THE RELATIVE EFFECTIVENESS OF THE CERVICAL ROTATORY ADJUSTMENT AND THE SUPINE LATERAL BREAK ADJUSTMENT IN THE TREATMENT OF FACET SYNDROME IN THE CERVICAL SPINE

by

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I, Robert van Schalkwyk,
do declare that this dissertation is
representative of my own work

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DEDICATION

This dissertation is dedicated to my mother and father, Mr and Mrs R. van Schalkwyk, for all their support, generosity and their belief in my ability to become what I am today.

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ABSTRACT

The aim of this investigation was to determine which of two manipulative approaches would prove to be the more effective in terms of increased cervical range of motion and pain relief in the treatment of cervical facet syndrome. The rational for this study was the observation that whenever a supine lateral break was delivered to a lateral fixation in the cervical spine, the adjustment resulted in pain and discomfort due to the sub-optimal mechanics of the facets on the side of contact (Lewis, Jones, Penter : Personal Interview 1996; Bergman 1993 : 232). Thus, because up to 70% of a chiropractors patient base can present with cervical facet syndrome (Jones, Penter : Personal Interview 1996), there was a need to find a manipulative method that would be effective in the treatment of cervical facet syndrome in terms of increased cervical range of motion and pain relief.

It was hypothesized that by giving a rotatory adjustment on the ipsilateral side of a lateral fixation or a supine lateral break on the contra-lateral side of a lateral fixation, both treatments would be effective for cervical facet syndrome. The rationale being that by delivering these adjustments in the above described procedure, there would be an increase in the facet joint space as opposed to a decrease in the facet joint space which occurs when a lateral break adjustment is delivered on the same side of the lateral break. However, it was proposed in terms of subjective and objective findings, that the rotatory adjustment would be more effective than the supine lateral break.

Thirty subjects, each diagnosed with cervical facet syndrome, were randomly allocated to two groups of 15 each. The first treatment group (group-A), received a supine rotatory adjustment on the ipsilateral side of the lateral flexion fixation. The second treatment group (group-B), received a supine lateral break on the contra-lateral side of the lateral flexion fixation.

All the patients were then subjectively monitored using the McGill Short-Form Pain Questionnaire, the C.M.C.C. Pain Disability Index and the Numerical Pain Rating Scale-101. The objective data were recorded using the algometer measuring discomfort at the level of joint discomfort and the goniometer, measuring the cervical range of motion.

Each patient was treated 9 times, 3 times a week over a 3 week period, or until symptom free. This was followed by a one month follow-up period. The demographic data indicated that the subjects were uniform and healthy (70% of the patients were over the age of 35) and that there was a fair representation of gender (15 males : 15 females).

The data obtained from all the questionnaires and the objective data were statistically analyzed using the non-parametric two-tailed Wilcoxson Signed Rank test at a 95% confidence level ($\alpha = 0.05$). The median values from the initial, 5th, final and follow-up consultations of both group-A and group-B were all utilized and represented in table form. The mean values of both the subjective and objective data were also tabulated and assessed. Some of the data was diagrammatically represented for visual interpretation.

Comparative analysis of group-A and group-B was done using the Mann-Whitney U test at a 95% confidence interval ($\alpha = 0.05$). The comparison was made using the median values of the 1st, 5th, 9th and follow-up consultations. This was done for each of the measurement parameters.

The results indicated that for both the subjective and objective data there was a significant improvement within both treatment groups ($\alpha = 0.05$). It was found that group-A improved at a quicker rate than group-B from the 5th treatment onwards. When comparing the two groups, however, there was no significant statistical difference between them ($\alpha = 0.05$).

In conclusion, the findings of this study showed that cervical manipulation increased the range of motion of the cervical spine and decreased neck pain. There was also sufficient clinical appraisal and significant statistical evidence that a significant improvement occurred within each group. However, there was no significant statistical evidence to support the alternate hypothesis that there would be a significant difference in the subjective and objective clinical findings on analysis of the inter-group data.

TABLE OF CONTENTS **Page No.**

LIST OF ADDENDA

LIST OF TABLES Page No.

LIST OF FIGURES **Page No.**

LIST OF ABBREVIATIONS

1) No Abbreviations

2) C1 - First Cervical Vertebra

C2 - Second Cervical Vertebra

C7 - Seventh Cervical Vertebra

VBI - Vertebral Basilar Insufficiency

3) C6 - Six Cervical Vertebra

C.R.O.M - Cervical Range of Motion

α - Alpha

IC - Initial Consultation

5C - 5th Consultation

FC - Final Consultation

FW - Follow-up Consultation

4) Grp-A - Group-A

Grp-B - Group-B

SD - Standard Deviation

F Flex - Forward Flexion

Ext - Extension

R Rot - Right Rotation

L Rot - L Rotation

L Lat Fl - Left Lateral Flexion

R Lat Fl - Right Lateral Flexion

P - P-value (two-tailed probability of equalling or exceeding the significant value)

S - Significant

NS - Non-Significant

MVA - Motor Vechile Accident

H/A - Headache

5) P-S Con - Parkin-Smith Control Group.

DEFINITION OF TERMS

Manipulation

A passive therapeutic maneuver in which specifically directed manual forces are applied to vertebral and extra-vertebral articulations of the body, with the object of restoring mobility to restricted areas (Gatterman 1990 : 410).

Fixation

The state whereby articulation has become temporarily immobilized in a position that it may normally occupy during any phase of physiological movement.

(Haldeman 1992 : 623).

Facet Syndrome

The term "facet syndrome" pertains to the condition characterized by an overriding of the facets of adjacent vertebra, whereby the intervertebral foramina are narrowed from superior to inferior (Peters 1984).

It also relates to a state of subluxation with tension, pressure, stretching or irritation of the vertebral joint capsule as a result of postural strain or trauma, but without any narrowing of the related foramina (Kleynhans 1976 : 14-15).

Adjustment

The Chiropractic adjustment is a specific form of direct articular manipulation using either long or short lever techniques with specific contacts and is characterized by a dynamic thrust of controlled velocity, amplitude, and direction
(Haldeman 1992 : 621).

Motion Palpation

Motion palpation is defined as palpation of the human spine in the diagnosis of muscular, discal or articular mechanical changes (Alley 1983).

Functional Spinal Unit

A functional spinal unit or motion segment refers to two adjacent vertebrae and the ligamentous and soft tissue elements that connect them (Plaugher 1993 : 13).

Subluxation Complex

Pathology of the back results in limitation of movement in that part of the spine in which it is situated. Pain arising from within or around any synovial joint results in reflex muscular spasm in an attempt to prevent painful movement of the joint. Muscle pathology produces local muscle spasm that produces secondary loss of movement in the joint (Mennell 1990).

Subluxation Complexion (Continued)

Voluntary movement depends on the integrity of joint play specific for each plane of voluntary movement. Muscles that move the joint with joint dysfunction become hypertonic due to irritation and pain, therefore active range of motion is restricted (Dishman 1988).

CHAPTER ONE

1.1 INTRODUCTION

The cervical spine forms a long lever, with the head balanced at the top, weighing approximately 10 % of the body weight. Thus this arrangement makes the cervical spine very vulnerable to traumatic forces (Gatterman 1990 : 205).

According to Kelsey (1982), 40%-50% of the general population will suffer from cervical mechanical neck pain. More related to this study, the prevalence of cervical facet syndrome seen in chiropractic clinics can, at times, be as high as 70%-80%(Jones, Penter 1995). Aprill and Bogduk (1994) did a study which showed the prevalence of cervical zygapophyseal joint pain to be as high as 64%. Hult (1954) also showed that, on average 5% of the work force is incapacitated from work because of neck problems.

According to Howe et al. (1983) there are various postulated causes of mechanical neck pain but according to Gatterman (1990 : 205), the most common neck injury is joint sprain with joint locking and associated muscle strain. Mennell (1990) did a study to support his belief that intrinsic rather than extrinsic factors more commonly cause cervical spine pain. Aprill and Bogduk (1994) did a study that showed a 64% prevalence of zygapophyseal joint dysfunction in people complaining of neck pain. This shows that there is a very high incidence of mechanical neck pain resulting in joint dysfunction.

Very little information regarding the treatment of cervical facet syndrome can be found due to the fact that chiropractic practices have only been scientifically researched for about 30 years (Gatterman 1990 : xviii), and most of the research that has been done, has involved the lumber spine.

One suggested method of treatment for cervical facet syndrome is percutaneous radiofrequency medial branch neurotomy (Barnsley and Bogduk 1992). The rationale for this procedure, is that it provides long term relief from zygapophyseal joint pain by coagulating the nociceptors that supply these joints. However, even though relief of pain can occur for up to 12 months, the procedure is expensive when compared to spinal manipulative therapy. In other studies where treatment protocols have been investigated, the effects of manual therapy, physiotherapy, treatment by a general practitioner and a placebo treatment were compared (Koes et al. 1991). Results showed that physiotherapy and manual therapy proved to be the best. Even though there was no significant difference between these two therapies, the number of treatments for the manual therapy group was less when compared to the physiotherapy group, thus showing the former to be more time and cost effective treatment.(Koes et al.1991: 33.)

There are many other researchers that have shown the efficacy of cervical adjustments for mechanical neck pain e.g. Sloop et al. 1982, Cassidy et al. 1992a.

Chiropractic research has also shown that spinal manipulative therapy (SMT) does increase the cervical spine range of motion as well as decrease the pain (Cassidy et al. 1992).

Vernon et al. (1990) did a study to show that a simple manipulation would produce a greater rise in pressure pain threshold levels in the paraspinal area surrounding the spinal fixation, thus showing that

SMT also decreases muscle spasm. The study showed that the mean increase in pain threshold ranged from 40%-50%, with an average of 45%.

Even though research has shown that SMT is a positive treatment protocol for mechanical neck pain, more research is needed to find out what adjustive techniques are best when treating mechanical neck pain .

The purpose of this study was to find an adjustive technique that would give the least pain when adjusting and would also be significantly effective in the treatment of mechanical neck pain, thus furthering scientific insight into the efficacy of cervical manipulation.

1.1.2 The Statement of The Problem

This study proposed to investigate the effectiveness of the Cervical Rotatory Adjustment on the ipsilateral side of the lateral flexion fixation, as opposed to the Supine Lateral Break Adjustment on the contra-lateral side of the lateral flexion fixation, in the treatment of facet syndrome in the cervical spine in terms of the patients' perception of pain as well as objective clinical findings, in order to determine the relative effectiveness of each treatment protocol.

1. Objective One

The first objective was to compare the relative effectiveness of the Cervical Rotatory Adjustment on the ipsilateral side of the lateral flexion fixation and the Supine Lateral Break on the contra-lateral side of the lateral flexion fixation, with regards to the treatment of facet syndrome in the cervical spine, in terms of subjective clinical findings.

2. Objective Two

The second objective was to compare the relative effectiveness of the Cervical Rotatory Adjustment on the ipsilateral side of the lateral flexion fixation and the Supine Lateral Break on the contra-lateral side of the lateral flexion fixation, with regards to the treatment of facet syndrome in the cervical spine, in terms of objective clinical findings.

3. Objective Three

The third objective was to integrate the data from the two treatment protocols, with reference to the respective objective and subjective clinical findings, in order to establish the relative effectiveness of each treatment protocol in cervical facet syndrome.

1.1.3 Need For a Solution to the Problem

According to Lewis, Jones and Penter (Personal Interview 1996), when a lateral break adjustment is given on the same side of the lateral flexion fixation, the patient may experience pain and/or discomfort and the condition may get worse (Maigne 1964). Due to the biomechanics of the cervical spine, when lateral flexion of the cervical spine occurs, jamming of the articular process occur and a

decrease of the facet joint space occur on the same side as the lateral fixation(Bergmann 1993: 232),. According to Jones and Lewis (Personal Interview 1996), biomechanically, this may cause the patient pain or discomfort and can exacerbate the condition (Maigne 1964). By comparing the efficacy of a lateral break on the contra-lateral side of a lateral flexion fixation to a rotatory adjustment on the ipsilateral side of a lateral flexion fixation, then a preferred technique may be identified for a lateral fixation in the cervical spine, that causes the least discomfort and pain to the patient and will not result in exacerbating the condition.
(Jones and Lewis : Personal Interview 1996 ; Maigne 1964.)

Due to the fact that when lateral flexion of the cervical spine occurs the opposite facet joints are relatively free to move, it was proposed that a Lateral Break be given on the opposite side of the lateral fixation. An alternate form of manipulation was to give a Rotatory Adjustment on the ipsilateral side of the lateral fixation. This is biomechanically possible due to the coupled movement that occurs between the cervical vertebrae (White and Panjabi 1990 : 99-100). With coupled movement of the cervical spine, whenever lateral flexion occurs, a certain degree of rotation of the vertebrae occurs, and *visa versa* (Gatterman 1990 : 26). In the light of the above explanation, a Rotatory Adjustment can be given to a lateral fixation in the cervical spine.

1.1.4 Benefits

The results of this project would allow Chiropractors to use a specific type of adjustment for mechanical neck pain, that would prove to increase the cervical range of motion and or pain to the patient and also possibly prove to be a very effective treatment protocol. The outcome of the study will help clinicians select the most correct treatment for patients based on the subjective and objective outcomes.

CHAPTER TWO

REVIEW OF THE RELATED LITERATURE

2.1 Introduction

Mechanical dysfunction of the cervical spine has been reported to be an important aetiological factor in the presentation of certain types of headaches, migraine, post hyperflexion/hyperextension injuries, shoulder and arm pain, tinnitis and autonomic nervous system disturbances (Byfield 1991 : 45).

It is important to find a way to treat mechanical neck pain conservatively. Pharmacological relief of pain has not been shown to enhance healing of spinal tissues. In fact, an individual who has been rendered pain free may be more apt to return to strenuous activity before adequate healing has been achieved, thus actually furthering injuring the compromised region. (Brunarski 1984.) Similarly, prolonged rest and immobilization have been shown to lead to increased cross-linking of collagen and joint contracture. It has been shown that mobility and decreased pressure on articular surfaces can stimulate joint repair. Spinal manipulative therapy is one of those conservative therapies that have shown to have some success in the treatment of these syndromes. (Brunarski 1984.)

Spinal manipulative therapy is the primary therapeutic tool that chiropractors use to improve the health of these patients. Clinically, there are many variations of spinal manipulative therapy in use today, creating a vast array of different manipulative techniques. Chiropractors have yet to prove whether any of these techniques possess unique characteristics (biomechanical, indications/contra-indications of use, efficacy, etc). For the practicing chiropractor, this makes the decision of which technique to employ for a clinical situation a highly subjective endeavour. (Kawchuk and Herzog 1993.)

Due to the limitations as outlined above, it is clear that there is a definite lack of adequate and accurate communication within the profession. This has led to a proliferation of manipulative techniques. As a result, change has to be made in the way in which chiropractors treat musculo-skeletal conditions and this change has to occur in the nature of how and what we do, e.g. there should probably be certain set treatment protocols for each chiropractic condition. (Fitz-Ritson 1990.)

Spinal manipulations are precise manoeuvers. Executed correctly, they have been proved to be an excellent therapy in a substantial number of vertebral pain syndromes. (Maigne 1964.)

2.2 Clinical Anatomy of the Cervical Spine.

The cervical spine consists of seven vertebrae which are divided into typical and atypical vertebrae. The two groups are divided as a result of their slight anatomical differences to allow for there functional diversity. The 1st, 2nd and 7th cervical vertebrae constitute the atypical group and the 3rd, 4th, 5th and 6th cervical vertebrae constitute the typical vertebrae.(Gatterman 1990 : 205-207.)

The cervical spine is made up of two anatomically and functionally distinct regions i.e. an upper and a lower cervical region. These two regions provide for a wide range of movement in all planes, allowing for almost pure rotation and lateral flexion in addition to flexion and extension of the neck. (Gatterman 1990 :205.)

Adjacent vertebrae are connected via a compound joint consisting of an intervertebral disk anteriorly and two zygapophyseal joints posteriorly. These latter joints are true joints provided with a complete capsule and lined with a definite synovial membrane. On the medial superior aspect, the ligamentum flavum blends into the capsule. The synovial membrane of the facet joints is made up of synovial villi which vary in size, shape and appearance, and contain a rich supply of blood vessels and nerves. Each posterior ramus supplies at least two facet joints and each facet joint receives innervation from at least two spinal levels. (Mooney and Robertson 1975 : 150.)

The cervical spine curve is a secondary curve which first appears in intrauterine life and is further accentuated when the child is able to hold up its head (3-4 months) and to sit upright (9 months). In the adult the lordosis extends from the atlas to the second vertebra. (Gray 1973 : 283.)

2.3 Clinical Biomechanics of the Cervical Spine

The exact nature of the mechanism at work during movement of the human spine is not well understood, nor well defined. The spine supports the torso against loads and allows freedom of motion, within physiologic limits, at the same time. (Smith and Fernie1991.)

More recently, the study of manipulation and how it affects the biomechanics of the cervical spine has attracted a larger audience, including researchers from other health professions. This is significant in the sense that finding Chiropractic appears to be becoming a more recognized profession.(Yeoman 1992.)

The vertebrea in the cervical spine functionally allow for six planes of motion namley, flexion, extension, right and left rotation and right and left lateral flexion, however composite motion in cervical motion segments involves the coupling of axial rotation and lateral flexion (Milne 1993). According to White and Panjabi (1990 : 537), physiological movements of the cervical spine are inherently connected, and the phenomenon of joint coupling is due to the geometry of the individual vertebrae, the attachment of the ligaments and disc and the curve of the spine.

In his study, Milne (1993) found that in the upper cervical spinal region the axial rotation and lateral flexion ratio was approximately equal irrespective of the applied movement. According to Milne (1993), when lateral flexion occurs, the maximum amount of rotation occurs in the upper cervical region and when axial rotation occurs, the greatest range of lateral flexion occurs at that particular vertebral level. The least amount of accompanying motion occurs at C7-T1. This indicate that the ratio of axial rotation to lateral flexion varies depending upon whether movement is applied in lateral flexion or axial rotation.

In a study done by Cassidy et al. (1992b), rotatory adjustments were given to patients complaining of neck pain. Their range of motion was measured after the treatment. The greatest increase in range of motion was present in ipsilateral rotation, followed by contra-lateral lateral flexion, then ipsilateral flexion. This shows that coupled movement between adjacent vertebrae probably does occur and that rotatory adjustments are effective when given to release a lateral fixation on the contra-lateral side of the lateral fixation. (Cassidy et al. 1992.) Adjustments that are given for laterality correct rotation and rotatory adjustments correct laterality (Haldeman 1980 : 337). Due to the overall shape of the motion segment and particularly the shape of the facets, the kinematics of the motion segment are controlled, and therefore the effect of manipulative or adjustive forces that are introduced into the spine is controlled. Coupled motions in the vertebral motion segments therefore bring about a general increase in all ranges of motion following a vertebral adjustment. (Haldeman 1980 : 338.)

With respect to spinal manipulative therapy, the side on which cavitation occurs, based on biomechanical principles, is based on the patient set up and the type of manipulative thrust employed (Reggars and Pollard 1995). Kawchuk et al. (1993 : 576) found that the type of manipulation thus employed in the rotatory component to the lateral fixation was the same (i.e. no significant difference was found). In a study done by Reggars and Pollard (1995), it was shown that in 47 of the 50 patients (94%) that received a typical diversified rotatory adjustment, cavitation occurred on the ipsilateral side to the side of head rotation. Good (1992) reported that the greater the amount of lateral flexion towards the side of contact, the more likely it is that the joint opposite the segmental contact point will release i.e. evidence that cavitation will occur on the contra-lateral side of a lateral fixation when a lateral break adjustment is given.

2.4 Incidence and Prevalence of Neck Pain

Approximately 1 million new patients are reported annually at a cost of 2 billion per year including days lost from work as a result of chronic neck pain. One third of all motor vehicle accidents are responsible for 85% of whiplash injuries. (Osterbauer et al. 1992 .)

According to Lenhart, there is a 66% incidence rate of cervical injuries following automobile injuries. Many cases of tension headache and cervical migraine are thought to be due to mainly cervical injury that may have been forgotten or simply ignored as trivial by the patient. (Lenhart 1988.)

Cassidy et al. (1992 : 570) reported that 40%-50% of the general population at some time during there lives suffer from neck pain.

Back and neck complaints occur frequently in Western countries. It was estimated that 80% of people in the Western countries experience back problems during there active lives. It was reported that neck problems are less frequently reported, but they constitute a major health problem as well. (Koes et al. 1991.)

Manual therapy has been proposed as a effective treatment for a wide variety of conditions, but it is most commonly associated with disorders that have there origin in pathomechanical or pathophysiologic alterations of the locomotor system and its synovial joints (Bergmann 1993 : 51-52.)

