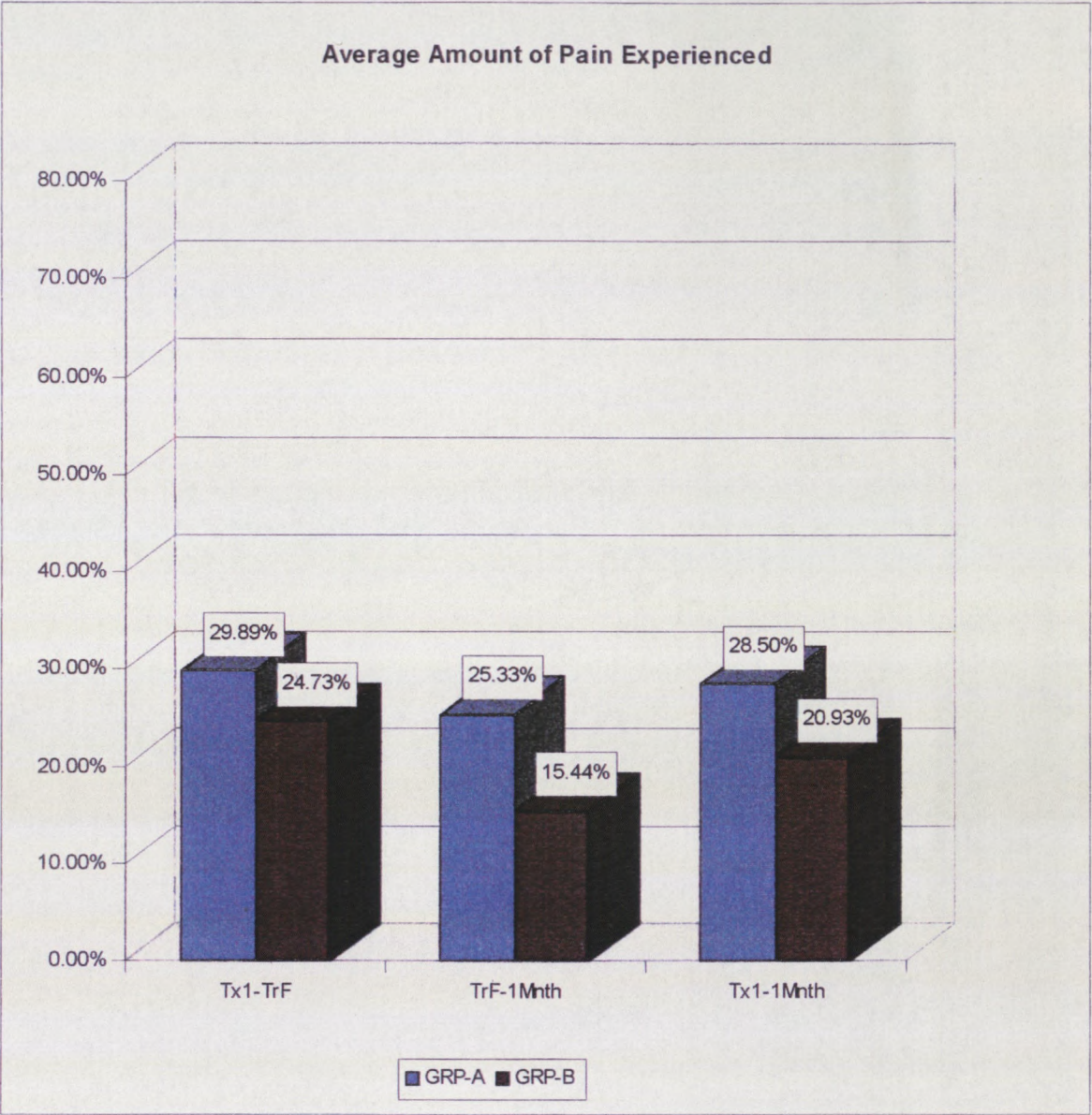




Figure 6.2: The average amount of pain experienced



## 6.2 RECOMMENDATIONS

- Larger sample size (increase validity)
- More accurate goniometer (eliminate reliability problems)

In conclusion, it is evident from this study that tension-type headache patients do respond to chiropractic manipulation.