Aprill and Bogduk (1994) did a study to prove the prevalence of cervical zygapophyseal joint pain. A sample of 318 consecutive patients with intractable neck pain was used. Of these, 25% had symptomatic zygapophsyeal joint pain with a possibility that a further 38% suffered zygapophyseal joint pain, although these results were not appropriately investigated, it is evident that zygapophyseal joint pain is not uncommon or rare and is worthy of further research. Aprill and Bogduk (1994) also reported that approximately 26% and 63% of patients may go underdiagnosed or incompletely diagnosed as having cervical zygapophyseal joint pain.

In a comparative study done on Chiropractic, Medical and Osteopathic care for work related sprains and strains on the neck, it was found that for those subjects that received care from chiropractors, the mean number of compensated days lost from work was at least 2.3 days less than for those who were treated by medical doctors, and at least 3.8 days less than for those who were treated by osteopathic doctors. Much less money in employment compensation was paid, on average, to those who saw chiropractors. (Johnson et al. 1989.)

2.5 Causes of Mechanical Neck Pain

Mechanical causes include :

1) Intra-articular jamming - This may be due to meniscoids, synovial folds or hypertonic villi becoming entrapped within the joint. This interfers with movement, causes pain, muscle spasim and inflammation. According to Panzer (1995 : 419), intra and extra-capsular adhesions, abnormal capsular tension and osseous mechanical locking offer alternate causes.

2) Shortening and scarring - Ligamentous shortening and articular adhesions (fibrosis). (Gatterman 1990 : 45).

According to Howe et al. (1983), the causes of neck pain or stiffness are poorly understood. Various postulated causes of mechanical neck pain are :

1) Minor subluxations of the facet joints;
2) derangement of the intervertebral discs with secondary osteoarthritis of the interarticular joints; and
3) entrapment of the meniscoid structures that exist in the upper cervical apophyseal joints straining the joint capsule.

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

1) intrinsic trauma;

2) immobilization with which disuse and aging must be considered; and

3) factors residual from the healing of some more serious pathological conditions.

According to a study done by Mennell (1990), less than two thirds of the study group whose predominant symptom was head pain, remember having a major cause for the pain, i.e. headache or concussion. This supports his belief that intrinsic rather than extrinsic factors more commonly cause cervical spine pain.

From a interest point of view a study done by Seltzer (1982), showed that food and food / drug combinations can result in head and neck pain syndromes. At least 25 syndromes have been described. These include those induced by colouring and flavouring agents, alcoholic products, chocolate, coffee and tea, foods containing tyramine, vitamins, minerals, pesticides and several others. Even these syndromes may not result in mechanical neck pain, and the knowledge of the etiology of such syndromes may help in their treatment.(Seltzer 1982.)

2.6 The Subluxation Complex

The concept of subluxation and spinal manipulation can be traced back as early as the Aurignacican period (17,500 B.C), the ancient Chinese (2700 B.C) and the Greek civilizations (1500 B.C) (Dishman 1988). The chiropractic subluxation has been proposed to be comprised of five parts. They are :

1) Neural; 2) kinesiopathological; 3) muscular; 4) cellular; and 5) biomechanical. (Dishman 1988.)

According to Mennell (1990), pain arising from within or around any synovial joint results in reflex muscular spasm in a attempt to prevent painful movement of the joint. Muscle pathology produces local muscle spasm that produces secondary loss of movement in the joint (Mennell 1990).

Voluntary movement depends on the integrity of joint play specific for each plane of voluntary movement. Muscles that move the joint with joint dysfunction become hypertonic due to irritation and pain, therefore active range of motion is restricted. A characteristic of a subluxation is this loss of joint play and pain on testing the joint. (Dishman 1988.)

According to Seltzer (1982), immobilization of a joint is known to be detrimental and leads to poor healing of articular cartilage. Poor healing takes place with fibrous tissue and fibrocartilage tends to degenerate. With continuous passive motion of the synovial joint post-operatively the healing of the articular cartilage results in tissue comparable to hyaline cartilage. (Seltzer 1982.)

Studies have shown that prolonged periods of internal fixation result in degenerative changes of the cartilage and that on removal of these fixations, the degenerative changes of the cartilage is reversible. In one experiment dogs were killed between 2-6 months post-opperatively, showing obvious gross and histological degenerative changes of the immobilized apophyseal joint. Every immobilized joint showed marked decrease motion when compared with joints that were not immobilized. After 2 months of internal fixation, the degenerative changes were not reversible. (Kahanovitz et al. 1984.) Dishman (1988) reports that the residual of not correcting a symptomatic subluxation results in fibrosis, contractures, adhesions, deformity and structural derangement. A person presenting with this problem will require repeated manipulative treatment for many years (Dishman 1988).

The potential pathological effects of the subluxation complex may be broadly divided into three categories (Bergmann 1993 : 54-61) :

1) Mechanical : Joint derangement results from acute injury, repetitive use injury, faulty posture or co-ordination, aging, congenital, developmental defects or other primary disease states. The process of repair can take months, especially in the presence of excessive immobilization. Internal joint derangement can also result in joint locking, i.e. entrapment of the joint meniscoids. Thus, mechanical dysfunction is considered a frequent and significant cause of spinal pain and spinal derangement. It is important therefore to detect mechanical dysfunction at an early stage of alteration and eliminate it before other permanent disorders develop.

2) Inflammatory/Vascular : These effects are initiated by joint injury, chronic mechanical joint derangement or immobilization. The effects include vascular congestion, ischaemia and inflammation. The pain may result in local muscle reflex muscle contraction, leading to local ischaemia and more pain leading to a self perpetuating cycle of pain and muscle spasm. One must remember that the inflammatory reaction is a normal protective response but it may accentuate the pain response, slowing recovery time and perpetuating joint dysfunction. If muscle contraction persists, this will lead to muscle contracture as the myofascial structures become shortened and are infiltrated with fibrotic tissue.

3) Neurobiologic : The effects here are as a result of vertebral joint dysfunction and its associated mechanical alterations, pain and potential local inflammation, as lesions capable of inducing chronically altered nociceptive and proprioceptive input. This altered input is theorized to produce sensitization of local spinal neuron pools and the establishment of abnormal somato-somato or somato-visceral reflexes, which become a potential driving force of altered somatic or visceral function. This proposed joint subluxation/dysfunction induced neurologic phenomena may be clinically manifested by the presence of pain, altered temperature, regulation hypersthesia or altered somatic and/or visceral function. According to Bergmann (1993 : 63), there are five diagnostic criteria for spinal dysfunction, represented by using the acronym **P.A.R.T.S.**

P. : Pain /Tenderness.

Pain and or tenderness is produced by palpation of osseous and soft tissue.

A. : Asymmetry/Alignment.

This is noted through observation of posture and gait as well as palpation for misalignment of vertebral segments.

R. : Range of Motion abnormality.

Change in active, passive and accessory joint motions is noted through procedures of motion palpation and stress x-ray.

T. : Tissue Tone, Texture, Temperature abnormality.

Changes in the characteristics of contigious and associated soft tissues (skin, fascia, muscle and ligaments) are noted through procedures of observation, palpation, instrumentation and tests length and strength.

S. : Special Tests.

e.g. leg length check, arm fossa test, therapy localization etc.

These above criteria can be used to decide which areas need adjustment. The clinical decision as to whether an adjustment will be made, how it is done, where and when to apply the adjustment depends on the practitioner. If practitioners were to standardize their evaluation, then comparison of treatment effectiveness and efficacy could be done. (Bergmann 1993 : 62.)

Mennel (1990) did a study to show the validation of the diagnosis of 'joint dysfunction'. The study showed that out of the 100 patients that were treated for 'joint dysfunction', 83 received manipulative therapy. Of these 83 patients, 17 were completely cured, 37 were markedly improved and entirely satisfied and 24 said that even though they had only moderate improvement, they had received more relief from this treatment than any other that they had received before. This shows the validity of proper joint dysfunction diagnosis and the importance of manual therapy.

2.7 Posterior Facet Syndrome

Posterior facet syndrome is a disorder of the spinal facet joints producing local and radiating pain. The diagnosis is based mainly on clinical evaluation, since radiographs are most often negative. The syndrome can be triggered from extrinsic factors like trauma or intrinsic factors like bad posture.(Roy et al. 1988.)

The facet joints are true synovial joints with a protective surface of hyaline cartilage and a joint space which is enclosed in a fibrous capsule, lined with a synovial membrane. The cervical facet joints are orientated obliquely to the saggital plane and approximately 90° to the transverse plane. Their function is to control and guide the movements of extension and flexion and to limit rotation. (Hourigan and Bassett 1989.)

Cervical Posterior facet syndrome is a well recognized cause of chronic pain of the head, neck and upper back. The proximity of the posterior branches of the vertebral nerve roots to the synovial capsule of the facet joints, explains the radiating pains when the capsule is stretched due to bad posture or extreme movements with or without rotation. (Roy et al. 1988.)

The facet as a source of pain was advanced by Goldthwait in 1911, but it was not until 1933 that Goldthwait introduced the term "The Facet Syndrome" implying that the articular facets may cause back pain (Hourigan and Bassett 1989).
The term "facet syndrome" pertains to the condition characterized by an overriding of the facets of adjacent vertebrae, whereby the intervertebral foramina are narrowed from superior to inferior (Peters 1984). It also relates to a state of subluxation with tension, pressure, stretching or irritation of the vertebral joint capsule as a result of postural strain or trauma, but without any narrowing of the related foramina (Kleynhans 1976).

In a study done by Dwyer et al. (1990), 5 people received injections into their zygapophyseal joints with contrast medium. A total of 11 joints were injected. They were stimulated under image-intensifier. After the injections, the subjects were examined for tenderness in the cervical and shoulder regions. The subjects felt pain as well as a slight hypersthesia in respected regions. The distribution of the evoked pain and any areas of tenderness were marked out on the skin, and the delimited area was recorded on a body diagram. The subjects also recorded the level of pain perceived on a visual analogue scale.

Literature suggests that the facet syndrome is tractable to manipulation and conservative management strategies; however, comparative efficacy of various adjustive methods appears to be relatively unresearched and thus should be the subject of a major study (Peters 1984.)

2.7.1 Classification of Facet Syndrome.

Kleynhans (1976), classifies facet syndrome into 3 categories.

1. Traumatic : this is accompanied by inflammation of the capsule, producing interfacet pressure and pain characteristics.
2. Pathologic : due to degenerative thinning of the intervertebral disc, this permits an approximation of the articular surface which is roughened and sclerosed.
3. Postural : damage to the structures of the back brought about in flexion, rotation, stress, unguarded movements or compromised musculature.

2.7.2 Causes and Predisposing Factors to Facet Syndrome.

Predisposing factors to subluxation and tearing of the capsule include :

- Spinal instability;
- degenerative changes in the disc;
- chronic occupational strain;
- excessive superimposed weight;

- weight bearing in a scoliotic or lordotic posture;
- driving vehicles which shake and jolt e.g. earthmoving equipment;
- certain sports e.g. judo;
- anything which decreases the controlled muscular support, e.g. fatigue.

(Peters 1984.)

Degenerative changes occur in all parts of Intervertebral joint complex simultaneously. Injuries to the facet joints can include osteoarthritis or compression subchondral fractures, involving the articulate. The tissue response includes effusion, synovitis and limitation of movement. The degenerative changes in the facet articulation include fibrillation of the articular cartilage, loss of articular cartilage, presence of loose body formation and adhesion between the capsule of the facet and the meningeal covering of the adjacent nerve root, synovial hypertrophy and capsule laxity. (Peters 1984.)

Causes of Facet Syndrome include :

- Chronic synovial and/or capsular reaction to trauma. This is successfully treated by chiropractors. Here pinching of the synovium and capsular folds can occur.
- Spinal instability. This is represented clinically by patients who find various sitting postures uncomfortable and require specific chairs to be relieved of disability.
- Degenerative conditions. This can be secondary to long term persistence of conditions of chronic synovial/capsular reaction and spinal instability which eventually results in degenerative changes at the synovial joint. (Mooney and Robertson 1975.)

2.7.3 Clinical Signs and Symptoms.

Posterior Cervical Facet Syndrome may present with the following clinical presentations :

1. Localized acute or chronic pain, with or without arm pain, arising from overstressed cervical segments.
2. A chronic condition with spondylitic changes of the cervical spine with hypomobility.
3. Symmetrical neck pain, brought on by movements and activities. The paravertebral musculature is palpably tender and movement is restricted;
4. Unilateral occipital and neck pain;
5. Painful and restricted rotation and lateral flexion.

(Grieve 1988 : 378).

2.8 Motion Palpation

Static and dynamic palpation is the chiropractors' most essential tool in the diagnosis of dysfunction. Dynamic motion palpation is becoming more widespread throughout the field of chiropractic.(Dishman 1988.)

Motion palpation is defined as palpation of the human spine in the diagnosis of muscular, discal or articular mechanical changes. Literature shows that motion palpation done by chiropractors and osteopaths has a high inter-examiner and intra-examiner reliability and validity (as high as a 99% correlation). Literature has also shown that the reliability and validity of Aneradiography was only 42% better than motion palpation, as apposed to being 57% and 52% better than static palpation and x-ray respectively. (Alley 1983.)

There are two main varieties of palpation, namely static and motion palpation. With static palpation, the patient is motionless and the examiner uses manual contact over soft and osseous tissue to detect tissue tone, temperature, areas of tenderness and the degree of osseous alignment. This type of palpation is not reliable due to the fact that some bony prominence could be mishaps, creating asymmetries that are not related to abnormal mechanical function. Also, the nature of the body is one of a dynamic architecture. (Alley 1983.)

Motion palpation is used to evaluate musculoskeletal compliance to dynamic demands. It can be divided into 2 categories, namely active and passive motion. Active motion is produced voluntarily by the patient, or aided by the examiner, whereby all the motion is within the patient's normal physiological range. Passive motion is motion that is not under the patient's voluntary control but is induced by the examiner and exceeds the patient's active range of motion. When passive motion is considered to be normal in one direction of a motion plane, but is decreased in the opposite motion plane, it is considered to be a dynamic indication of joint fixation or subluxation. As a result the joint may not meet the functional demands placed on the motion segment. If the condition is not normalized i.e. by manipulation, it is possible that early decompensatory pathological changes may occur in the involved joint.(Alley 1983.)

According to Mennel (1990), all pathology of the back results in limitation of movement in that part of the spine in which it is situated.

The detection of dysfunction is not an exact science and any of the examination procedures utilized to detect subluxations may produce false positive, false negative and equivocal results (Bergmann 1993 : 52).

A study was done by Jull et al (1988), to show the accuracy of manual diagnosis for cervical zygapophyseal joint pain syndromes (facet syndrome). The study consisted of 20 subjects. In 11 of the subjects, the detection of present or absent symptomatic joints was established by means of radiologically-controlled diagnostic nerve blocks. The subjects were then assessed by the manipulative therapist, who had no knowledge of the medical diagnosis. The other 9 subjects were first assessed by the manipulative therapist and then by means of the diagnostic blocks. Results showed that the manipulative therapist correctly identified all the 15 patients that had symptomatic zygapophyseal joints, and correctly specified the segmental level of the symptomatic joint. Thus manual diagnosis done by a trained manipulative therapist can be as effective but less expensive than radiologically-controlled diagnostic blocks in the diagnosis of cervical zygapophyseal syndromes. However, according to Dishman (1988), inter-examiner reliability of motion palpation is directly related to his or her training and psychomotor skills.

No doubt with time, further assessment and study will lead to the refinement, exclusion and addition of physical examination procedures used in the detection of joint subluxation/dysfunction. It would be wrong to reject an analytical or therapeutic procedure because it is untested as it would be wrong to accept the same procedure in the absence of convincing evidence (Bergmann 1993 : 66).

Table 2.1 : The average normal ranges of motion for the cervical spine are:

(White and Panjabi 1990 : 110)

	MEAN DEGREES flexion plus extension	lateral flexion (one side)
C0-C1	13	8
C1-C2	10	0
C2-C3	8	10
C3-C4	13	11
C4-C5	12	11
C5-C6	17	8
C6-C7	16	7

	axial rotation (one side)
C0-C1	0
C1-C2	47
C2-C3	9
C3-C4	11
C4-C5	12
C5-C6	10
C5-C6	9

An important study done by Nansel et al. (1992) revealed a incidental finding. A random goniometric screening of a student population revealed that on any particular day, 1 out of 3 individuals can be expected to exhibit a cervical lateral flexion passive end-range asymmetry of 10° or greater. Thus the authors question the legitimacy of the term 'dysfunctional' if based solely on the mere observation of a range of motion asymmetry of 10°-15°.(Nansel et al. 1992.)

2.9 The Efficacy and Validity of Cervical Spine Manipulation

2.9.1 The Manipulation and its Validity

In order for a good manipulation to be given, 5 factors must be taken into consideration : (Haas 1990.)

1. Quickness : This factor is made up of 2 components, namely high velocity and brevity. The brevity aspect of quickness exploits inertia to facilitate joint isolation therefore not inducing unwanted cavitation. Exploitation of inertia by quickness is probably the chief mechanism facilitating joint cavitation.

2. Amplitude : A short amplitude serves to protect the joint from over- distention past the level of anatomical integrity, as well to protect the adjacent motion segments from distraction by isolating the joint of interest.

3. <u>Countertension :</u> Tension increases the inertia permitting distraction to cavitation with less quickness.

4. <u>Preadjustive Tension :</u> This serves to limit the dissipation of energy by dampening forces. It also limits dispersion of force and energy into structures other than the joint of interest.

5. <u>Mass and Acceleration :</u> Acceleration regulates the impact velocity which along with the mass, are the explicit extrinsic variables governing the adjustive force. Acceleration also contributes to the quickness of the adjustment.

In the study done by Maigne (1964), adjusting the patients revolved around the concept of painlessness and opposite motion in spinal manipulations. Here the manipulation was executed in a direction opposite to the motion that was painful and limited. The manipulation had to be painless as this allowed the determination of (Maigne 1964) :

- whether the manipulation was possible and desirable;
- the exact procedure to apply and its direction; and
- how the treatment was to progress.

Manipulation should not be given routinely on a vertebral segment without consideration of the individual clinical case. Each case demands a particular manoeuver which has to be strictly adapted to the individual needs. To force a painful spinal movement sometimes results in a sharp pain, thus making the condition worse. (Maigne 1964.)

According to Maigne (1964) there is a reason for the pain and limitation of movement, thus a forced movement may irritate the lesion and increase the inflammation in the area, making the condition worse.

The manipulation can be divided into three phases : (Maigne 1964)

1) Positioning, 2) tightening and 3) manipulation per se (forced, short, unique motion, executed at the point of tightening.)

According to Haldeman (1980 : 340), for a manipulation to be effective it must be given to :

1) the specific facet which is subluxated (malpositioned);

2) the facet whose main motion is restricted (fixated); and/or

3) the holding elements, by producing a dynamic stretch to the ligamentous or muscular tissues.

To summarize, the manipulative thrust should be directed towards the fixated facet with a line of thrust in the plane of the involved facet in the direction which stretches the holding elements (Haldeman 1980 : 340).

The actual effects that a manipulation has on the spinal column are not well understood. However, the following effects have been observed or are hypothesized to occur : (Herzog 1994.)

1. Absolute and relative movement of the vertebral bodies in the vicinity of the manipulative application. According to Sandoz (1976) after cavitation there was a gain of 5°-10° in a range of passive movement of a joint in all directions.

2. Cavitation of the facet joints.

3. A reflex response of the paraspinal muscles in the vicinity of the spinal manipulative application.

Koes et al. (1992) compared the effects of manual therapy, physiotherapy, treatment from a general practitioner (G.P) and placebo therapy on patients who had had neck pain for ± 6 weeks. The manual therapy consisted of manipulative and mobilization techniques, the physiotherapy consisted of exercises, massage and physical therapy modalities, the G.P treatment consisted of a prescription of analgesics, non-steroidal anti-inflammatories., advice about posture, home exercises and bed rest, and the placebo therapy consisted of detuned ultrasound and detuned short-wave diathermy. Both the manual therapy and physiotherapy had the best recovery rates. There was no significant difference between the 2 therapies but the patients in the manual therapy group received considerably fewer treatments than the physiotherapy patients. There were 3, 6 and 12 week follow-up periods and there was a significant statistical difference between the manual and physiotherapy groups at the 3 week follow-up period when compared to the G.P therapy group.

2.9.2 The Efficacy of the Spinal Manipulation

Sloop et al. (1982) did a double-blinded control study whereby 21 patients with non-specific neck pain were given diazepam before a manipulation. Eighteen Other patients served as the control group and only received diazepam but no manipulation. After a 3 week period, 12 of the 21 patients (57%) responded affirmatively. Only 5 of the 18 patients (28%) responded affirmatively. At the 12 week follow-up period a larger proportion of the manipulative group improved as compared to the control group. However, this difference was not statistically significant.

A retrospective, uncontrolled review was done by Lippit (1984), whereby he injected a total of 117 facet joints with lidocaine. The study involved 99 patients suffering with chronic neck pain.. The results proved to be outstanding in 17% of the patients, good in 20%, fair in 9%, mediocre in 4% and no change in symptoms occurred in 44% of the patients. He concluded that this procedure could be used as a safe, simple, cost-effective facet blockade diagnostic technique. He recommended that this procedure be used for diagnosing and conservative therapy.

In a randomized controlled study done by Howe (1983), he took 52 subjects complaining pain in the hand, arm or neck thought to be due to a lesion in the cervical spine. The control group received an injection of azapropazane with evidence of reduced movement at one or more of the cervical intervertebral joints. The treatment group received both the injection of azapropazane and a cervical manipulation. After 3 weeks, the treatment group showed an immediate significant improvement, as compared to the control group, in symptoms with those patients with pain or stiffness in the neck and shoulder. The improvement, even though not as significant as in the neck and shoulder, was still good for those patients suffering with pain and/or paresthesia in the arm or hand. The range of motion in the cervical spine of the treatment group was also greater than that of the control group.

Brunarski (1982) did a review to determine if there was sufficient evidence in the scientific literature to suggest that spinal manipulative therapy could be more effective than medical care in the management of painful neuromusckuletal conditions. From the 50 studies reviewed, it was found that improvement in the manipulative groups averaged above the non-manipulative groups by 20%.

Maigne (1964) did a study that was similar to this study whereby he performed an adjustment by taking contact on the painless and opposite side of the restricted motion. He concludes that this method allows effective, gentle manipulations which are without pain and without risk. He treated 1000 patients without one single undesirable incident.

Cassidy et al. (1992) did a study to determine if there is a relationship between pain and range and motion in the cervical spine. The study consisted of 50 patients who suffered with unilateral neck pain and without neurological deficits. Immediately prior to and after the treatment, the range of motion was recorded with a goniometer. The pain intensity was recorded using the 101-numerical rating scale. Results concluded an increase in all planes of post-treatment range of motion and a decrease in all post-treatment pain intensities, thus showing a distinct relationship between in the decrease in pain and increase in cervical range of motion.

A study done by Yeoman (1992) showed that the cervical range of motion after spinal manipulative therapy significantly increases to the range of motion as apposed before the manipulative therapy was given.

Terrett and Vernon (1984) did a study to show that a simple manipulation could increase paraspinal pain tolerance levels. The results showed that there was a significant increase in pain tolerance levels of the paraspinal tissue after the manipulation was given as compared to the control group that received a passive joint play manoeuver into the zone of "end-feel".

Nansel et al. (1993) showed in their study that cervical spinal manipulation can have significant effects on the tonicity of the lumbopelvic musculature, presumably by facilitating tonic neck reflexes involving intersegmental spinal pathways. It was found that manipulation of the lower cervical spine had a greater effect on the lumbopelvic region musculature when compared to the manipulation of the upper cervical spine (Nansel et al. 1993).

In another study done by Nansel et al. (1992), manipulations delivered to the upper cervical region produced significant effects related to the rotatory axis but were relatively ineffective in ameliorating asymmetries exhibited along the lateral axis. Manipulations delivered to the lower cervical region on the other hand produced significant amelioration of lateral flexion asymmetries but were relatively ineffective in inducing changes in the end-range along the rotatory axis.

In a study done by Leach (1983), it was found that manipulation of the cervical spine improved hypolordosis of the cervical spine by a mean improvement of 4.55°. These findings lend support to the fundamental chiropractic aspects such as that spinal manipulative therapy, when executed correctly, can prove to be beneficial in correcting biomechanical disorders of the spine (Leach 1983).

2.10 Complications and Contra-indications of Cervical Manipulation

All forms of treatment, medical or otherwise, can lead to accidents and chiropractic is no exception (Laderman 1990).

A chiropractor, when confronted with a "joint dysfunction", should not just adjust as there may be complications involved. When a joint dysfunction is perceived as the sole cause of the disorder, then manipulative therapy may stand as the treatment protocol. However, when the dysfunction may be secondary to other disorders, the therapy should be directed to treatment of the source of the problem.(Bergmann 1993 : 51-52.)

According to Bergmann (1993 : 51-52) there are a number of disorders that display joint and somatic functional alterations which are effectively treated with chiropractic manipulation, but there are also a number of pathological processes capable of inducing joint dysfunction/subluxation and therefore can lead to complications.

The complications due to spinal manipulation include (Haldeman 1980 :379- 381.) :

1. Accidents resulting in Vertebrobasilar Insult (VBI);
2. Atlas compression of the internal carotid artery;
3. Hematomylelia due to cervical hypertension;
4. Dislocations from the manipulative therapy e.g. Anterior dislocation of the atlas or axis.

In a literature review done by Michaeli (1993), it was found that neurophysiologically the cervical spine can cause dizziness known as cervical vertigo. The mechanism appears to be a distortion of the neuron afferent input to the vestibular nucleus from the upper cervical spine. Michaeli (1993) also found that neuroanatomical interconnections between C1, C2 and C3 nerve roots and the spinal tracts can cause a referral of pain from the neck to the head and that symptoms of nausea and vomiting can be produced via connections between the upper cervical nerves with the vagus, accessory and hypoglossal nerves through the superior cervical sympathetic ganglion.

Michaeli (1993) sent a questionnaire to practicing physiotherapists in South Africa who performed cervical manipulation as part of their treatment protocols. The results of the questionnaire revealed that dizziness, severe headache and nausea were the most common side effects of cervical manipulation.

There are certain pathological conditions that are contra-indicated to manipulation of the spine and every chiropractor must be aware of these conditions. (Gatterman 1990 : 67-68); (Haldeman 1980 : 379-380.)

1. Arthritides e.g. ankylosing spondylitis, rheumatoid, psoriatic and Reiters arthritis.
2. Articular trauma, dislocations, ruptured ligaments and recent trauma e.g. whiplash.
3. Joint hypermobility e.g. long term micro trauma.
4. Bone weakening diseases e.g. osteoporosis, secondary malignancy and tumors.
5. Circulatory disturbances e.g. aneurysms and VBI.
6. Psychological conditions e.g. psychological intolerance of the patient to pain or discomfort, hysteria, malingering
7. Bone infections e.g. osteomyelitis and bone tuberculosis
8. Neurological complications e.g. advanced disc lesion.
9. Metabolic disorders e.g. osteopaenia.

There is one aspect of manipulation of the cervical spine that every chiropractor should be aware of and that is post traumatic brainstem syndromes. In the past 50 years, 100 cases of these syndromes have been reported, 12 of these the responsibility of chiropractors (Ladermann1990). The age of occurrence is generally under 40 years and is generally not found in those patients who do not suffer from osteoarticular degeneration or arteriosclerosis (Ladermann 1990). A list of brainstem syndromes that can follow cervical manipulation include : 1) Wallenberg's syndrome; 2) Babinski-Nargeotte syndrome; 3) "locked -in" syndrome; 4) internuclear opthalmoplegia; 5) sensorineural hearing loss; and 6) global brain stem and cerebellar syndrome. (Ladermann 1990.)

According to Theil (1991) the cause of vertebrobasilar insufficiency syndrome (VBI) is associated with head turning and or head extension. One possible mechanism of this involves spinal manipulative therapy in the cervical spine. At least 123 cases of cardiovascular accident (CVA) have been cited due to neck manipulation. Those activities that can cause VBI and can predispose a person to a CVA include those activities which cause hyperextension and rotation of the neck e.g. calisthenics, yoga, archery practice, motor vehicle accidents, infant delivery and resuscitation maneouvers.(Theil 1991.)

The vertebral artery is different to other arteries in the human body as it is the only artery to run for most of its length within an osteofibrotic channel that has moveable segments. The blood flow in the vertebral arteries ranges from 10-90 ml per minute, with an average flow of 45 ml per minute. The two vertebral arteries contribute approximately 11% of the total cerebral blood flow and supply blood to over 70% of the cervical spinal cord, nerve roots and their surrounding tissue. (Thiel 1991.)

The vertebral artery is divided into 4 segments. The segments begin at the origin of the vertebral artery at the subclavian artery. It then passes into the transverse foramen at C7 and runs up these foramina up to C2, along the transverse foramen process of the axis and atlas, penetrates the dura of the foramen magnum and ends when the vertebral arteries unit with each other.(Theil 1991.)

It is at the third segment, at the atlantoaxial joint, where most complications lie for chiropractors.(Thiel 1991.) According to Panjabi et al. (1988) 70% of the cervical spine rotation takes place at the occipital C1-C2 region and the greatest intervertebral motion in the spine is axial rotation at the C1-C2 joint. This is an area where the vertebral artery is most susceptible to injury and to damage as a result of mechanical impingement by degenerative changes (Terret 1987 b). It is suggested that the atlantoaxial joint is the most probable site for vessel compression. (Thiel 1994.)

Due to the amount of rotation, extension and force that occur when giving a rotatory cervical adjustment, it stands to reason that manipulation is a precipitating factor to VBI, but it is not the fundamental cause. A manipulation cannot cause VBI, but it can cause a transitory VBI to worsen into a permanent one and this is due to the fact that a manipulation is a physical, mechanical impulse applied to a articular segment in a specific direction, using force and velocity.(Ladermann 1990.)

A simple test to determine if a person is predisposed to VBI is to do Wallenberg's test or extension rotation test (Gatterman 1990 : 58).

Wallenberg's test has the advantage of being a simple, economical and easy to perform test, but the validity and reliability of this is questioned. A study was done by Haynes (1995) whereby he used a Doppler Ultrasound Scan to prove the reliability and validity of the Wallenberg's test. Results revealed that the Wallenberg's test was not valid. Proof of the test's reliability has not been demonstrated and thus, according to Ladermann (1990), it is of little help. Ladermann (1990) feels that better knowledge of the pathogenesis of the VBI conditions can be obtained by using tools like computerized angiograph and Doppler investigations.

According to Ladermann (1990) and Thiel (1991) VBI is clinically manifested by a broad range of symptoms including : ataxia, vertigo, nausea, visual disturbances, tinnitis, vomiting, light-headedness, inco-ordination of extremities, dysarthria, numbness on one side of the face and/or body and difficulty in walking.

Theil (1991) feels that movements of the head, especially rotation and extension, may transitory interfere with the vertebral arterial blood flow and lead to symptoms of VBI.

2.11 Differential Diagnosis of Mechanical Neck Pain

There are other conditions which present with a clinical presentation which is similar to that of mechanical neck pain and thus could be misleading to a chiropractor, leading to incorrect diagnosis and thus to incorrect treatment. It is important for a chiropractor to be aware of these conditions as they could be contra-indicated to chiropractic manipulation. In some of these conditions the incorrect treatment could exacerbate the condition. The conditions are listed below (Gatterman 1990 : 232.) :

1. Muscular syndromes e.g. cervical sprain.
2. Inflammatory disorders e.g. rheumatoid arthritis, reiters and ankylosing spondylitis.
3. Tumors : primary (rare) and secondary e.g. to liver and breast.
4. Systemic disorders e.g. leukemia, Paget's disease and osteoporosis.
5. Congenital abnormalities e.g. cervical rib.
6. Biomechanical disorders e.g. degenerative disc disease.

2.12 Alternate Treatment for Mechanical Neck Pain

In a study done by Roy et al. (1988), 21 patients with cervical facet syndrome, underwent 39 facet joint infiltrations with corticosteroids using fluoroscopic guidance. The infiltrations included 22 intra-articular and 17 periarticular injections. The results showed a relief in 91% of the patients. Follow-up treatments ranged from 1 week to 12 months.

However, it was to be found that symptoms re-occurred in 71% of the patients with complete responses and in 42% of those patients with partial relief. There was no significant difference between those patients who received either the intra-articular or periarticular injection.

In a study which involved 6 patients with chronic intractable neck pain, the medial branches of the cervical dorsal rami were interrupted by percutaneous radiofrequency neurotomy, therefore blocking the pain signals from the areas supplied by the medial branches of the cervical dorsal rami. All the patients experienced received relief of some or all of their neck pain. The technique was found to be a safe and effective therapy for cervical zygapophyseal joint pain. However, it was expensive to perform. (Barnsley and Bogduk 1992.)

Other forms of treatment where a chiropractor could use injunction with manipulation include :

1) ergonomic and postural advice;

2) soft tissue massage;

3) triggerpoint therapy;

4) manual traction;

5) application of heat or cold;

6) use of orthopedic supports; and

7) nutritional counselling and recommended exercise.

(Jones and Penter : Personal Interview : 1996.)

2.13 Conclusion

Besides the difficulty in diagnosis, the treatment of neck injuries is also problematic and poorly described, focusing mainly on reducing muscle spasm and pain and improving function. Traditional approaches include medication (e.g. muscle relaxants), soft cervical collars, intermittent traction, ultrasound and electrotherapy. Like chiropractic manipulation, minimal clinical data have been documented to prove the effectiveness of any of these treatments. (Osterbauer 1992.)

Chiropractic management and rehabilitation has obtained a certain degree of success; however, like in any 'young' profession, there are certain limitations which are intrinsic in this chiropractic approach.

These include:

- lack of proper motion palpation procedures;
- imprecise identification of the location and nature of spinal lesions;
- lack of specific adjusting procedures;
- inadequate knowledge of the assessment of the problem and areas contributing to the problems and disregard for the role of the muscle and the effect of the problem.

These limitations outlined have lead to a lack of adequate and accurate communication within the profession, and have also lead to a proliferation of chiropractic techniques. (Fitz-Ritson 1990.)

It is hoped that this study and other studies to follow, will help in understanding and bettering the knowledge of the treatment of mechanical neck pain. This study, which compares the effectiveness of 2 different chiropractic manipulative approaches, will help decrease the limitations mentioned above, making chiropractic a more adequate, effective and reliable profession.

According to Grieve (1988 : 521), although much has been written on the principles of manipulation in the treatment of neck pain, little is understood involving the cause and mechanism of such pain.

This study will hopefully open other avenues of chiropractic research to further help in the understanding of chiropractic treatment and management.

CHAPTER THREE

MATERIALS AND METHODS

3.1 INTRODUCTION

This chapter covers the details of the experimental method. It involves the type, location and description of the data needed. A description of each questionnaire is given and the validity and reliability of each measurement parameter are assessed. A description of each treatment group is given, as well as the inclusion and exclusion criteria for the acceptance of patients. Treatment interventions are discussed in detail, followed by a discussion of the systematic process of statistical analysis.

3.2 MEASUREMENT AND OBSERVATION

3.2.1 THE DATA

The data collected consisted of primary and secondary data. A description of each is given below :

The primary data

- How the patient perceives their pain level as rated on a scale i.e. pain intensity. (Numerical Pain Rating Scale)

- How the patient perceives their disability, in terms of normal daily functional activity. (CMCC Neck Disability Index)
- A sensory description of the type of pain felt by the patient i.e. quality of pain.(McGill Short-Form Pain Questionnaire)
- The range of motion of the patient's cervical spine. (Goniometer)
- The patient pain/pressure threshold at the symptomatic joint level. (Algometer)

The secondary data

- This included the more recent documentation pertaining to manipulation, biomechanics and contra-indications to Chiropractic treatment of the cervical spine.
- Documentation pertaining to the validity and significance of the methods of subjective and objective measurement.
- Personal interviews conducted with registered Chiropractors pertaining to the incidence and significance of Chiropractic manipulation of the cervical spine.

3.2.2 METHODS OF MEASUREMENT

Subjective measurement

1. CMCC Neck Disability Index (addendum C)

This questionnaire has been designed as a method of assessment of disability, targeted at activities of daily living which are most affected by neck pain. It is an indicator to the researcher how the treatment is affecting the patient's ability to manage in everyday life, in terms of progression or regression of their neck pain. This questionnaire is a reviewed form of the Oswestry Low Back Index (Vernon and Mior 1991).

The questionnaire proved to have a high level of test and retest reliability, internal consistency and a acceptable level of construct and concurrent validity. It is applicable to a wide age range and is unaffected by gender. (Vernon and Mior 1991.)

The questionnaire consists of 10 questions, each scoring a maximum of 5 points and a minimum of 0. points. It is scored out of 50 and is represented as a percentage disability.

2. **McGill Short-Form Pain Questionnaire** (addendum A)

This questionnaire has been designed to provide information on the affective, sensory and evaluative dimensions of pain experience. It discriminates against different pain problems and has become one of the most widely used tests for the measurement of pain. (Melzack 1987.)

This questionnaire has proved to be useful in research which requires more information than the Visual Analogue Scale or the Present Pain Intensity Index (Melzack 1987). Even though the Long-Form McGill Pain Questionnaire (LF-MPQ) provides more information, the Short-Form is preferred by researchers due to the long time needed for the LF-MPQ to be administered (Melzack 1987).

The SF-MPQ takes 2-5 minutes to be administered, as apposed to the 10 minutes of the LF-MPQ. The SF-MPQ is also preferred over the questionnaires due to the simple wording, and the intensity ranking is easily understood by patients (Melzack 1987).

The questionnaire consists of 15 representative words (descriptors) derived from the LF-MPQ. These descriptors were selected on the basis of their frequency of endorsement by patients. Each descriptor was ranked on an intensity scale of : 0=none; 1=mild; 2=moderate; 3=severe (Melzack and Katz 1992).

3. Numerical Pain Rating Scale (101 Scale) (addendum B)

According to Jensen et al. (1986), of the components that are assessed, subjective pain intensity is probably the one most often measured in both clinical work and in treatment outcome research.

Jensen et al. (1986) conducted a study whereby 6 examples of various pain intensity scales were measured. The methods were judged according to 5 major criteria :

1. The ease of administration and the scoring;
2. Rates of correct responding;
3. The relative sensitivity of the scores as defined by the number of response categories they provide,
4. The relative sensitivity of the scores as defined by their ability to detect treatment effect;

5. The magnitude of the relationship between each side and a 'best possible' combined measure of subjective pain intensity.

According to Jensen et al. (1986), each pain intensity measure meets these criteria at some level; however, the NRS-101 has several practical advantages over the other measures because :

- It is more simple and practical to administer and score,
- it can be administered in written or verbal form; and
- it does not appear to be associated with age.

The NRS-101 includes two visual lines, each ranging from 0 = no pain to 100 = worst pain imaginable. The patient is required to indicate by means of a percentage on the first line, the intensity of the pain experienced prior to the treatment, when the pain is at its least, and on the second line, when the pain is at its worst. The average between these two figures gives an indication of the average pain intensity experienced by the patient.

According to Downie et al. (1978), the NRS-101 is preferred over the Visual Analogue Scale and the Simple Descriptive Scale, on the grounds of measurement error and reliability.

Objective Measurement:

1. **Cervical Spine Range of Motion (C.R.O.M)** (Addendum D)

The C.R.O.M apparatus has been used in many studies in the past by e.g. Cassidy et al. (1992), Wong and Nansel (1992), and Maigne (1964).

Cassidy et al. (1992) said that the use of the C.R.O.M is important in studies as it is decreased in painful states and needs to be measured as chiropractic manipulation increases the range of motion.

The C.R.O.M is used to measure the amount of neck movement along the Y, X and Z planes. The measurements taken are bilateral rotation, bilateral lateral flexion, flexion and extension of the neck. The apparatus is a product of Performance Attainment Associates (3600 Labore Rd, Suite 6, St Paul, MN 55110-4144) and the extend of motion is measured in degrees.

According to Youdas et al. (1991), the C.R.O.M proved to show the highest degree of reliability when compared to two other similar instruments. The C.R.O.M also had a higher degree of inter-examiner reliability. Youdas et al. (1991) also said that it was a good apparatus in the study of neck pain as it did not seem to aggravate the patients' neck pain.

2. Algometer (appendum E)

The Force Dial (Push-Pull Force Gage) was used in this research project. It is a product of Wagner Instruments (P.O.Box 1217, Greenwich, CT 06836, U.S.A). The readings obtained by this instrument are measured in kilograms per square centimeter. The higher the readings the less pain felt by the patient.

After the lateral flexion fixation was detected, the measurements were taken at the level of joint dysfunction by applying pressure to the articular pillar of the joint. After the most tender area was chosen, Kemps' test must be positive on the same side of the lateral fixation. Once the most tender area was found, only that region was used to take measurements for the first, fifth , ninth and follow-up consultations.

According to Fischer (1986), the pressure algometer has been used in numerous studies, by measuring sensitivity in normal tissue. He explained that the algometer's ability to measure pressure sensitivity and to be used as a " diagnostic hallmark of tender spots.......", allows it to be used as a means of quantifying treatment in improvement by manipulation.

The apparatus is fitted with a one square centimeter rubber disc, so that it can be more suitable for measuring tenderness in muscle, ligaments, joint capsules and tendons (Fischer 1986).