The results of this study showed that the patients responded favourably to their treatment, irrespective of the treatment that was given.

In further studies it would be advised that age and gender characteristics be taken note of combined with a larger sample size in order to obtain a extensive and more sound research.

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## LIST OF APPENDICES

APPENDIX #1	Case History
APPENDIX #2	Physical Examination
APPENDIX #3	Cervical Regional
APPENDIX #4	CMCC Neck Disability Index
APPENDIX #5	Short-Form McGill Pain Questionnaire
APPENDIX #6	Numerical Rating Scale
APPENDIX #7	Patient Consent Form
APPENDIX #8	CROM Procedure Manual
APPENDIX #9	Goniometer Readings

TECHNIKON NATAL CHIROPRACTIC DAY CLINICCASE HISTORY

Patient: \_\_\_\_\_ Date # \_\_\_\_\_

File #: \_\_\_\_\_

X-ray #: \_\_\_\_\_

Age: \_\_\_\_\_ Sex: \_\_\_\_\_ Occupation: \_\_\_\_\_

Intern: \_\_\_\_\_ Signature: \_\_\_\_\_

FOR CLINICIAN'S USE ONLY

Initial visit clinician: \_\_\_\_\_

Signature: \_\_\_\_\_

## Case History:

## Examination:

Previous: TN  
OtherCurrent: TN  
Other

## X-ray Studies:

Previous: TN  
OtherCurrent: TN  
Other

## Clinical path. lab.:

Previous: TN  
OtherCurrent: TN  
Other

## Case status:

PTT: Conditional: Signed off: Final sign out:

## Recommendations:



Intern's case history

1. Source of history:
2. Chief complaint: (patient's own words)

3. Present illness:

Location

Onset

Duration

Frequency

Pain (character)

Progression

Aggravating factors

Relieving factors

Associated S & S

Previous occurrences

Past treatment and outcome

4. Other complaints:

5. Past history:

General health status

Childhood illnesses

Adult illnesses

Psychiatric illnesses

Accidents/injuries

Surgery

Hospitalizations

6. Current health status and life-style:  
Allergies

Immunizations

Screening tests

Environmental hazards  
(home, school, work)

Safety measures  
(seat belts, condoms)

Exercise and leisure

Sleep patterns

Diet

Current medication

Tobacco

Alcohol

Social drugs

7. Family history:

Immediate family:

Age

Health

Cause of death

DM

Heart disease

TB

HBP

Stroke

Kidney disease

CA

Arthritis

Anaemia

Headaches

Thyroid disease

Epilepsy

Mental illness

Alcoholism

Drug addiction

Other

8. Psychosocial history:

Home situation

Daily life

Important experiences

Religious beliefs

9. Review of systems:

General

Skin

Head

Eyes

Ears

Nose/sinuses

Mouth/throat

Neck

Breasts

Respiratory

Cardiac

Gastro-intestinal

Urinary

Genital

Vascular

Musculoskeletal

Neurologic

Haematologic

Endocrine

Psychiatric.

**TECHNIKON NATAL CHIROPRACTIC DAY CLINIC****PHYSICAL EXAMINATION**

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

Patient: \_\_\_\_\_ File # \_\_\_\_\_

Last name

First name

Clinician: \_\_\_\_\_ Signature: \_\_\_\_\_

Intern: \_\_\_\_\_ Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Height: \_\_\_\_\_ Weight: \_\_\_\_\_ Temp: \_\_\_\_\_

Rates: Heart: \_\_\_\_\_ Pulse: \_\_\_\_\_ Respiration: \_\_\_\_\_

Blood pressure: Arms: L       /       R       /

Legs: L       /       R       /

General appearance:

STANDING EXAMINATION.

Minor's sign

Skin changes

Posture

erect

Adam's

"Ranges of motion:

T/L spine: Flexion: 90 Fingers to floor

Extension: 50

R.lat.flex.: 30 Fingers down leg

L.lat.flex.: 30 Fingers down leg

Rot.to R.: 35

Rot.to L.: 35

Flex.

L.Rot.

R.Rot.

L.lat  
flex.R.lat.  
flex.

Ext.

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

Romberg's sign.

Pronator drift.

Trendelenburg's sign.