3.3 THE LOCATION OF THE DATA

The primary data were obtained from the NRS-101, the CMCC Neck Disability Index and the SF-MPQ. These questionnaires were completed by the patients at the beginning of the 1st, 5th, 9th and follow-up treatment sessions. The C.R.O.M and algometer readings were also taken at the beginning of the 1st, 5th, 9th and follow-up treatment sessions. The recordings were taken by the researcher, who was present when the questionnaires were completed. All consultations were conducted at Technikon Natal Chiropractic Day Clinic.

The secondary data were collected from current journals, text books and CD -ROM which are available in the Technikon Natal Library.

3.4 STUDY DESIGN AND PROTOCOL

3.4.1 Object of the Study

The object of this study was to establish which of the two treatment protocols had a greater relativity effectivety in terms of the objective and subjective measurements, thus allowing Chiropractors to administer the best type of chiropractic treatment for mechanical neck pain.

3.4.2 Allocation of subjects

The two treatment groups comprised a total of 30 subjects, i.e.

1) Treatment 1 group of 15 subjects [Group-A]

2) Treatment 2 group of 15 subjects [Group-B]

Group A was treated using the Cervical Rotatory Break with contact taken on the ipsilateral side of the Lateral Fixation, while Group B was treated using the Lateral Break on the contra-lateral side of the Lateral Fixation.

The subjects were placed in the two treatment groups using the Random Sampling Method. In this method, a dice was thrown and each number from 1-6 was represented as follows: 1) AABB; 2) ABAB; 3) ABBA; 4) BAAB; 5) BABA; 6) BBAA. On the first throw, whatever the number the dice landed on, the first four people fell into those groups respectively that the number represented e.g. if the dice landed on 4, then the first person was placed in Group B, the second and third in Group-A and the fourth in Group-B. The dice was then thrown for the next 4 people and so on until both groups had a of 15 patients each.

3.4.3 Inclusion and Exclusion Criteria for the Subjects

All the subjects had to meet the following criteria in order to be accepted into this study :

Each subject had to :

- undergo a full Case History (Addendum F) and a Physical Examination (Addendum G), to exclude pathology or disease;
- undergo a Cervical Regional Examination (Addendum H), thus determining if the subject had mechanical neck pain;
- be examined for a Lateral flexion Fixation anywhere in the cervical spine (C0-C1 to C6-C7);
- be literate and over the age of 15;
- be diagnosed with Cervical Facet Syndrome (Gatterman 1990: 161-162) with a negative Wallenberg's Test (Gatterman 1990: 58);
- exhibit no contra-indications to chiropractic manipulation (Gatterman 1990: 222-223), and go for cervical x-rays if necessary. Cervical x-rays were only taken to rule out conditions that were contra-indicated to chiropractic treatment e.g. tumors, osteoporosis, ponticulus posticus, vascular complications, traumatic injuries, bone infections, arthritides and nerve root damage (Gatterman 1990 : 55-68). According to Haldeman (1980 : 189-191), these contra-indications are divided into Critical and Non-critical Pathological Changes. Examples of critical changes include : multiple myeloma, metastatic neoplasms and pyogenic arthritis. Examples of non-critical changes include : herniated intervertebral disc and ankylosing spondylitis.
- agree to stop taking any medication or any other form of treatment for their neck pain for the duration of the study;
- and on agreement of the above, sign an informed consent (addendum I) before treatment.

3.4.4 Interventions

At the initial consultation, the subjects that fulfilled the above criteria (3.4.3) completed the Numerical Pain Rating Scale, the McGill Short-Form Pain Questionnaire and the CMCC Neck Disability Index. The C.R.O.M and algometer measurements were also taken. The Questionnaires were answered under supervision of the researcher and the C.R.O.M and algometer measurements were done by the researcher.

Each subject was treated only by the researcher for a total of 10 treatments, 3 times a week on non-consecutive days, over a period of about 3 weeks, with a follow-up consultation, one month after the 3 week treatment period was complete. If a subject became asymptomatic during the treatment period, then that subject was asked to come twice a week on non-consecutive days for a reassessment, in terms of taking a brief history to see if the subject had become symptomatic again and for completion of the measurement parameters. If the subject had become symptomatic again, treatment would continue as before until the specified treatment period was over. Each assessment, whether the subject was treated or not, was taken as 1 of the 10 treatments. Each subject had to fill in the necessary questionnaires and undergo the above mentioned C.R.O.M and algometer measurements at the 1st, 5th, 9th and follow-up consultations whether they had become asymptomatic or not.

The treatment for the Group-A consisted of a Cervical Rotatory Adjustment on the ipsilateral side of the lateral fixation, as apposed to the Group-B which received a Lateral Break on the contra-lateral side of the lateral fixation. Diversified adjustive techniques were used. A description of the manipulative techniques is as follows:

1) Cervical Rotatory Adjustment

The subject lies in the supine position with the researcher in a squatting position at the head of the subject slightly toward the side of the fixation. Contact is taken on the ipsilateral side of the fixated segment. As contact is taken, the Researcher steps to the side of the lesion, maintaining the low squatting position. An index contact is used with the hand relaxed and wrist straight. The indifferent hand cups the ear with the hooked against the rim of the occiput to provide rotation and cephalad traction. As soon as contact is taken against the involved articular process, the segment as well as the head is rotated until the restriction in rotation is reached. Laterally flex the head toward the side of contact to further isolate the segment. A sudden, short amplitude, pectoral thrust is given with slight ulna deviation of the contact hand in a rotatory fashion. (Szaraz 1990 : 2.17.)

2) Supine Lateral Break

With the subject in a supine position, the Researcher takes up a squatting position at the head of the subject slightly towards the contra-lateral side of the lateral fixation. The indifferent hand supports and guides the head and cervical spine. As the contact hand generates specific joint tension in a lateral to medial direction, and the indifferent hand counters that movement by bending the cervical spine around the contact, a high velocity thrust is given, with the contact hand in a lateral to medial vector. (Szaraz 1990 : 2.20.)

3.4.5 Solving for the sub-problems

Statistical analyse were conducted on the objective and the subjective data. The results obtained from the data were then used to address each of the objectives.

The null [Ho] and alternative [Ha] hypotheses for each of the objectives were as follows:

1. Objective One

The first objective was to compare the relative effectiveness of the Cervical Rotatory Adjustment on the ipsilateral side of the lateral flexion fixation and the Supine Lateral Break on the contra-lateral side of the lateral flexion fixation, with regards to the treatment of Facet Syndrome in the cervical spine, in terms of subjective clinical findings.

The hypothesis for both A and B groups was :

Ho : There would be no difference in the subjective clinical findings on analysis of the intra-group data, showing that the treatment was not effective.

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

2. Objective Two

The second objective was to compare the relative effectiveness of the Cervical Rotatory Adjustment on the ipsilateral side of the lateral flexion fixation and the Supine Lateral Break on the contra-lateral side of the lateral flexion fixation, with regards to the treatment of facet syndrome in the cervical spine, in terms of objective clinical findings.

The hypothesis for both A and B groups was :

Ho : There would be no difference in the objective clinical findings on analysis of the intra-group data, showing that the treatment was not effective.

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

3. Objective Three

The third objective was to integrate the data from the two treatment protocols, with reference to the respective objective and subjective responses of the patients, in order to establish the relative effectiveness of both treatment protocols in Cervical Facet Syndrome.

The hypothesis for both A and B groups was :

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, showing that the treatments were not equally effective.

3.5 STATISTICAL ANALYSIS

3.5.1 TREATMENT OF THE DATA

3.5.1.1 Treatment of the Subjective Data :

1) The completed questionnaires were screened to determine if they were completed correctly by the subjects.
2) After the scores of the three questionnaires were individually added up, they were converted to percentages and recorded separately for the two treatment groups.
3) The data were then statistically analyzed.

3.5.1.2 Treatment of the Objective Data :

1) The readings from the C.R.O.M were recorded in degrees of flexion, extension, left/right lateral flexion and left/right rotation. This was done separately for the two treatment groups.
2) The readings obtained from the alogometer were recorded separately for the two treatment groups.
3) The data then underwent statistical analysis.

3.5.2 STATISTICAL ANALYSIS OF THE DATA

On advice given by the Technikon Natal statistician, the statistical analyses was conducted at a 95% confidence level ($\alpha = 0.05$ level of significance), for the following reasons :

- The testing is of a non-parametric nature and
- a small sample size was used (only 15 subjects per group), thus the t-test and confidence interval were not appropriate.

3.5.2.1 Non-Parametric Paired Hypothesis Tests

The Subjective Data :

The subjective results were statistically analyzed using the Wilcoxon Signed Rank Test, for both treatment groups. The units, in percentages, compared were taken from:

1) The initial consultation [IC] and the final consultation [FC],

2) the initial consultation [IC] and the 5th consultation [5C],

3) the 5th consultation [5C] and the final consultation [FC],

4) the initial consultation [IC] and the follow-up consultation [FW] and

5) the final consultation [FC] and the follow-up consultation [FW].

i.e. :	A-GROUP	B-GROUP
	IC<=>FC	IC<=>FC
	IC<=>5C	IC<=>5C
	IC<=>FW	IC<=>FW
	5C<=>FC	5C<=>FC
	FC<=>FW	FC<=>FW

These figures were compared to determine the level of significance.

The Objective Data :

The C.R.O.M measurements were statistically analyzed using the Wilcoxon Signed Rank Test, for both treatment groups. Each range of motion was separately assessed, and the units, in degrees, compared were taken from:

1) The initial consultation [IC] and the final consultation [FC],

2) the initial consultation [IC] and the 5th consultation [5C],

3) the 5th consultation [5C] and the final consultation [FC],

4) the initial consultation [IC] and the follow-up consultation [FW] and

5) the final consultation [FC] and the follow-up consultation [FW].

i.e. :	A-GROUP	B-GROUP
	IC<=>FC	IC<=>FC
	IC<=>5C	IC<=>5C
	IC<=>FW	IC<=>FW
	5C<=>FC	5C<=>FC
	FC<=>FW	FC<=>FW

These figures were compared to determine the level of significance.

The algometer readings were statistically analyzed using the Wilcoxson Signed Rank Test, for both treatment groups. The units, in kilograms per centimeter squared, compared were taken from:

1) The initial consultation [IC] and the final consultation [FC],

2) the initial consultation [IC] and the 5th consultation [5C],

3) the 5th consultation [5C] and the final consultation [FC],

4) the initial consultation [IC] and the follow-up consultation [FW] and

5) the final consultation [FC] and the follow-up consultation [FW].

i.e. :	A-GROUP	B-GROUP
	IC<=>FC	IC<=>FC
	IC<=>5C	IC<=>5C
	IC<=>FW	IC<=>FW
	5C<=>FC	5C<=>FC
	FC<=>FW	FC<=>FW

These figures were compared to determine the level of significance.

3.5.2.2 Non-Parametric Unpaired Hypothesis Test

The subjective Data :

The Mann-Whitney U-Test was used to analyze the mean units taken separately from each questionnaire from both treatment groups. The mean units (in percentages) compared were:

1) The initial consultation [IC] of A-group and B-group,

2) the 5th consultation [5C] of A-group and B-group,

3) the final consultation [FC] of A-group and B-group and

4) the follow-up consultation [FW] of A-group and B-group.

i.e. : A-GROUP + B-GROUP

IC<=======>IC

5C<=======>5C

FC<=======>FC

FW<======>FW

These figures were compared to determine the level of significance.

The Objective Data :

The Mann-Whitney U-Test was used to analyze the mean units of both A-group and B-group of the C.R.O.M. The median units (in degrees) compared were:

1) The initial consultation [IC] of A-group and B-group,

2) the 5th consultation [5C] of A-group and B-group,

3) the final consultation [FC] of A-group and B-group and

4) the follow-up consultation [FW] of A-group and B-group.

i.e. : A-GROUP + B-GROUP

IC<=======>IC

5C<=======>5C

FC<=======>FC

FW<======>FW

These figures were compared to determine the level of significance.

The Mann-Whitney U-Test was used to analyze the median units of both A-group and B-group of the algometer readings. The median units (in kilograms per centimeter squared) compared were:

1) The initial consultation [IC] of the A-group and B-group,

2) the 5th consultation [5C] of the A-group and B-group,

3) the final consultation [FC] of the A-group and B-group and

4) the follow-up consultation [FW] of the A-group and B-group.

i.e. : A-GROUP + B-GROUP

IC<=======>IC

5C<=======>5C

FC<=======>FC

FW<======>FW

These figures were compared to determine the level of significance.

The standard deviation was used to determine where the values of a frequency distribution were located in relation to the mean. For the purposes of this study, it was better to use the term 'the standard error' rather than the standard deviation. According to Levin and Rubin (1991 : 267), "the standard deviation of the distribution of a sample statistic is known as the standard error of the statistic."

The standard error was calculated to determine the variability in the observed means of the results. If the distribution of a sample mean was less spread out, then a better estimator of the population mean was found as opposed to a distribution that was widely dispersed, thus giving a larger standard error.

For example, it was found that the mean algometer readings for group-A proved to be less at the final follow-up consultation than the mean readings of group-B. From the above results one could conclude that the treatment for group-A was more effective than for group-B, however one could further strengthen and substantiate these findings by showing that the standard error for both the groups was similar, giving a more accurate result and thus making the result more statistically significant.

"Correlation analysis is the statistical tool that we can use to describe the degree to which one variable is linearly related to another" (Levin and Rubin 1991 : 505.)

It was the purpose of the researcher to use correlation in this study but based on the advice of the Technikon Natal Statistician, correlation was not used due to the fact that the degree of reliability of the results was less than 30% as a result of the small sample size.

Bar charts and/or graphs were used to help in the visual interpretation of the above mentioned data.

Summary statistics were tabulated and bar charts were used to graphically represent the results. Statgraphics Version 6+ was used for the statistical analyses, supplied by Manugistics Inc. .

CHAPTER FOUR

RESULTS

4.1 Introduction

This chapter covers the results obtained from the CMCC, McGill and NRS-101 questionnaires and the algometer and goniometer readings. The results were obtained from the subjective and objective data that were recorded at the 1st, 5th, 9th and follow-up consultations from both group-A and group-B.

In this chapter, two sets of results are recorded. The first set of results gives the mean readings obtained from each questionnaire, goniometer and algometer recordings for both group-A and group-B. These results were recorded to give an impression when comparing both groups as well as a basis for further statistical analysis if necessary, or as a comparison of data with other research studies.

The second set of results was statistically analyzed using the Wilcoxson Signed Rank Test and the Mann-Whitney U-Test. The results were tabulated to display the probability value (p-value), which was used to compare a 95% confidence level for all the tests. The p-value was used to determine whether the null or alternate hypothesis was either accepted or rejected.

4.2 Criteria Governing the Admissibility of the Data

- Only the results of those patients that met the criteria of the study were utilized.
- Only those data that were recorded in the questionnaires, under the supervision of the researcher, were utilized.
- Only those data that were measured and recorded, with the algometer and goniometer, by the researcher were utilized.
- Any data that were not recorded under the supervision of the researcher, or that were not recorded by the researcher or supervising clinician, were not utilized in this study.

4.3 Key For Abbreviations

Grp-A : Group-A

Grp-B : Group-B

SD : Standard Deviation

F Flex : Forward Flexion

Ext : Extension

R Rot : Right Rotation

L Rot : L Rotation

L Lat Fl : Left Lateral Flexion

R Lat Fl : Right Lateral Flexion

ic : initial consultation

5th : fifth consultation

fc: final consultation

fw : follow-up

P : P-value

s : significant

ns : non-significant

mva : motor vechile accident

H/A : headache

4.4 Demographic data.

Table 4.1 : Patient age group range.

Range	**16-25**	**26-35**	**36-45**	**46-55**	**56-65**
No of Patients	16	5	4	4	1

Table 4.2 : Division of Patient Gender.

Male	Female
15	15

Table 4.3 : Division of Patient Race.

European	Indian
27	3

Table 4.4 : Demographic data related to Group-A

Grp-A	Age	Sex	Chronic	Trauma	Neck	neck, H/A	Arm Pain
1	37	M	Y	Y-mva		*	*
2	29	M	Y	Y-mva		*	
3	23	M	Y	N	*		
4	42	F	Y	N		*	
5	20	F	N	N	*		
6	22	M	N	N	*		
7	22	F	Y	N	*		
8	29	M	N	N		*	
9	50	F	Y	N		*	
10	45	F	Y	N		*	
11	33	F	Y	Y-mva		*	
12	52	F	Y	Y-mva		*	*
13	21	M	Y	Y-mva		*	*
14	23	F	Y	N	*		
15	48	M	Y	Y-fall		*	

Table 4.5 : Demographic data related to Group-B

Grp-B	Age	Sex	Chronic	Trauma	Neck	neck, H/A	Arm Pain
1	22	F	Y	N		*	
2	48	F	N	N	*		
3	22	M	Y	Y-fall		*	
4	25	F	Y	N		*	
5	24	M	Y	Y-fall		*	*
6	26	M	N	N	*		
7	21	F	Y	N		*	
8	40	F	Y	N		*	
9	23	M	Y	N	*		
10	26	M	Y	Y-mva		*	
11	19	M	Y	N	*		
12	19	M	N	N	*		
13	24	M	Y	N	*		
14	19	F	N	N		*	
15	57	F	Y	N	*		

Tables 4.4 and 4.5 are representitive of a small randomized sample of the total population and thus gives an unbaised representation of the variables affecting this sample.

4.5 Tabulation of Results

4.5.1 Objective Data

Table 4.6 : Mean readings of each plane of motion for intra-group comparisons. All the range of motion readings were measured in degrees (x°). A lower reading indicates a decrease in range of motion and a higher reading indicates an increase in range of motion.

ROM (x°)	**ic**	**5th**	**fc**	**fw**	**fc-fi**	**fc-fw**
Grp-A (F Flex)	58.8	61.2	60.8	60.8	2	0
Grp-B (F Flex)	57.5	60.4	61.4	60.9	3.9	0.5
Grp-A (Ext)	52.7	53.7	52.9	53.4	0.2	0.5
Grp-B (Ext)	57.4	54.8	55.8	54.8	-1.6	1.0
Grp-A (R Rot)	62.9	62.2	66.9	66.6	4.0	0.3
Grp-B (R Rot)	59.4	63.1	61.8	63.0	2.4	1.2
Grp-A (L Rot)	61.2	61.7	61.3	64.2	0.1	2.9
Grp-B (L Rot)	61.2	62.8	63.0	63.0	1.8	0
Grp-A (L Lat Fl)	41.8	42.8	44.8	43.8	3.0	1.0
Grp-B (L Lat Fl)	40.9	45.8	44.5	43.6	3.6	.09
Grp-A (R Lat Fl)	40.4	41.4	44.6	42.9	4.2	1.7
Grp-B (R Lat Fl)	39.6	42.9	43.6	41.7	4.0	1.9

Table 4.7 : Mean readings of each plane of motion for inter-group comparisons. All the range of motion readings were measured in degrees (x°).

ROM (x°)	**ic-ic**	**5th-5th**	**fc-fc**	**fw-fw**
Grp-A-Grp-B (F Flex)	1.3	0.8	-0.6	-0.1
Grp-A-Grp-B (ext)	-4.9	-1.1	-2.9	-1.4
Grp-A-Grp-B (R Lat Flex)	0.8	-1.5	1.0	1.2
GrpA-Grp-B (L Lat Flex)	0.9	-3.0	0.3	0.2
Grp-A-Grp-B (R Rot)	3.5	-0.9	5.1	3.6
Grp-A-Grp-B (L Rot)	0	-1.1	-1.7	1.2

From the difference of the sum of the means of group-A to group-B, one can see that even though not statistically proven, there was no appreciable difference in the readings between the two groups.

Table 4.8 : Mean algometer readings for intra-group and inter-group comparison. The readings were measured in kilograms per centimeter squared (kg/cm^2). The smaller the reading, the less pressure was required to produce pain or disability.

Algometer	**ic**	**5th**	**fc**	**fw**	**fc-ci**	**fc-fw**
Grp-A	2.85	3.13	3.46	3.32	0.61	-0.14
Grp-B	2.76	2.99	3.18	3.78	0.42	0.6

	ic-ic	**5th-5th**	**fc-fc**	**fw-fw**
Grp-A-Grp-B	0.09	0.14	0.28	-0.46

From the difference of the sum of the means of the algometer readings of group-A and group-B, one can see that even though not statistically proven, there was no appreciable difference between the two groups. However, there was an appreciable difference between the two groups at the final and follow-up consultations. From the above readings a general trend of gradual improvement can be seen in both groups over the treatment period.

4.5.2 Subjective Data.

Table 4.9 : Mean readings taken from the Numerical Pain rating scale-101 for both intra-group and inter-group comparisons. The readings were taken as a percentage (%). For intra-group comparison, the lower the percentage the greater the recovery of the patient from their pain or disability.

N.R.S-101	**ic**	**5th**	**fc**	**fw**	**fc-ic**	**fc-fw**
Grp-A	38.28	20.75	11.83	9.40	26.45	2.40
Grp-B	33.25	22.07	18.52	17.54	15.00	0.98

	ic-ic	**5th-5th**	**fc-fc**	**fw-fw**
Grp-A-Grp-B	5.03	-1.32	-6.69	-8.14

From the difference of the sum of the means of the N.R.S-101 readings of group-A and group-B, one can see that even though not statistically proven, there was an appreciable difference between the two groups for both intra and inter-group comparisons. However, it can be seen from the above readings that both groups gradually increased over the treatment period.

Table 4.10 : Mean readings taken from the McGill Short-Form Pain Questionnaire for both intra-group and inter-group comparisons. The readings were taken as a percentage (%). For intra-group comparison, the lower the percentage the greater the recovery of the patient from their pain or disability.

McGill	ic	5th	fc	fw	fc-ic	fc-fw
Grp-A	25.14	6.86	6.18	4.27	18.96	1.91
Grp-B	19.41	10.95	9.08	7.48	11.93	1.60
	ic-ic	**5th-5th**	**fc-fc**	**fw-fw**		
Grp-A-Grp-B	5.73	-4.09	-2.9	-3.21		

From the difference of the sum of the means of the McGill Short-Form Pain readings of group-A and group-B, one can see that even though not statistically proven, there was an appreciable difference between the two groups, particularly at the initial to the final consultations. However, both groups gradually improved over the treatment period.

Table 4.11 : Mean readings taken from the C.M.C.C Neck Disability Index for both intra-group and inter-group comparisons. The readings were taken as a percentage (%). For intra-group comparison, the lower the percentage the greater the recovery of the patient from their pain or disability.

C.M.C.C	**ic**	**5th**	**fc**	**fw**	**fc-ic**	**fc-fw**
Grp-A	22.53	11.33	6.53	6.0	16.00	0.53
Grp-B	16.40	10.53	6.93	6.13	10.27	0.8
	ic-ic	**5th-5th**	**fc-fc**	**fw-fw**		
Grp-A-Grp-B	6.13	0.8	-0.4	-0.13		

From the difference of the sum of the mean readings of the C.M.C.C Neck Disability Index of group-A and group-B, one can see that even though not statistically proven, there was no appreciable difference between the two groups. However both groups gradually improved over the treatment period.

In the researches opinion, from the above results it can clearly be seen that there was no appreciable difference between the objective results of the two groups even though both groups did appreciably improve over the treatment period. From the subjective results it can be seen that there was an appreciable difference between the two groups favouring group-A. It must be mentioned that the above results were merely a comparison of the means taken from the initial, 5th, final and follow-up consultations of both groups, and were not statistically analyzed data.

Figure 1 : Overall improvement of the Subjective Data

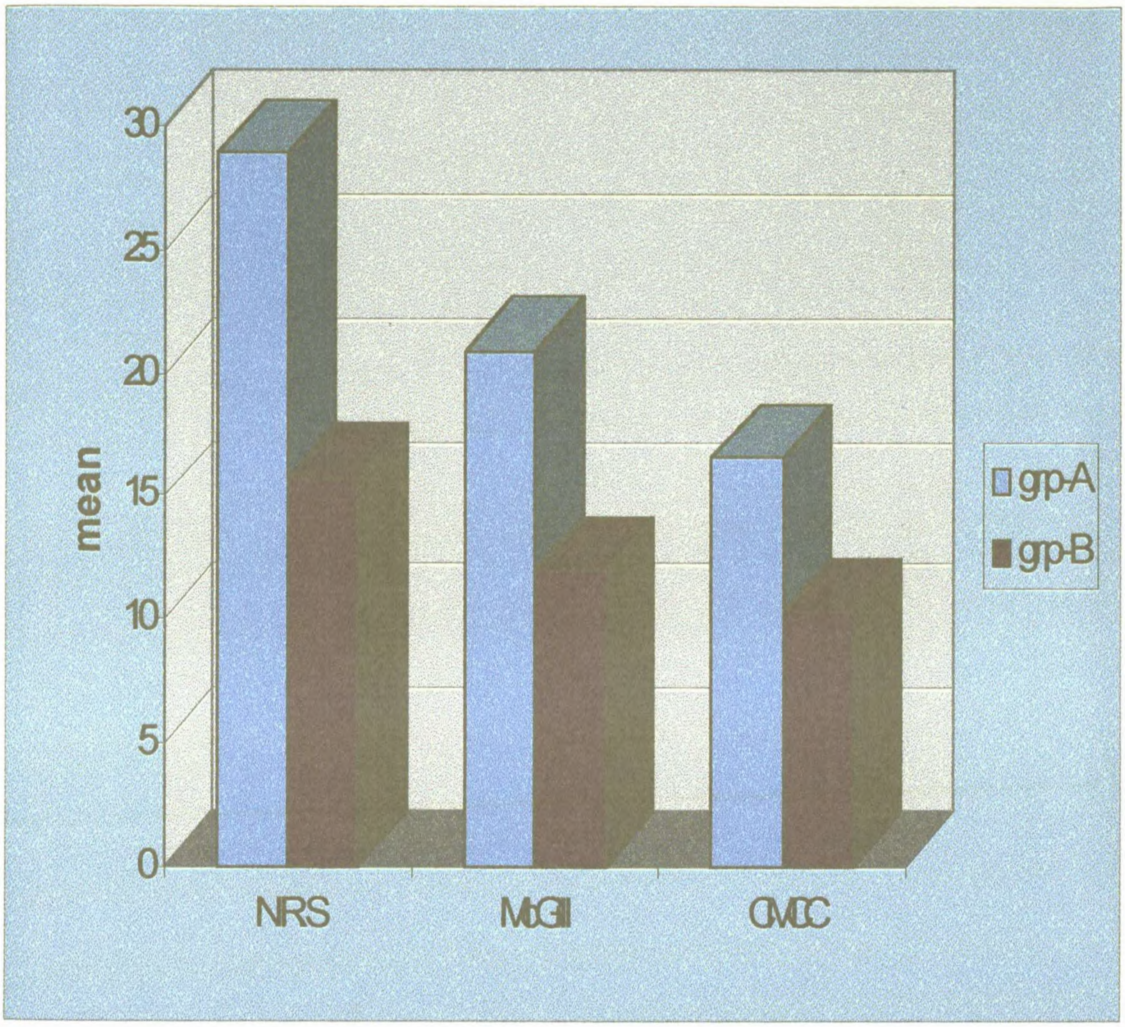
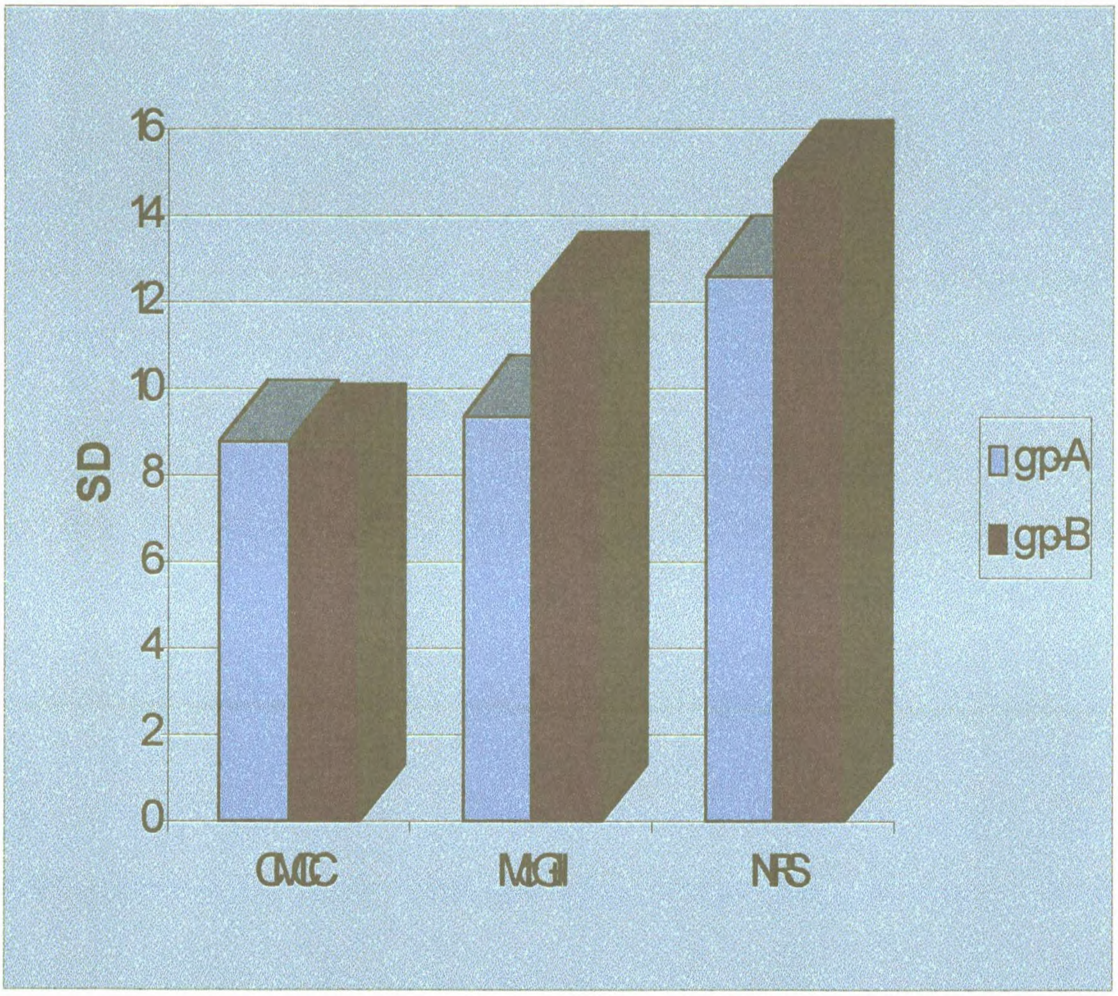


Figure 2 : Comparison of the average Standard Deviations



4.6 Tabulation of the Statistically Analyzed Data.

The data were analyzed using a 95% confidence level using a two-tailed test.

($\alpha = 0.05$)

- Reject Ho if the P-value is $P < \alpha/2 = 0.05/2 = 0.025$
- Accept Ho if the P-value is $P \geq \alpha/2 = 0.05/2 = 0.025$

4.6.1 Subjective Data (Two-Tailed Wilcoxson Signed Rank Test)

4.6.1.1: Results of the C.M.C.C Neck Disability Index

Table 4.12 : The intra-group treatment readings comparing the initial (ic), fifth (5th), final (fc) and follow-up (fw) consultations for group-A and group-B.

C.M.C.C	ic - 5th	ic - fc	ic - fw	5th - fc	fc - fw
Grp-A(P)	0.0019 s	0.0003 s	0.0003 s	0.0044 s	0.7518 ns
Grp-B(P)	0.0055 s	0.0032 s	0.0003 s	0.0161 s	1.0 ns

The null hypothesis was rejected for both group-A and group-B between the initial and final consultations, indicating that there was a significant improvement in both groups. However, the null hypothesis was accepted between the final and follow-up consultations which suggests that there was no significant improvement over the one month rest period for either of the groups.

4.6.1.2: Results of the McGill Short-Form Pain

Table 4.13 : The intra-group treatment readings comparing the initial (ic), fifth (5th), final (fc) and follow-up (fw) consultations for group-A and group-B.

McGill	**ic - 5th**	**ic - fc**	**ic - fw**	**5th - fc**	**fc - fw**
Grp-A(P)	0.0161 **s**	0.0132 **s**	0.0005 **s**	0.773 **ns**	0.5464 **ns**
Grp-B(P)	0.0032 **s**	0.039 **ns**	0.0019 **s**	0.302 **ns**	1.0 **ns**

The null hypothesis for group-A and group-B was rejected between the initial through to the follow-up consultations, indicating an overall improvement. However the null hypothesis was accepted between the 5th to the final and the final to the follow-up consultations indicating that most of the improvement occurred in the first five consultations.

4.6.1.3: Results of the Numerical Pain Rating Scale-101

Table 4.14 : The intra-group treatment readings comparing the initial (ic), fifth (5th), final (fc) and follow-up (fw) consultations for group-A and group-B.

N.R.S	ic - 5th	ic - fc	ic - fw	5th - fc	fc - fw
Grp-A(P)	0.0032 **s**	0.0032 **s**	0.0003 **s**	0.0158 **s**	0.1489 **ns**
Grp-B(P)	0.0161 **s**	0.0098 **s**	0.121 **ns**	0.096 **ns**	0.5790 **ns**

The null hypothesis for group-A was rejected between the initial through to the follow-up consultation, indicating that there was an overall improvement over the treatment period. However, the null hypothesis was accepted between the final to the follow-up consultations indicating that there was no significant improvement over the one month rest period.

The null hypothesis for group-B was rejected between the initial and the fifth and final consultations, indicating that there was an overall improvement up to the final treatment. However, the null hypothesis was accepted between the initial and the follow-up, fifth and the final and the final and follow-up consultations indicating that significant improvement occurred only over the first five consultations.

4.6.2 Objective Data(**Two-Tailed Wilcoxson Signed Rank Test**)

4.6.2.1: Results of Flexion

Table 4.15 : The intra-group treatment readings comparing the initial (ic), fifth (5th), final (fc) and follow-up (fw) consultations for group-A and group-B.

Flexion	**ic - 5th**	**ic - fc**	**ic - fw**	**5th - fc**	**fc - fw**
Grp-A(P)	0.773 **ns**	0.423 **ns**	0.267 **ns**	0.789 **ns**	0.7728 **ns**
Grp-B(P)	0.096 **ns**	0.043 **ns**	0.149 **ns**	0.752 **ns**	0.5049 **ns**

The null hypothesis for group-A and group-B was accepted for each sample analysis, thus showing that there was no significant difference during the treatment and follow-up consultations.

4.6.2.2: Results of Extension

Table 4.16 : The intra-group treatment readings comparing the initial (ic), fifth (5th), final (fc) and follow-up (fw) consultations for group-A and group-B.

Extension	**ic - 5th**	**ic - fc**	**ic - fw**	**5th - fc**	**fc - fw**
Grp-A(P)	0.386 **ns**	0.423 **ns**	0.423 **ns**	0.605 **ns**	0.5790 **ns**
Grp-B(P)	0.342 **ns**	1.0 **ns**	0.789 **ns**	1.0 **ns**	0.7728 **ns**

The null hypothesis for group-A and group-B was accepted for each sample analysis, thus showing that there was no significant difference during the treatment and follow-up consultations.

4.6.2.3: Results of Right Lateral Flexion

Table 4.17 : The intra-group treatment readings comparing the initial (ic), fifth (5th), final (fc) and follow-up (fw) consultations for group-A and group-B.

R L Flex	**ic - 5th**	**ic - fc**	**ic - fw**	**5th - fc**	**fc - fw**
Grp-A(P)	0.3864 **ns**	0.0433 **ns**	0.2672 **ns**	0.2672 **ns**	0.3864 **ns**
Grp-B(P)	0.2672 **ns**	0.0960 **ns**	0.2672 **ns**	0.2672 **ns**	1.0 **ns**

4.6.2.5: Results of Right Rotation Test

Table 4.19 : The intra-group treatment readings comparing the initial (ic), fifth (5th), final (fc) and follow-up (fw) consultations for group-A and group-B.

R Rot	**ic - 5th**	**ic - fc**	**ic - fw**	**5th - fc**	**fc - fw**
Grp-A(P)	1.0 **ns**	0.3864 **ns**	0.2277 **ns**	0.1814 **ns**	1.0 **ns**
Grp-B(P)	0.1489 **ns**	0.1814 **ns**	0.1138 **ns**	1.0 **ns**	0.3427 **ns**

The null hypothesis for group-A and group-B was accepted for each sample analysis, thus showing that there was no significant difference during the treatment and follow-up consultations.

4.6.2.6: Results of Left Rotation

Table 4.20 : The intra-group treatment readings comparing the initial (ic), fifth (5th), final (fc) and follow-up (fw) consultations for group-A and group-B.

L Rot	**ic - 5th**	**ic - fc**	**ic - fw**	**5th - fc**	**fc - fw**
Grp-A(P)	0.5790 **ns**	0.7728 **ns**	0.5790 **ns**	1.0 **ns**	0.4226 **ns**
Grp-B(P)	0.3864 **ns**	0.7892 **ns**	0.5790 **ns**	1.0 **ns**	1.0 **ns**

The null hypothesis for group-A and group-B was accepted for each sample analysis, thus showing that there was no significant difference during the treatment and follow-up consultations.

4.6.2.4: Results of the Left Lateral Flexion

Table 4.18 : The intra-group treatment readings comparing the initial (ic), fifth (5th), final (fc) and follow-up (fw) consultations for group-A and group-B.

L L Flex	**ic - 5th**	**ic - fc**	**ic - fw**	**5th - fc**	**fc - fw**
Grp-A(P)	0.7728 **ns**	0.2672 **ns**	1.0 **ns**	0.5450 **ns**	0.7518 **ns**
Grp-B(P)	0.0158 **s**	0.0704 **ns**	0.7728 **ns**	0.5464 **ns**	0.7728 **ns**

The null hypothesis for group-A was accepted for each sample analysis, thus showing that there was no significant difference during the treatment and follow-up consultations.
A statistically significant difference was found between the initial and fifth consultations, thus the null hypothesis was accepted. This indicated that there was a significant increase in left lateral flexion between the initial and fifth consultations. Thus the null hypothesis for group-B was accepted for each sample analysis, except for ic-5th.

4.6.3.2: Results of Extension

Table 4.23 : The inter-group treatment readings comparing the initial (ic), fifth (5th), final (fc) and follow-up (fw) consultations of groups-A and group-B

Extension	ic		5th		fc		fw	
Groups	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
S D	13.2	11.1	14.6	10.2	11.6	10.8	11.8	6.6
P-Value	0.4535 **ns**		0.6320 **ns**		0.9171 **ns**		0.8186 **ns**	

The null hypothesis was accepted on comparing group-A and group-B for each sample analysis, which indicated that at a 95% confidence level, there was no statistically significant difference in extension readings when comparing the initial (ic), fifth (5), final (fc) and follow-up (fw) consultations. Thus neither of the groups improved significantly more than the other. Analysis of the standard deviation showed a relative familiraity around the mean, therefore both groups displayed a similar reliability, indicating no clinical differences.

4.6.3.3: Results Right Lateral Flexion

Table 4.24 : The inter-group treatment readings comparing the initial (ic), fifth (5th), final (fc) and follow-up (fw) consultations of groups-A and group-B

R L Flex	**ic**		**5th**		**fc**		**fw**	
Groups	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
S D	7.8	8.3	9.3	10.7	8.7	10.9	7.6	9.0
P-Value	0.6923 **ns**		0.9667 **ns**		0.4909 **ns**		0.5321 **ns**	

The null hypothesis was accepted on comparing group-A and group-B for each sample analysis, which indicated that at a 95% confidence level, there was no statistically significant difference in right lateral flexion readings when comparing the initial (ic), fifth (5), final (fc) and follow-up (fw) consultations. Thus neither of the groups improved significantly more than the other. Analysis of the standard deviation showed a relative familiraity around the mean, therefore both groups displayed a similar reliability, indicating no clinical differences.

4.6.3.4: Results of Left Lateral Flexion

Table 4.25 : The inter-group treatment readings comparing the initial (ic), fifth (5th), final (fc) and follow-up (fw) consultations of groups-A and group-B

L L Flex	**ic**		**5th**		**fc**		**fw**	
Groups	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
S D	13.0	9.1	8.1	8.8	9.0	9.6	8.7	9.5
P-Value	0.2274 **ns**		0.6602 **ns**		0.7032 **ns**		0.8180 **ns**	

The null hypothesis was accepted on comparing group-A and group-B for each sample analysis, which indicated that at a 95% confidence level, there was no statistically significant difference in left lateral flexion readings when comparing the initial (ic), fifth (5), final (fc) and follow-up (fw) consultations. Thus neither of the groups improved significantly more than the other. Analysis of the standard deviation showed a relative familiraity around the mean, therefore both groups displayed a similar reliability, indicating no clinical differences.

4.6.3.5: Results of Right Rotation

Table 4.26 : The inter-group treatment readings comparing the initial (ic), fifth (5th), final (fc) and follow-up (fw) consultations of groups-A and group-B

R Rotation	**ic**		**5th**		**fc**		**fw**	
Groups	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
S D	8.8	8.6	11.5	6.8	5.2	8.2	4.6	6.6
P-Value	0.1729 **ns**		0.9667 **ns**		0.0996 **ns**		0.1084 **ns**	

The null hypothesis was accepted on comparing group-A and group-B for each sample analysis, which indicated that at a 95% confidence level, there was no statistically significant difference in right rotation readings when comparing the initial (ic), fifth (5), final (fc) and follow-up (fw) consultations. Thus neither of the groups improved significantly more than the other. Analysis of the standard deviation showed a relative familiraity around the mean, therefore both groups displayed a similar reliability, indicating no clinical differences.