Gait.

rhythm

balance

pendulousness

on toes

on heels

tandem

Half squat.

Scapular winging.

Muscle tone.

Spasticity/Rigidity.

**Shoulder:**

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

**Chest measurement**

- inspiration
- expiration

**Visual acuity**

**Breast examination:**

**Inspection:**

- skin
- size
- contour
- nipples
- arms overhead
- hands against hips
- leaning forward.

**Palpation:**

- axillary lymph nodes.

**SEATED EXAMINATION.**

**Spinal posture**

**Head**

- scalp
- skull
- face
- skin

**Eyes**

- conjunctiva
- sclera
- eyebrows
- eyelids
- lacrimal gland
- nasolacrimal duct
- alignment
- corneal reflex
- ocular movement

L  
III IV VI

R  
III IV VI

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



vessels  
general background  
macula  
vitreous  
lens

**Ears:**

auricle  
ear canal  
drum  
auditory acuity  
Weber test  
Rinne test

**Nose:**

external  
internal  
septum  
turbinates  
olfaction

**Sinuses (frontal & maxillary):**

tenderness  
transillumination

**Mouth and pharynx:**

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

**Neck:**

posture  
size  
swelling  
scars  
discoloration  
hair line

ROM:

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

Flex.

L.Rot.

R.Rot.

L.Lat.  
flex.

R.lat.  
flex.

Ext.

lymph nodes  
trachea  
thyroid  
carotid arteries (thrills, bruit)

CN V

CN VII

CN VIII (nystagmus)

CN IX

CN XI

TMJ

Inspection

ROM

deviation

Palpation

crepitus

tenderness

**Neurological:****Dermatomes**

C5

C6

C7

C8

T1

**Tendon reflexes**

biceps

triceps

brachioradialis

**Muscle strength**

C5

C6

C7

C8

T1

**Coordination:**

point-to-point

dysdiadochokinesia

**Thorax:****Chest:****Inspection:**

skin

shape

respiratory distress

rhythm (respiratory)

depth "

effort "

intercostal/supraclavicular retraction

**Palpation:**

tenderness

masses

respiratory expansion

tactile fremitus

**Percussion:**

lungs (posterior)

diaphragmatic excursion

kidney punch

**Auscultation:**

breath sounds

vesicular

bronchial

adventitious sounds

crackles (rales)

wheezes (rhonchi)

voice sounds

broncophony

whispered pectoriloquy

egophony

Cardiovascular:  
auscultation (aortic murmurs)  
Allen's test

SUPINE EXAMINATION

JVP

PMI

auscultation heart (L.lat.recumbent)

respiratory excursion

percussion chest (anterior)

breast palpation

The abdomen:

Inspection:

skin

umbilicus

contour

peristalsis

pulsations

hernias (umbilical/incisional)

Auscultation:

bowel sounds

bruit

Percussion:

general

liver

spleen

Palpation:

superficial reflexes

cough

light

rebound tenderness

deep

liver

spleen

kidneys

aorta

intra-/retro-abdominal wall mass

shifting dullness

fluid wave

Acute abdomen:

where pain began and now

cough

tenderness

guarding/rigidity

rebound tenderness

Rovsing's sign

psoas sign

obturator sign

cutaneous hyperaesthesia

rectal exam

Murphy's sign.

**Male genitals and hernias.****Inspection:**

skin  
 prepuce  
 glans  
 meatus  
 nits/lice  
 scrotum  
 inguinal/femoral bulges

**Palpation:**

penis (tenderness/induration)  
 testes  
 epididymis  
 inguinal canal  
 femoral canal  
 cremasteric reflex

**Auscultation:**

scrotal mass.

**Peripheral vasculature:****Inspection:**

skin  
 nail beds  
 pigmentation  
 hair loss

**Palpation:**

pulses - radial, brachial, femoral, popliteal, post.tibial,  
                     dorsalis pedis  
 lymph nodes - epitrochlear, femoral (horizontal & vertical)  
 temperature (feet & legs)  
 Manual compression test  
 Retrograde filling (Trendelenburg) test  
 Arterial insufficiency test

**Musculoskeletal:****ROM****hip**

flex. 90/120  
 ext. 15  
 abd. 45  
 add. 30  
 int rot 40  
 ext rot 45

**knee**

flex. 130  
 ext. 0/15

**ankle**

plantar flex 45  
 dorsiflex 20  
 inversion 30  
 eversion 20

leg length

**Neurological:**

**dermatomes**

L1

L2

L3

L4

L5

S1

**muscle strength**

hip flexion

knee extension

ankle dorsiflexion

plantar flexion

**tendon reflexes**

patellar

Achilles

**plantar reflex**

**Rectal examination:**

**Inspection**

sacrococcygeal & perianal areas

**Palpation**

sphincter tone

tenderness

induration

nodules

prostate

seminal vesicles

**Mental status**

**Appearance and behaviour:**

level of consciousness

posture and motor behaviour

dress, grooming, personal hygiene

facial expression

affect

**Speech and language:**

quantity

rate

volume

fluency

aphasia (prn)

**Mood**

**Thought processes (logical, relevant, organized)**

**Memory and attention:**

orientation (time, place, person)

remote memory

recent memory

new learning ability

**Higher cognitive functions:**

information and vocabulary (general & specialised knowledge)

abstract thinking.



TECHNIKON NATAL CHIROPRACTIC DAY CLINIC.

REGIONAL EXAMINATION -- CERVICAL SPINE.

PATIENT: \_\_\_\_\_

FILE # : \_\_\_\_\_ DATE: \_\_\_\_\_

INTERN/RESIDENT: \_\_\_\_\_

SUPERVISING CLINICIAN : \_\_\_\_\_

OBSERVATION :

Posture  
Swelling  
Scars  
Discoloration  
Hair Line  
Bony and soft tissue contours

Shoulder position:

Left =

Right =

Muscle spasm

Facial expression

RANGE OF MOTION:

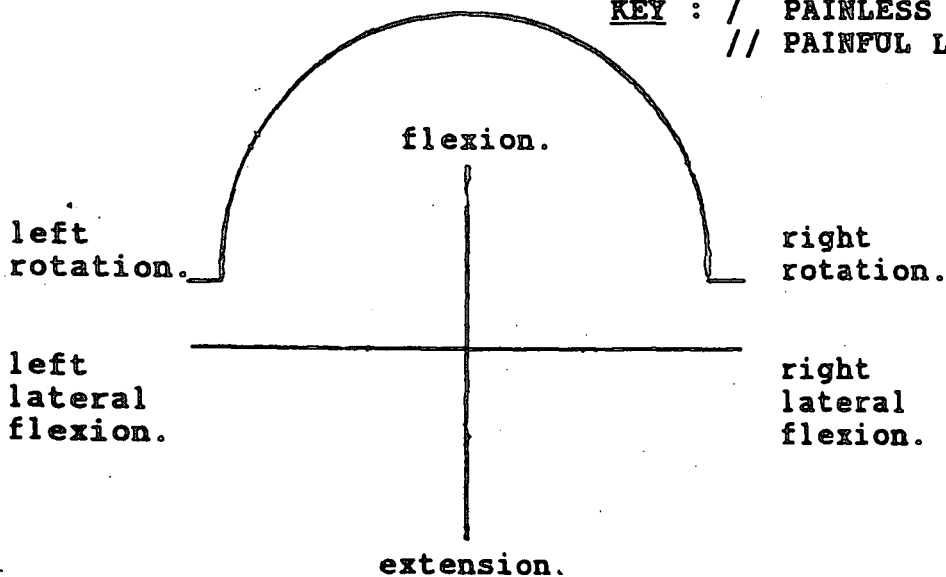
Flexion = 45 degrees.

Extension = 70 degrees.

L/R Rotation = 70 degrees.

L/R Lateral flexion = 45 degrees.

KEY : / PAINLESS LIMITATION.  
// PAINFUL LIMITATION.



PALPATION : lymph nodes.  
trachea.  
thyroid gland..

**ORTHOPAEDIC EXAMINATION :****Tenderness****Active MF Trigger Points :**

SCM.  
Trapezius.  
Scaleni.  
Levator Scapulae.  
Posterior Cervical musculature.

Doorbell Sign

Kemp's Test

Cervical Distraction

Halstead's Test

Hyperabduction Test (Wright's)

Shoulder abduction Test

Dizziness rotation Test

Brachial Plexus Tension

Cervical Compression

Lateral Compression

Adson's Test

Costoclavicular Test

Eden's (traction) Test

Shoulder depression Test.