4.6.3.6: Results of Left Rotation

Table 4.27 : The inter-group treatment readings comparing the initial (ic), fifth (5th), final (fc) and follow-up (fw) consultations of groups-A and group-B

L Rotation	**ic**		**5th**		**fc**		**fw**	
Groups	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
S D	10.7	9.4	9.8	6.9	5.7	10.0	6.1	7.0
P-Value	0.9662 **ns**		0.9667 **ns**		0.4396 **ns**		0.7051 **ns**	

The null hypothesis was accepted on comparing group-A and group-B for each sample analysis, which indicated that at a 95% confidence level, there was no statistically significant difference in left rotation readings when comparing the initial (ic), fifth (5), final (fc) and follow-up (fw) consultations. Thus neither of the groups improved significantly more than the other. Analysis of the standard deviation showed a relative familiraity around the mean, therefore both groups displayed a similar reliability, indicating no clinical differences.

4.6.3.7: Results of the Algometer

Table 4.28 : The inter-group treatment readings comparing the initial (ic), fifth (5th), final (fc) and follow-up (fw) consultations of groups-A and group-B

Algometer	**ic**		**5th**		**fc**		**fw**	
Groups	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
S D	0.8	0.9	1.0	1.3	0.9	1.2	0.9	1.3
P-Value	0.5752 **ns**		0.2804 **ns**		0.1464 **ns**		0.4673 **ns**	

The null hypothesis was accepted on comparing group-A and group-B for each sample analysis, which indicated that at a 95% confidence level, there was no statistically significant difference in algometer readings when comparing the initial (ic), fifth (5), final (fc) and follow-up (fw) consultations. Thus neither of the groups improved significantly more than the other. Analysis of the standard deviation showed a relative familiraity around the mean, therefore both groups displayed a similar reliability, indicating no clinical differences.

4.6.4 Subjective Data **(Two-Tailed Mann-Whitney U-Test)**.

4.5.4.1: Results of the CMCC Neck Disability Index

Table 4.29 : The inter-group treatment readings comparing the initial (ic), fifth (5th), final (fc) and follow-up (fw) consultations of groups-A and group-B

C.M.C.C	**ic**		**5th**		**fc**		**fw**	
Groups	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
S D	12.2	10.2	9.5	10.3	6.8	8.0	6.7	6.6
P-Value	0.1493 **ns**		0.6619 **ns**		1.0 **ns**		0.9662 **ns**	

The null hypothesis was accepted on comparing group-A and group-B for each sample analysis, which indicated that at a 95% confidence level, there was no statistically significant difference in CMCC Neck Disability readings when comparing the initial (ic), fifth (5), final (fc) and follow-up (fw) consultations. Thus neither of the groups improved significantly more than the other. Analysis of the standard deviation showed a relative familiraity around the mean therefore both groups displayed a similar reliability, indicating no clinical differences.

4.6.4.2: Results of the McGill Short-Form Pain Questionnaire

Table 4.30 : The inter-group treatment readings comparing the initial (ic), fifth (5th), final (fc) and follow-up (fw) consultations of groups-A and group-B

McGill	**ic**		**5th**		**fc**		**fw**	
Groups	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
S D	19.8	15.8	7.3	13.2	5.8	10.7	4.8	9.1
P-Value	0.3837 **ns**		0.3352 **ns**		0.5572 **ns**		0.4257 **ns**	

The null hypothesis was accepted on comparing group-A and group-B for each sample analysis, which indicated that at a 95% confidence level, there was no statistically significant difference in McGill Short-Form Pain readings when comparing the initial (ic), fifth (5), final (fc) and follow-up (fw) consultations. Thus neither of the groups improved significantly more than the other. Analysis of the standard deviation showed a relative familiraity around the mean therefore both groups displayed a similar reliability, indicating no clinical differences.

4.6.4.3: Results of the Numerical Pain Rating Scale-101

Table 4.31 : The inter-group treatment readings comparing the initial (ic), fifth (5th), final (fc) and follow-up (fw) consultations of groups-A and group-B

N.R.S	**ic**		**5th**		**fc**		**fw**	
Groups	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
S D	14.0	17.8	15.4	13.8	11.8	14.0	9.4	13.8
P-Value	0.5754 **ns**		0.8681 **ns**		0.2424 **ns**		0.1458 **ns**	

The null hypothesis was accepted on comparing group-A and group-B for each sample analysis, which indicated that at a 95% confidence level, there was no statistically significant difference in Numerical Pain Rating Scale-101 readings when comparing the initial (ic), fifth (5), final (fc) and follow-up (fw) consultations. Thus neither of the groups improved significantly more than the other. Analysis of the standard deviation showed a relative familiraity around the mean therefore both groups displayed a similar reliability, indicating no clinical differences.

CHAPTER FIVE

DISCUSSION

5.1 Introduction

This chapter provides a discussion of the results of the objective and subjective data from the statistical analysis, summary statistics and diagramatic representations. The data were divided into 2 sections. Firstly the intra-group comparison, whereby assessments within each group were made between the initial (ic), 5th (5th), final (fc) and follow-up consultations (fw). The assessments between the (ic) to (fc) represented the efficacy of the treatment regime. The assessment of the (fc) to the (fw) represented whether the treatment regime was maintained or not. The assessment of the (ic) to the (fw) showed if there was an overall improvement in the treatment regime. The (5th) was used to assess whether improvement had occurred in the early or late stages of the treatment regime. With inter-group comparison, the comparison of the (ic) between the groups displayed whether or not there was any variance in the subjective or objective findings before each group was subjected to the full course of treatment. The comparison of the (5th) confirmed which group was improving earlier in the treatment protocol. The comparison of the (fc) confirmed which treatment was more effective and appraisal of the (fw) confirmed which group, if any, maintained itself more effectively.

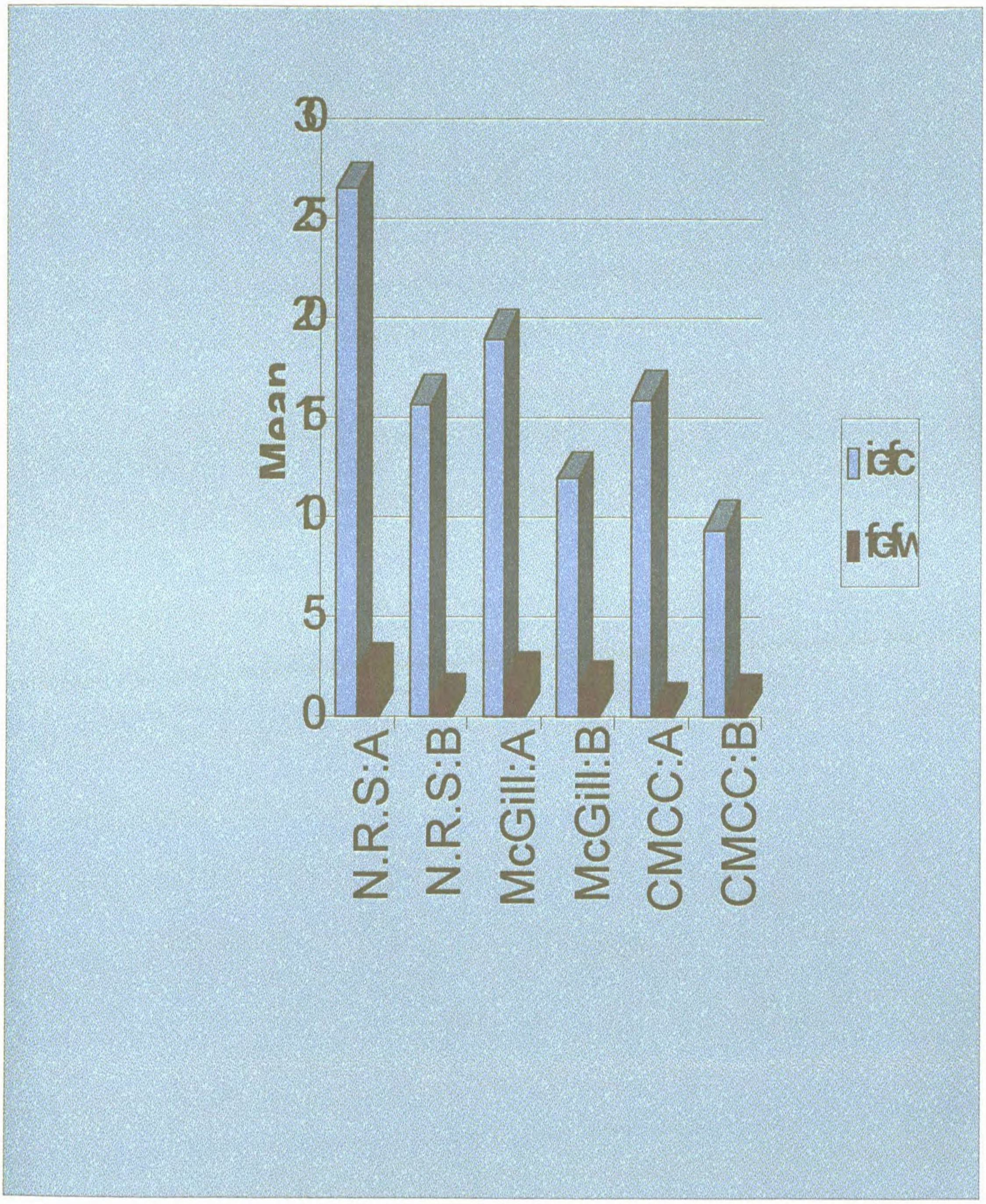
5.2 Results of the Subjective Data

5.2.1 Intra-group Comparisons

5.2.1.1 The Numerical Pain Rating Scale

With regards to the mean readings, initially the readings for both groups were similar. However, from the (5th) through to the (fw), an appreciable difference occurred more so in group-A than group-B (Table 4.4). Both groups improved from the (ic) to the (fw). However, a greater appreciable difference occurred within group-A from the (5th) to the (fw). Within group-A, the pain intensity decreased more significantly, and the overall improvement was greater (Figure 1 pg: 80; Figure 3).

Figure 3 : Difference in Mean values comparing the subjective data between the intial treatment to the final treatment and from the final treatment to the follow-up treatment.



With regards to the statistically analyzed data, a significant decrease in pain intensity occurred in group-A between (ic) all the way through to the (fw) implying an overall improvement. However, the pain intensity decreased significantly over the treatment period but was not maintained over the one month treatment period as no significant difference occurred over this period (Table 4.8). With regards to group-B, the pain intensity decreased significantly up to the (fc). However, most of the pain intensity decreased over the first five consultations with the treatment regime not being maintained over the one month follow-up period, and there was no overall improvement for group-B (Table 4.8).

5.2.1.2 The McGill Short-Form Pain Questionnaire.

Both groups had an overall improvement in terms of the effective, sensory and evaluative pain experienced. However, the figure for group-B was closer to the 95% confidence level implying that the clinical improvement was not as substantial as that of group-A to warrant discussion (Table 4.7). The difference in the percentages of the mean readings was greater for group-A than group-B (Table 4.5) implying that group-A clinically improved more appreciably. The pain perception of group-A decreased significantly over the treatment period, however was not significantly maintained over the one month follow-up period. Group-B only significantly improved over the first 5 treatments implying that group-A was more likely to maintain a favourable long term response to treatment.

There was a definite clinical difference between the two groups, favouring group-A (Figure 3).

5.2.1.3 The C.M.C.C Neck Disability Index

In terms of assessment of disability, both groups significantly improved overall. Both group-A and group-B clinically improved during the treatment regime. However, this improvement was not maintained in the one month follow-up period. The only significant clinical difference between the two groups occurred between the (5th) to the (fc) (Table 4.6). The mean values show that there was an appreciable difference from the (ic) to the (fc), but no appreciable difference occurred between the (fc) to the (fw) (Table 4.5; Figure 3). From the results, both treatment methods showed similarity in improvement rate.

5.2.2 Inter-Group Comparisons

5.2.2.1 Numerical Pain Rating Scale

Statistical comparison of the first treatment bore no difference in the inceptive degree of pain intensity, showing a similarity in nature of pain intensity.

Analysis of the (5th) and (fc) comparison showed no statistical difference between the two groups. Even though there was an 8% improvement in pain intensity in favour of group-A in the mean readings for the (fw), (Table 4.4), no significant statistical difference was found between the two groups.

Analysis of the standard deviation (Figure 2 pg: 81) revealed that even though group-A had a slightly lower standard deviation (± 3), a familiarity around the mean was found, therefore both groups displayed a similar predictability and reliability over their respective treatment periods, indicating that there was no significant clinical difference between the two groups in terms of pain intensity (Table 4.24).

5.2.2.2 The McGill Short-Form Pain Questionnaire.

Evaluation of the measurements of the (ic) indicated no significant difference in the original degree of pain perception, even though there was a 5.73% difference in mean readings in favour of group-B (Table 4.5). This therefore suggests that both treatment groups were similar in nature.

No significant statistical differences were found at the (5th), (fc) and (fw). The mean readings comparing the two groups (Table 4.5), showed a decrease in the difference of percentages between them i.e. 5.73% (ic) ⇒ -3.21% (fw).

Analysis of the standard deviation (Figure 4 pg: 103) revealed that even though group-A had a slightly lower standard deviation (± 4), a familiarity around the mean was found, therefore both groups displayed a similar predictability and reliability over their respective treatment periods, indicating that there was no significant clinical difference between the two groups in terms of pain of the effective, sensory and evaluation of pain experienced (Table 4.23).

5.2.2.3 The C.M.C.C Neck Disability Index.

The results of the measurements disclosed no significant difference in the inceptive degree of disability caused by the cervical facet syndrome. This suggested that both treatment groups were related in character in terms of disability.
Examination of the measurements of the (5th), (fc) and (fw) indicated that neither group had a significantly more effective improvement. There was no significant difference between the inter-group mean readings (Table 4.22).

Analysis of the standard deviation (Figure 2 pg: 81) revealed that a familiarity around the mean was found, therefore both groups displayed a similar predictability and reliability over their respective treatment periods, indicating that there was no significant clinical difference between the two groups in terms of disability (Table 4.22).

5.3 Results of the Objective Data

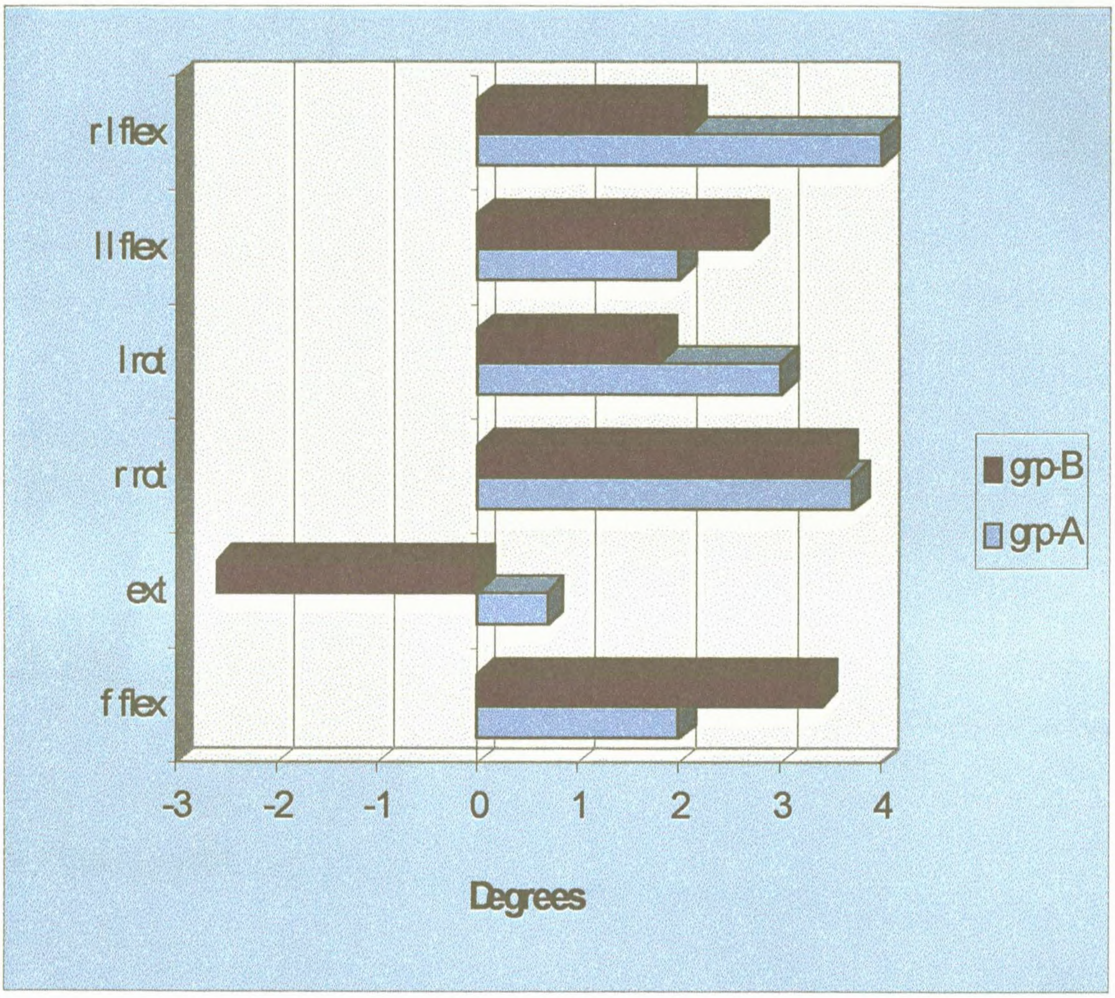
5.3.1 Intra-Group Comparisons

5.3.1.1 Range of Motion

As little as a 2°-3° difference was found within each group from the (ic) through to the (fw) for all the ranges of motion in terms of the difference in mean readings (Table 4.1; Figure 4), showing to be of little clinical significance.

Comparison of the (ic) to the (5th) period disclosed a significant difference only on left lateral flexion for group-B (Table 4.11) and the difference in mean readings was 5° (higher than any other difference in mean readings for this study). This proved to be of little clinical significance due to the proximity of the value to the 95% confidence level. Statistical evaluation of the six cervical ranges of motion parameters within the (ic) through to the (fw) exhibited no statistical differences and thus was found to be of no clinical relevance.

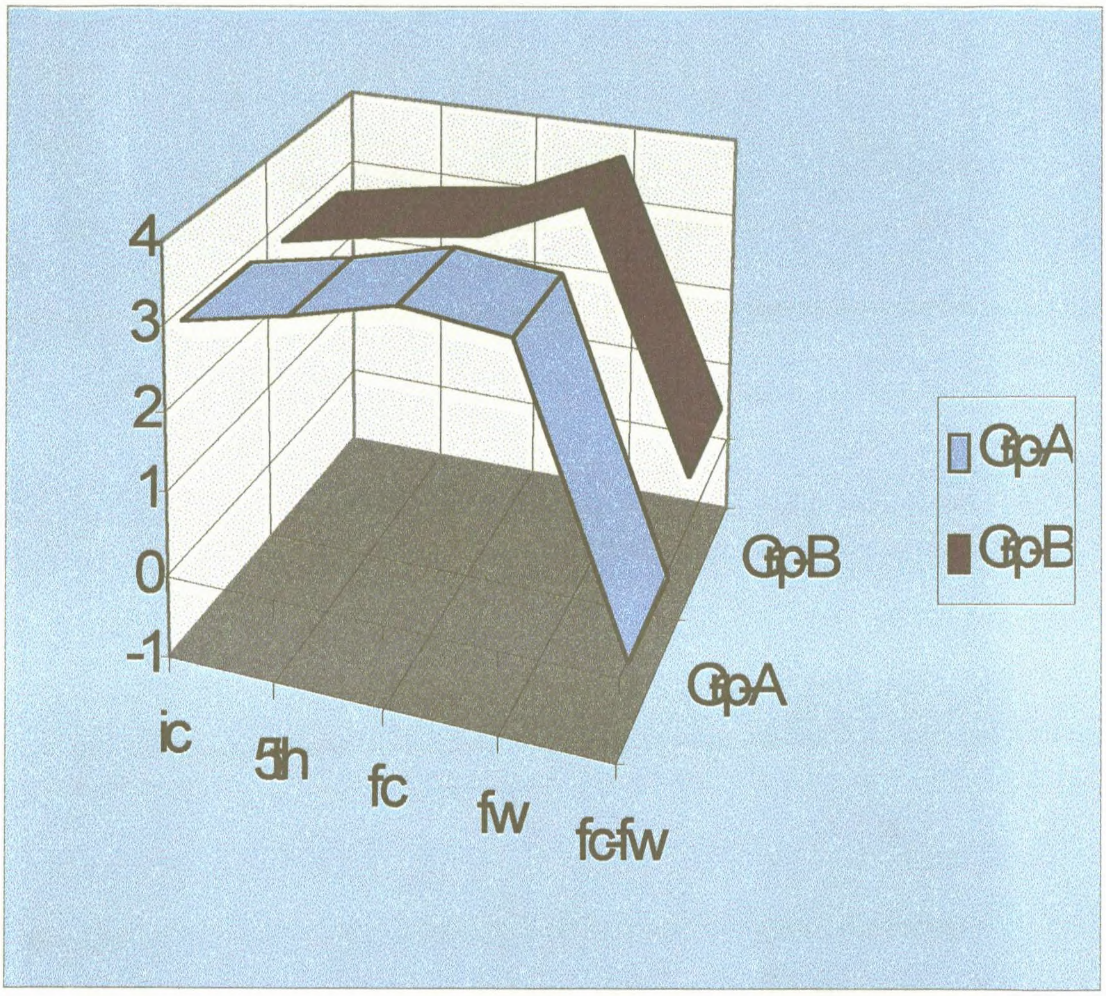
Figure 4 : Comparison, in degrees, to show the overall change in the range of motion of group-A and group-B.(fw-ic)



5.3.1.2 Algometer readings

Comparison of the (ic) to the (fw) period disclosed a non-significant difference on the algometer readings. However, both groups did improve steadily over the treatment regime. The mean readings over this period only showed a difference of 1.02 kilograms per square centimeter (Table 4.3). As a result the above comparison was not likely to be of any clinical significance. Statistical evaluation of the algometer parameters within the (ic) through to the (fw) exhibited statistically a non-significant difference and thus was found to be of no clinical significance (Table 4.14; Figure 5). The algometer results for both groups were very similar throughout the treatment protocol implying that both groups, even though not clinically significant, had similar improvements.