Lhermitte's Sign

O'Donoghue Manoeuvre

Remarks : \_\_\_\_\_

**NEUROLOGICAL EXAMINATION :****DERMATOMES: Left; Right. MYOTOMES: Left; Right. REFLEXES: Left; Right.**

C2		C1		C5	
C3		C2		C6	
C4		C3		C7	
C5		C4			
C6		C5			
C7		C6			
C8		C7			
T1		C8			
		T1			



VASCULAR :

LEFT.

/ RIGHT.

BLOOD PRESSURE.

CAROTIDS.

SUBCLAVIAN ARTERIES.

WALLENBERG'S TEST.

COMMENTS:

MOTION PALPATION :

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

# CMCC NECK DISABILITY INDEX

PATIENT NAME: \_\_\_\_\_ FILE #: \_\_\_\_\_ DATE: \_\_\_\_\_

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

## Section 1 - Pain Intensity

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

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

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

## Section 3 - Lifting

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

## Section 4 - Reading

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

## Section 5 - Headaches

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

## Section 6 - Concentration

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

## Section 7 - Work

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

## Section 8 - Driving

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

## Section 9 - Sleeping

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

## Section 10 - Recreation

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

## MEASUREMENT OF PAIN

## SHORT-FORM MCGILL PAIN QUESTIONNAIRE

RONALD MELZACK

PATIENT'S NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

	<u>NONE</u>	<u>MILD</u>	<u>MODERATE</u>	<u>SEVERE</u>
THROBBING	0) _____	1) _____	2) _____	3) _____
SHOOTING	0) _____	1) _____	2) _____	3) _____
STABBING	0) _____	1) _____	2) _____	3) _____
SHARP	0) _____	1) _____	2) _____	3) _____
CRAMPING	0) _____	1) _____	2) _____	3) _____
GNAWING	0) _____	1) _____	2) _____	3) _____
HOT-BURNING	0) _____	1) _____	2) _____	3) _____
ACHING	0) _____	1) _____	2) _____	3) _____
HEAVY	0) _____	1) _____	2) _____	3) _____
TENDER	0) _____	1) _____	2) _____	3) _____
SPLITTING	0) _____	1) _____	2) _____	3) _____
TIRING-EXHAUSTING	0) _____	1) _____	2) _____	3) _____
SICKENING	0) _____	1) _____	2) _____	3) _____
FEARFUL	0) _____	1) _____	2) _____	3) _____
PUNISHING-CRUEL	0) _____	1) _____	2) _____	3) _____

NO PAIN |-----| WORST POSSIBLE PAIN  
 P P I

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

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

**NUMERICAL RATING SCALE -101 QUESTIONNAIRE**

Patient Name : \_\_\_\_\_ File No. : \_\_\_\_\_ Date : \_\_\_\_\_

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

\_\_\_\_\_

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

\_\_\_\_\_

**PATIENT CONSENT FORM**

Dear patient.

Please read the following consent form carefully as it contains important information regarding the research with which you will be participating at the Technikon Natal Chiropractic clinic with respect to tension-type headaches.

All treatment received at the Technikon Natal Chiropractic clinic will be used for research purposes, therefore the results of the research in which you will participate will contribute to further knowledge and understanding of tension-type headache, and help the Chiropractic profession in determining the best treatment for tension-type headache sufferers.

All patients participating in the above said research will remain anonymous, and all information submitted by the patient to the researcher (Antony Angus) will be confidential.

Participation in the research project will benefit you in that:

- A) You will receive treatment for your tension-type headache free of charge.
- B) After completion of an entire history and physical examination, should you suffer from any condition that is outside the scope of this research you will be referred to an appropriate physician who can treat your condition.

The benefits of the research for the profession\researcher will be the following:

- A) The Chiropractic profession will gain further understanding in the treatment of tension-type headaches.
- B) Greater recognition for Chiropractic on a national and international level.
- C) Completion of the researcher's Masters diploma in Chiropractic.

**Rules for participation in this research project:**

- A) For the duration of this research project you will not be allowed to receive any other treatment for tension-type headache, this includes drug therapy, physiotherapy, acupuncture, massage or any other forms of treatment.
- B) If you are currently on any medication for your tension-type headache, it is important that you inform the researcher of the type of medication as well as the amount being taken. Should you begin taking drugs for any conditions as well as tension-type headache it is important that you also tell the researcher about the type and amount of the drug being taken.

C) Treatment will take place at the Tecnikon Natal Chiropractic clinic in Ritson rd. and will be spread over an approximate period of 2 months. Apppointmemts for treatment must be kept punctual and unchanged as much as possible, this is to ensure the successful completion of the research and ultimately maximum benefit for the patient.

D) In the course of the treatment you may at some stage you may be required to undergo X-ray procedures, therefore it is necessary to inform the researcher if you are pregnant.

Involvement in the research project is entirely voluntary, you are thus under no obligation to participate. If you are uncertain about any aspect of this research please feel free to ask the researcher questions you may have at this time.

On completion of your last treatment you will be required to return approximately one month later to be evaluated, in the event that you still suffer from tension-type headache after completion of the research, you will be referred to a physician for further evaluation and treatment.

I, ..... on this day..... of the month of..... of the year 1995 have read the above document and understand all that is contained therein and agree to abide to the rules as set out in the document.

Signed .....

Witness .....

## **CROM Procedure Manual**

### **Procedure for Measuring Neck Motion with the CROM**

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

***Performance Attainment Associates  
3600 Labore Road, Suite 6  
St. Paul, MN 55110-4144***

## 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
- measures all planes of motion
- comfortable
- time efficient
- easily adjusted

- 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 (cranio-thoracic postures) and rounded shoulders (scapular 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**.



Figure 1: CROM with rotation arm and magnetic yoke

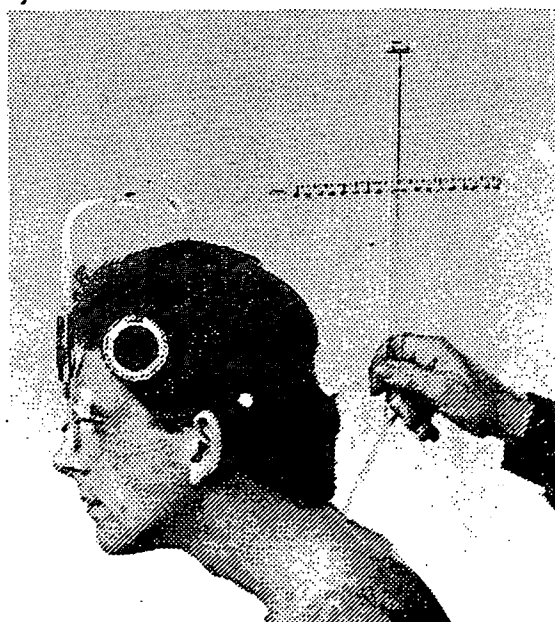


Figure 2: CROM with forward head arm and vertebra locator

## Suboccipital Flexion and Extension

Instruct the subject to position the **CROM instrument** as if putting on a pair of glasses. Fasten the velcro strap in line with the bows. You will not need the magnetic yoke, rotation arm, forward head arm or vertebra locator for these measurements. Instruct the subject to stand facing away from an outside corner of a wall or edge of a open door frame. The subject's sacrum, thoracic spine and occiput must be in contact with the corner of the wall or door edge (see figure 3). Instruct the subject to maintain constant pressure to prevent substitution movements. Since the sagittal plane meter normally reads zero when the ear bows are parallel to the horizontal plane, this reading (zero or otherwise) indicates the subject's resting suboccipital posture; record it on the recording sheet\*.



Figure 3: Resting posture

Instruct the subject to flex the suboccipital area as much as possible while maintaining equal pressure at the skull, thorax and sacrum (see figure 4). Record this measurement.



Figure 4: Flexion

Instruct the subject to extend the suboccipital area as much as possible without allowing the skull, thorax and sacrum to leave the contact surface (see figure 5). Record this measurement.



Figure 5: Extension

\*A sample recording sheet is provided in the back of this manual. Tablets of the recording sheet may be ordered from your dealer as PAA Form 101.

## 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 on 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 vertebra 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.