Figure 5 : Comparison of the algometer intra-group mean values for Group-A and Group-B from the initial treatment to the follow-up treatment.

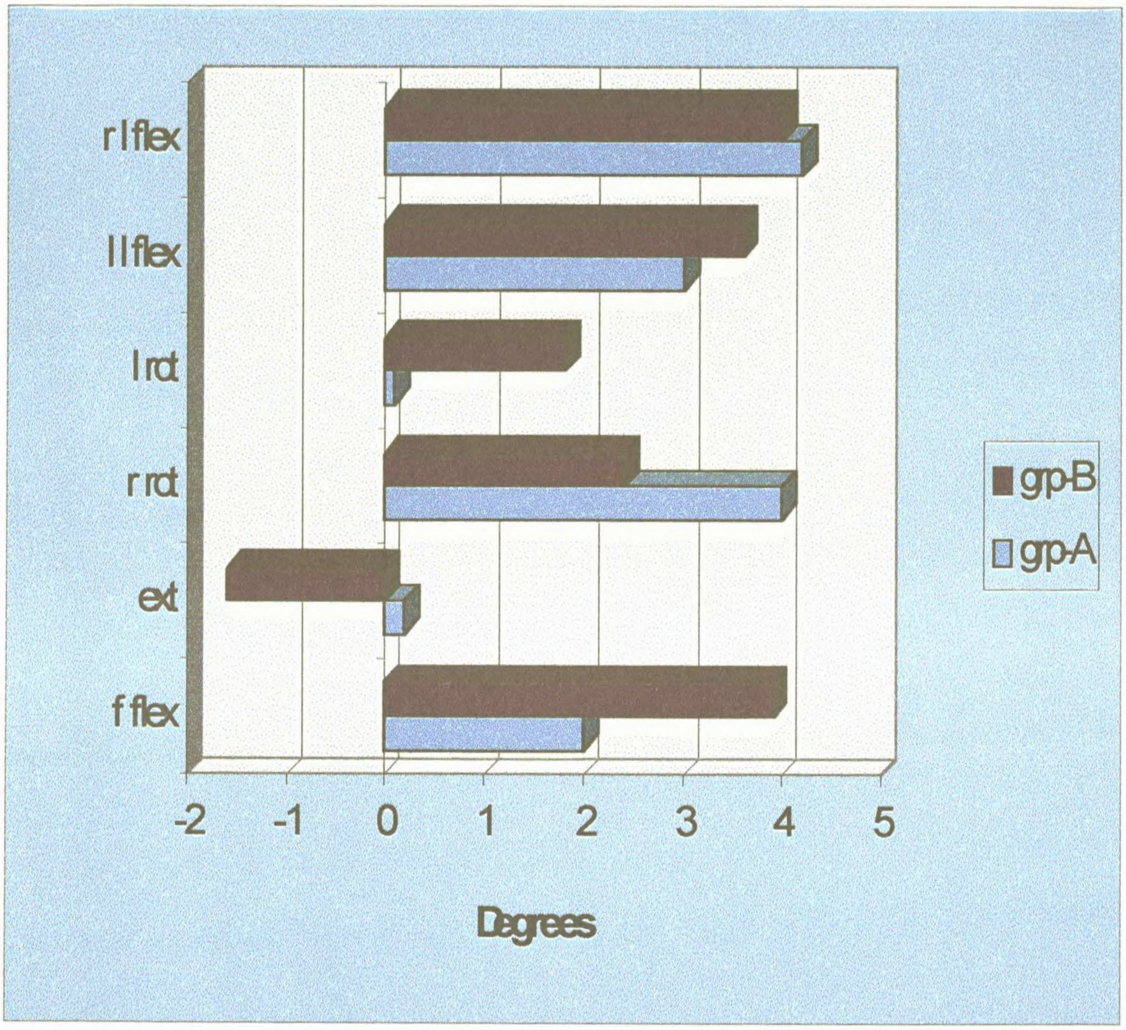


5.3.2 Inter-Group Comparisons

5.3.2.1 Range of Motion

Comparison of the cervical range of motion measurements with the goniometer presented no statistically significant difference. Even though statistically non-significant, a mean difference of 5.1° was noted between the two groups at the (fc) in favour of group-A Analysis of the standard deviation revealed that a familiarity around the mean was found, therefore both groups displayed a similar predictability and reliability over their respective treatment periods, indicating that there was no significant clinical difference between the two groups in terms of range of motion.

Figure 6 : Comparison, in degrees, to show if the treatment regime in terms of the range of motion of group-A and group-B was effective.(fc-ic)



5.3.2.2 Algometer readings

Comparison of the algometer measurements with the goniometer presented no statistically significant difference. There was no appreciable difference between the mean readings either and the analysis of the standard deviation revealed that a familiarity around the mean was found, therefore both groups displayed a similar predictability and reliability over their respective treatment periods, indicating that there was no significant clinical difference between the two groups.

5.4 Interpretation of the Data

5.4.1 The Subjective Data

It was hypothesized that there would be a difference in the subjective clinical findings on analysis of the inter-group and intra-group data, showing that the treatments were not equally effective. This was rejected. It was also hypothesized that there would be no difference in the subjective clinical findings on analysis of the intra-group and inter-group data, showing that the treatment was effective. This was accepted.

Results showed that even though there was no statistically significant difference between the two groups, both groups responded favourably to their respective treatments. On inspection of the data, even though statistically non-significant, it was found that group-A indicated a slightly more effectatious overall clinical improvement, particularly in terms of the time period taken to improve and its favourability to the long term response to treatment.

For all three of the pain questionnaires, both groups appreciably improved. However, the greater appreciable improvement occurred in group-A. The results of group-A were also found to be closer to the 95% confidence level than those of group-B. It must be mentioned that even though both groups improved, the improvement only took place in the treatment period and neither of the groups statistically maintained their treatment regime over the one month follow-up period.

The trend for the standard deviation showed a predominant similarity between the figures of the two treatment groups over the treatment period. Yet again the standard deviation values for group-A were ± 3 units less than group-B. However, being statistically and clinically insignificant, it is likely that this is an indication that both groups exhibited approximately the same reliability and predictability.

5.4.2 The Objective Data

It was hypothesized that there would be a difference in the objective clinical findings on analysis of the inter-group and intra-group data, showing that the treatments were not equally effective. It was also hypothesized that there would be no difference in the objective clinical findings on analysis of the intra-group and inter-group data, showing that the treatment was effective. This was accepted.

On inspection of the data it was found that there was no appreciable difference in the mean readings and that there was no statistically significant difference in the intra-group and inter-group results.

For range of motion, only a 2-3° difference from the (ic) to the (fw) was found between the two groups and the only statistically significant finding was left lateral flexion in favour of group-B, which was also very close to the 95% confidence level.

The only difference between the two groups for the algometer readings was 1.02 kilograms per centimeter squared. Thus no appreciable difference in the mean readings was found and there was no statistically significant difference in the intra-group and inter-group algometer results.

The trend for the standard deviation showed a predominant similarity between the figures of the two treatment groups over the treatment period. This was an indication that both groups exhibited approximately the same reliability and predictability.

5.5 Problems encountered with the Data

5.5.1 The Subjective Data

Problems encountered included :

- With regards to the questionnaires one has to take into account Type I and Type II errors. Type I errors : The problem encountered here included patients that answered the questionnaires based on what they remembered filling in on previous questionnaires. Type II errors : Calculation errors and mathematical errors in the addition results of the questionnaires.

- It is impossible to have an ideal environment to do the research (i.e. elimination of stress, daily and sports activities.)

- A larger sample size would have made the results more representative of the population and could of made the recovery rate more apparent.

- The questionnaiers may not have been sensitive to subtle changes in pain intensity and disability.

5.5.2 The Objective Data

Problems encounted included :

- The accuracy of the goniometer (calibrated in increments of two degrees) combined with the aspect of user error would have affected the sensitivity of the goniometer to subtle changes in cervical motion.

- User error of the algometer in terms of proper positional placement, force and direction each time the instrument was used, questioning the sensitivity to subtle changes.

Errors were reduced by careful accurate recordings which were rechecked if the researcher felt that it was necessary. These errors could have been reduced by the use of more technologically advanced equipment that is inexpensive and more readily available.

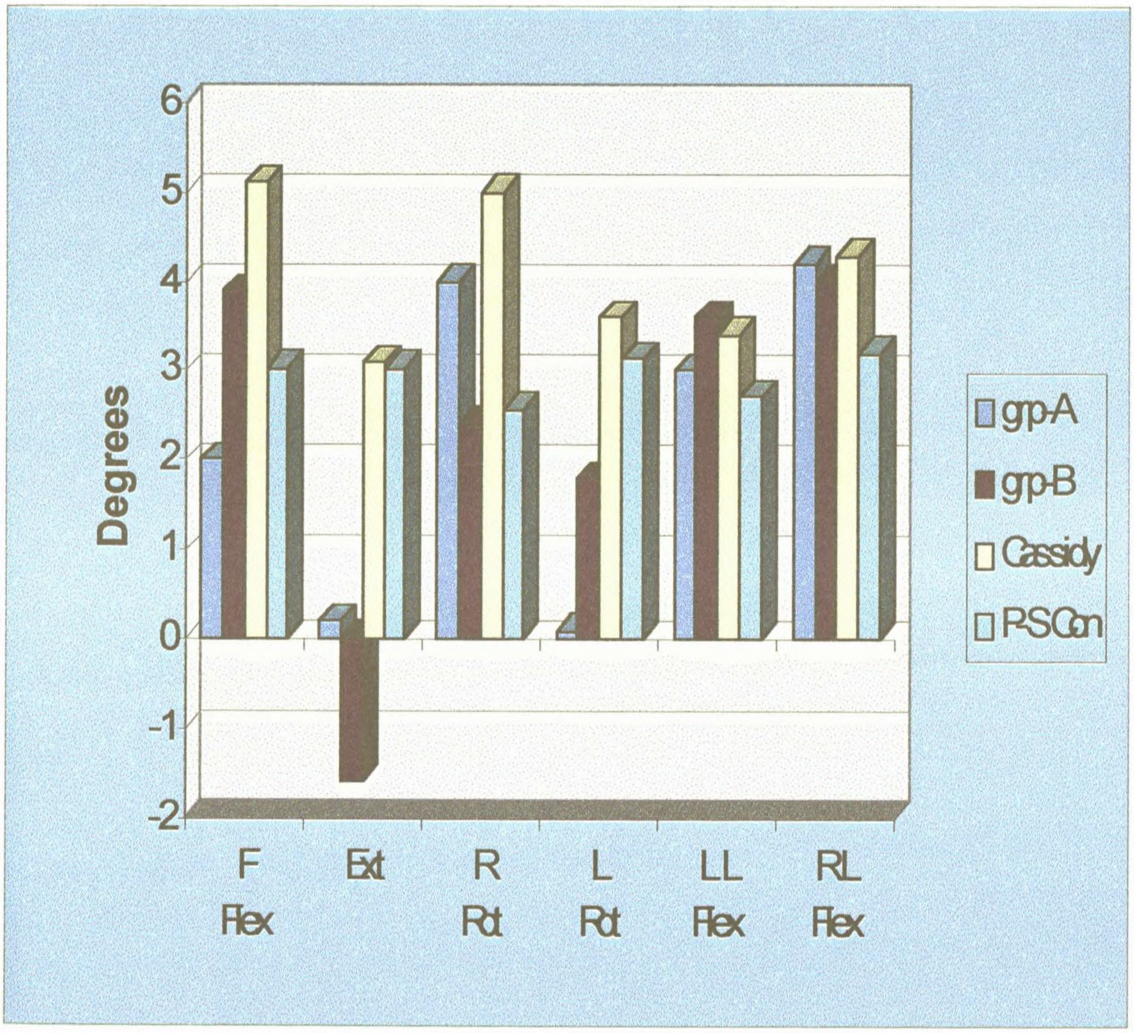
5.6 Comparison of Results to Previous Research

According to Cassidy et al. (1992 : 574), with manipulation there is a significant increase in the range of motion and a decrease in neck pain. The results of Cassidy's study proved to be very similar to this study. It must be mentioned that Cassidy's study was only a pilot study and only a single manipulation was given to each patient (Cassidy et al. 1992 : 574). As a result a direct comparison between these studies cannot be made.

A comparison was also made with the range of motion results of Parkin-Smith's (1996 : 54) study. In this study he compared the efficacy of cervical manipulation to combined cervical and thoracic manipulation in the treatment of mechanical neck pain. The results of the control group (purely cervical manipulation) were used as a comparison with the results of this study. The results of his study were found to be similar to the results of this study in terms of an increase in range of motion and a decrease in neck pain. Due to the nature of the study being similar to this study, the results could be comparable.

Figure 7 : Comparison of Cassidy et al's. (1992: 574) study and Parkin-Smith's (1996: 54) study on manipulation (ROM) to this study's treatment groups :

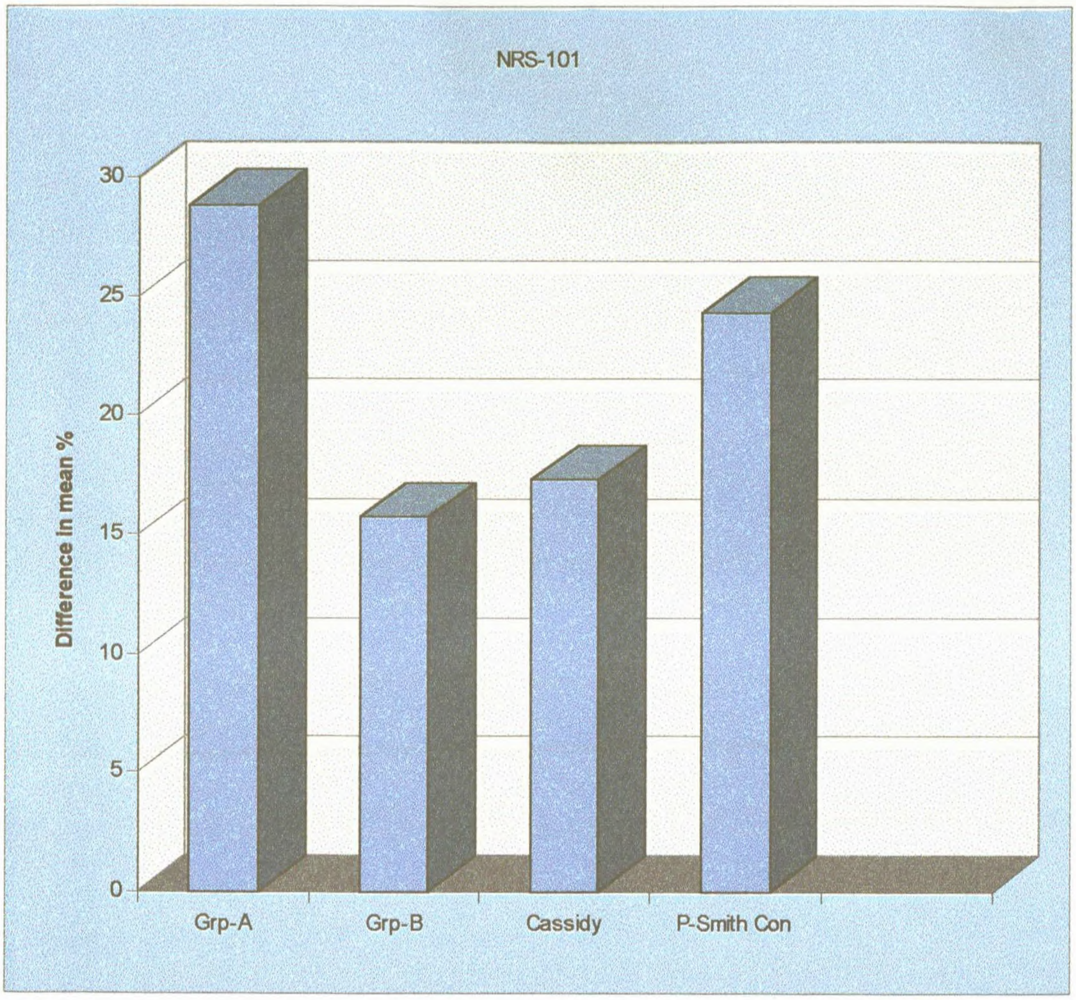
Abbreviations : P-S Con = Parkin-Smith Control Group.



From Figure 7 one can see that there is only an interval of ± 2-4° difference between the different studies. The only noticeable difference found in Figure 7 was that in this study a decrease in range of motion was found in extension for group-B when compared to the other studies. No explanation can be afforded for this finding.

The mean improvement of the NRS-101 scores was also compared with Cassidy et al. (1992 : 573) and Parkin-Smith (1996 : 53).

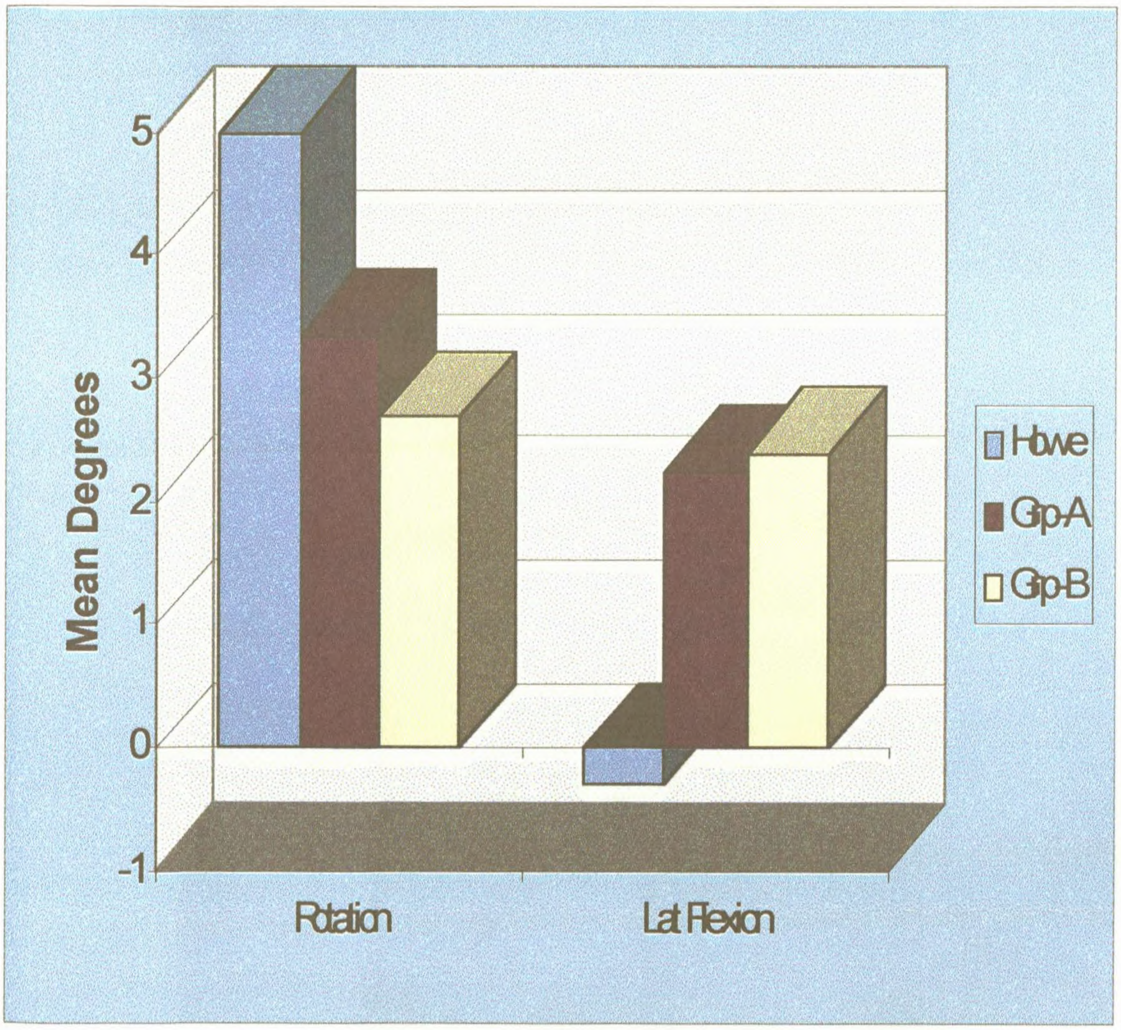
Figure 8 : Comparison of mean improvement in NRS-101 scores with Cassidy et al. (1992 : 573) and Parkin-Smith (1996 : 53).



From figure 8, one can see that group-A's improvement was similar to the results of the control group of Parkin- Smith's (1996 : 53), and Group-B's results in terms of the NRS-101, were comparable with Cassidy et al's (1992), thus allowing the probability that the results of this study were similar to the results of other studies.

In a study done by Howe et al. (1983 : 574-579), 52 patients underwent manipulation in the treatment of pain and or stiffness in the neck and pain or paresthesia in the shoulder. All patients improved significantly. In the study by Howe et al. (1983 : 574) it was found that manipulation significantly increased rotation that maintained for three weeks and a immediate improvement in lateral flexion that was not maintained.

Figure 9 : Comparison of improvement in rotation and lateral flexion in degrees with Howe et al.'s (1983 : 578) study on cervical manipulation.



From Figure 9, it can be seen that, unlike the results from Howe et al. (1983 : 578), the results of lateral flexion from this study were maintained and indicated a greater improvement. However, group-A's rotation results were similar to Howe et al.'s (1983) results, whereas the results of group-B were slightly less than Howe et al. (1983), allowing the assumption that the amount of rotational increase in cervical range of motion is greater for a rotational adjustment as apposed to a lateral break adjustment.

In a study done by Yeomans (1992 : 106-114), the cervical intersegmental mobility was assessed before and after cervical adjustments. The frequency of spinal manipulative therapy averaged at 3 times per week, ranging from 2-6 weeks i.e. similar to this study. Yeomans (1992 : 106) revealed that, like this study, post-manipulative mobility was significantly greater (exception of C1) than before spinal manipulative therapy.

Mennel (1990 : 7-11) did a study in which he manipulated 83 patients suffering from cervical spine involvement. Of the 100% patients treated 30% were totally cured, 34% improved markedly and 29% improved moderately. According to Mennell (1990 : 10), the chronicity of the patients complaint does not seem to alter the clinical results. He also says that the age of the patient does not affect the clinical outcome.

In a study done by Maigne (1964 : 55-69), he adjusted patients suffering from lower back pain using the concept of painless and opposite motion in spinal manipulations, i.e. he adjusted patients in the direction which was opposite to their pain and restricted motion.

This concept was very similar to the one applied in this study. His results showed that in the group that received manipulation alone, 73% of the cases had complete disappearance of pain after 1-6 manipulations distributed over a period of 1-20 days. At the 4 month follow-up period, only 40% of the patients maintained their results. In comparison to this study, according to the NRS-101 scores, there was a significant and appreciable difference in both groups. For group-A there was a 26.45% mean decrease in pain experienced which was maintained over the one month follow-up period. For group-B there was a 14.73% mean decrease in pain experienced which was maintained over the one month follow-up period. However, group-B which was adjusted on the opposite side of restriction did not improve as much as in Maigne (1964 : 67), but did maintain improvement over the one month period.

In conclusion, it was found that both groups improved in terms of the objective and subjective findings, but more so for group-A as a result of a quicker rate of recovery as seen in the intra-group readings. However, even though a few comparisons can be made which lend support to the findings, the comparisons are not concrete and substantial enough to make absolute conclusions.

CHAPTER 6

Conclusions and Recommendations

6.1 Conclusions

This study consisted of 30 patients who were randomly divided into 2 treatment groups, consisting of 15 patients per group. All were diagnosed as having cervical facet syndrome after undergoing an intensive medical history, physical and orthopaedic examination. Group-A patients were subject to a rotatory adjustment on the same side of the lateral flexion fixation, while group-B were subject to a supine lateral break on the opposite side of the lateral flexion fixation.

Both treatment groups received 9 treatments over a 3-4 week period and a follow-up period which occurred 1 month after the 9th treatment.

The results showed that there was a statistically significant improvement within both the treatment groups, indicating that both treatment protocols were effective in the treatment of cervical facet syndrome. However, it was found in terms of the subjective data of the mean readings that group-A had improved at a quicker rate than group-B, and that the improvement was more appreciable for group-A than for group-B. In terms of the objective data of the mean readings, there was a definite increase in range of motion and a a decrease in pain sensitivity, as a result of manipulation. However it was found that extension for group-B actually decreased (Table 4.6; Figure 1). A possible reason may be due to the fact that when a supine lateral break is delivered there is no extension vector in the adjustment protocol; whereas, there is a slight extension vector in a rotatory adjustment.

According to the mean readings both groups maintained improvement throughout the one month follow-up period. (the standard deviations were similar for both groups)

In terms of the inter-group comparison there was no statistically significant differences between the two groups, thus implying that both treatments were equally effective in the treatment of cervical facet syndrome. To further strengthen the results the demographic data showed that there was an equal division of patient gender, i.e. 15 male and 15 female. Also, 70% of the patients were under the age of 35, thus decreasing variables such as degenerative joint disease, arthritides, cancers etc. which could diminish the validity of the results.

This study was designed to compare the relative efficacy between two different chiropractic manipulations in the treatment of cervical facet syndrome, with the intention of showing the short-term efficacy and not long term efficacy. It is therefore argued that the lack of follow-up consultations over monthly periods, did not diminish the validity of the results.

6.2 Recommendations

In future studies it is recommended that longer follow-up periods be allowed to show the relative long-term efficacy of the chiropractic adjustments. Factors like gender, level of joint dysfunction, age, chronicity of the condition and outside variables such as sport played and stress of occupation should be taken into consideration to make the results more valid.

It is also advisable that a study be proposed to determine what side cavitation occurs in the cervical spine when a supine lateral break is delivered and when a rotatory break is delivered. To support this study even further a study should be proposed whereby the efficacy of a supine lateral break be given on the contra-lateral side of the lateral fixation as compared to a supine lateral break which should be given on the ipsilateral side of the lateral fixation.

It is also advisable that with future studies a larger sample size be used to further strengthen the results, thus making the project more valid and more representative of the population. The measurement parameters being used in this study were not concise and accurate enough to validate and signify subtle findings with such a small sample size, thus a larger sample size would expose subtle changes in cervical range of motion and improvement of pain. This would allow sufficient statistical significance to be achieved.

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ADDENDUM A:

MEASUREMENT OF PAIN

SHORT-FORM McGILL PAIN QUESTIONNAIRE

Ronald Melzack

Patient's Name:........................... Date:...........

	(0) NONE	(1) MILD	(2) MODERATE	(3) SEVERE
THROBBING	[ ]	[ ]	[ ]	[ ]
SHOOTING	[ ]	[ ]	[ ]	[ ]
STABBING	[ ]	[ ]	[ ]	[ ]
SHARP	[ ]	[ ]	[ ]	[ ]
CRAMPING	[ ]	[ ]	[ ]	[ ]
GNAWING	[ ]	[ ]	[ ]	[ ]
HOT-BURNING	[ ]	[ ]	[ ]	[ ]
ACHING	[ ]	[ ]	[ ]	[ ]
HEAVY	[ ]	[ ]	[ ]	[ ]
TENDER	[ ]	[ ]	[ ]	[ ]
SPLITTING	[ ]	[ ]	[ ]	[ ]
TIRING-EXHAUSTING	[ ]	[ ]	[ ]	[ ]
SICKENING	[ ]	[ ]	[ ]	[ ]
FEARFUL	[ ]	[ ]	[ ]	[ ]
PUNISHING-CRUEL	[ ]	[ ]	[ ]	[ ]

The 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.

ADDENDUM B:

NUMERICAL PAIN RATING SCALE - 101 QUESTIONNAIRE

Patient's Name:........................ 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.

....

ADDENDUM C:

CMCC NECK DISABILITY INDEX

Patient's Name:...................... Date:.........

This questionnaire has been designed to give the doctor information as to how your neck pain has affected you every day life. Please answer every section and mark in each section only ONE box which applies to you. Please choose the box 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 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 someone to 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 weights but it give extra pain.
[ ] Pain prevents me from lifting weights off the floor, but I can manage them if they are conveniently placed.
[ ] Pain prevents me from lifting heavy weights, but I can manage them if they are conveniently placed.
[ ] I can lift very light weights.
[ ] I cannot lift or carry anything at all.

Section 4 - Reading
[ ] I can read as much as I like without pain in my neck.
[ ] I can read as much as I like with only slight pain.
[ ] I can read as much as I want with moderate pain.
[ ] I can't read as much as I want due to moderate pain.
[ ] I can hardly read due to 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 as much as I want 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 as long as I want with 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 due to moderate neck pain.
[ ] I can hardly drive at all due to severe neck pain.
[ ] I can't drive my car at all.

Section 9 - Sleeping

[ ] I have no trouble sleeping.
[ ] My sleep is slightly disturbed (< 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 recreational activities with no neck pain at all.
[ ] I am able to engage in all my recreational activities with some neck pain.
[ ] I am able to engage in most, but not all of my recreational activities because of my neck pain.
[ ] I am able to engage in a few of my usual recreational activities because of my neck pain.
[ ] I can hardly do any recreational activities because of my neck pain.
[ ] I can't do any recreational activities at all.

ADDENDUM D:

CERVICAL RANGE OF MOTION INSTRUMENT

AND

RECORDING SHEET

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 a 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

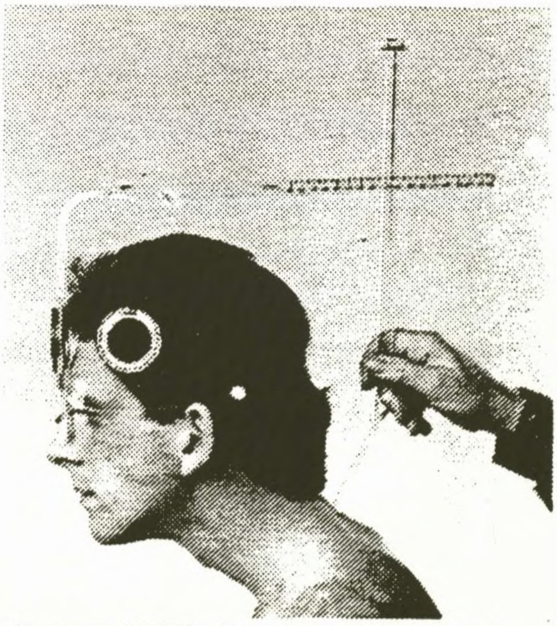


Figure 2: CROM with forward head arm and vertebra locator

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*.

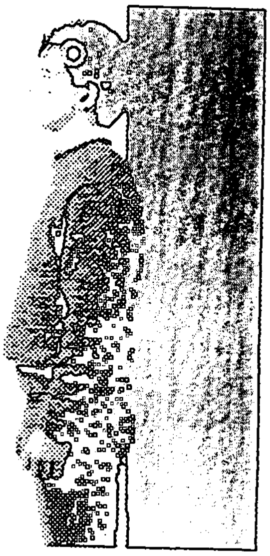


Figure 3: Resting posture

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.

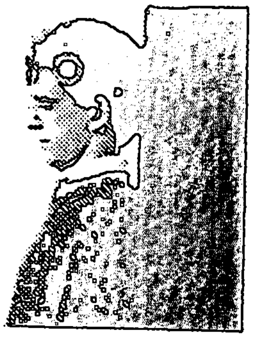


Figure 4: Flexion

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 snuggly 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 magetic 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.

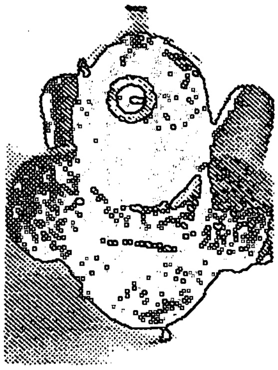


Figure 10: Magnetic yoke pointing north

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.

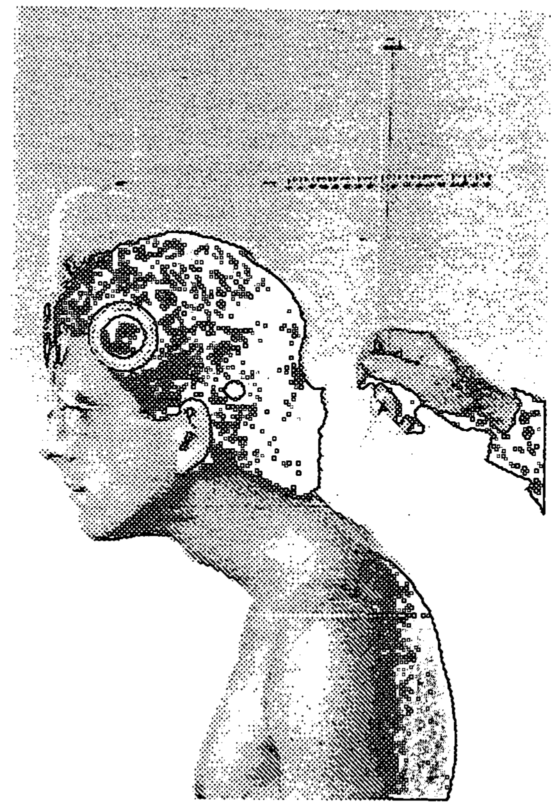


Figure 13: CROM with forward head arm and vertebra locator

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.

CROM Recording Sheet

Name:________________________ Date of Initial Evaluation:____________

Facility:_______________________ Examiner:__________________________

MEASUREMENTS		DATES						
Suboccipital:	Resting Posture							
	Flexion							
	Extension							
Cervical:	Flexion							
	Extension							
Lateral Flexion:	Resting Posture							
	Left							
	Right							
Rotation:	Left							
	Right							
Forward Head:	Retraction							
	Resting Posture							
	Protraction							
Round Shoulder:	Left							
	Right							

Form 101 - Performance Attainment Associates, Roseville MN 55113

ADDENDUM E:

FORCE DIAL

(PUSH - PULL FORCE GAGE)

and

RECORDING SHEET

FORCE DIAL

CERTIFICATE OF CALIBRATION

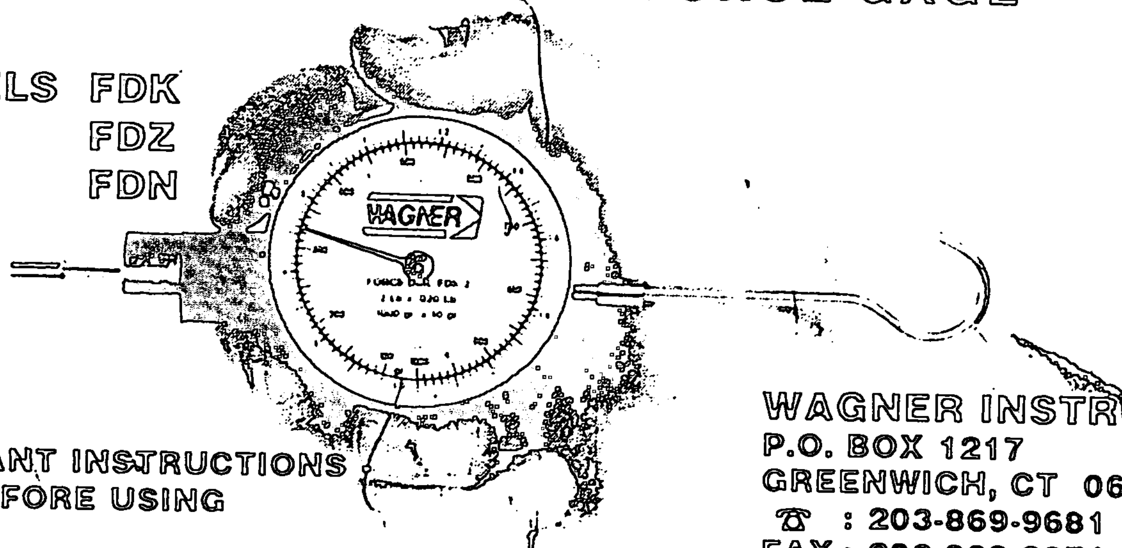
WAGNER INSTRUMENTS certifies that all **FORCE DIALS** are calibrated at the factory to meet the specified accuracy of ± 1% of full scale, advertised in our current catalog.

QUALITY CONTROL DIRECTOR

FORCE DIAL™

PUSH - PULL FORCE GAGE

MODELS FDK
FDZ
FDN



IMPORTANT INSTRUCTIONS
READ BEFORE USING

WAGNER INSTRUMENTS
P.O. BOX 1217
GREENWICH, CT 06836 U.S.A.
☎ : 203-869-9681
FAX : 203-869-9871

GENERAL

Your FORCE DIAL should not be used to measure forces below 25% of full scale since true accuracy is degraded as readings decrease from full scale. Before placing the FORCE DIAL into service it is also recommended to test for accuracy according to procedures found in the CALIBRATION section of this manual.

Model FDK FORCE DIALS have no zero on the dial, since setting the pointer at zero has no significance in calibration or accuracy: see CALIBRATION for details.

Lubrication of the FORCE DIAL is not recommended.

IMPORTANT

To prevent damage, keep an implement/ accessory on the plunger even when the gage is not in use and when using the pull hook. This provides a positive stop and prevents the plunger from being pushed too far.

CALIBRATION

The calibration of the FORCE DIAL may be checked by attaching the pull hook and suspending test weights at 1/4, 1/2, 3/4, and full capacity in the vertical position. The weight of the plunger, flat, tip and pull hook (.03 LB, 17/32 OZ, 15 G) should be subtracted from test results. If it is determined that recalibration is required the instrument should be returned to the factory.

IMPLEMENT WEIGHT ADJUSTMENT
The FORCE DIAL is calibrated for use in the horizontal position. When using low capacity models - thru 2 LB/ 1000 G/ 10 N - in the vertical position, add or deduct the weight of the implements used from your readings, as follows:

WEIGHT OF IMPLEMENTS:

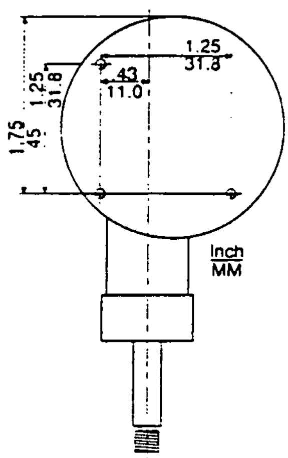
- Plunger: .015 LB/ 1/4 OZ/ 7 G
- Flat Tip: .004 LB/ 1/16 OZ/ 2 G
- Long Rod: .009 LB/ 5/32 OZ/ 4 G
- Pull Hook: .013 LB/ 7/32 OZ/ 6 G

ADJUSTMENT:

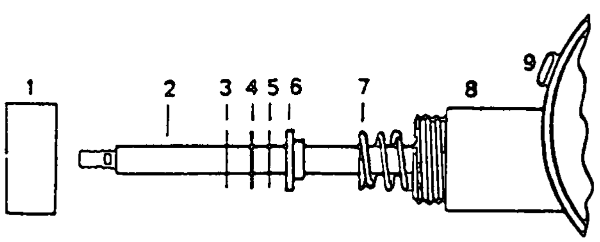
USE	WITH	+/-
Pushing Down	Plunger/Flat Tip	+9 G
Pushing Down	Pliunger/Long Rod	+11 G
Pulling Down	Plunger/Flat Tip/Hook	+15 G
Pushing Up	Plunger/Flat Tip	-9 G
Pushing Up	Plunger/Long Rod	-11 G
Pulling Up	Plunger/Flat Tip/Hook	