Figure 8: Left lateral flexion

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.



Figure 9: Right lateral flexion

## 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.

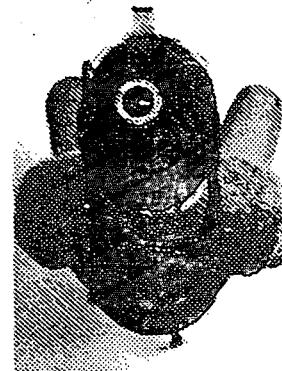


Figure 10: Magnetic yoke pointing north

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.



Figure 11: Left rotation

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.



Figure 12: Right rotation

\*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.

## Forward Head

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 side and feet flat on the floor. You will need to use the CROM instrument plus the forward head arm and the vertebra locator for this measurement, but not the magnetic yoke nor the rotation arm.

Attach the forward head arm on the CROM in place of the rotation arm (see figure 13). Stand to the subject's left side so you can read the sagittal plane meter. To assure that the forward head arm is horizontal, assist the subject to position the head with the sagittal plane meter reading zero. While the subject maintains this position, locate the seventh cervical vertebra and place the foot (bottom tip) of the vertebra locator on the spinous process. Position the locator so the bubble is centered within the vertical lines on the vial. The forward head arm is calibrated in centimeters for the horizontal distance from the nose bridge to the locator contact point with the seventh vertebra.

Now, instruct the subject to slide the head as far back as possible, while keeping the chin level. Note the measurement at the junction of the forward head arm and the vertebra locator and record it as retraction.

Next, instruct the subject to relax and record this measurement as the resting posture.

Then, instruct the subject to protract or protrude the head forward as much as possible, while keeping the chin level. Record this measurement as protraction.

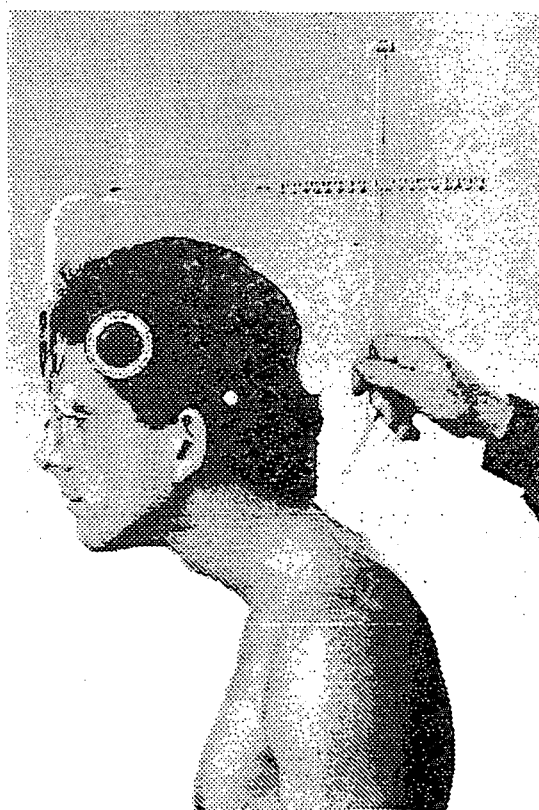


Figure 13: CROM with forward head arm and vertebra locator

- GONIOMETER READINGS: PATIENT NAME:.....

DATE:.....

FLEXION:  
EXTENSION:LAT FLEXION-RIGHT:  
LAT FLEXION-LEFT:ROTATION-RIGHT:  
ROTATION-LEFT:

DATE:.....

FLEXION:  
EXTENSION:LAT FLEXION-RIGHT:  
LAT FLEXION-LEFT:ROTATION-RIGHT:  
ROTATION-LEFT:

DATE:.....

FLEXION:  
EXTENSION:LAT FLEXION-RIGHT:  
LAT FLEXION-LEFT:ROTATION-RIGHT:  
ROTATION-LEFT:

DATE:.....

FLEXION:  
EXTENSION:LAT FLEXION-RIGHT:  
LAT FLEXION-LEFT:ROTATION-RIGHT:  
ROTATION-LEFT:

DATE:.....

FLEXION:  
EXTENSION:LAT FLEXION-RIGHT:  
LAT FLEXION-LEFT: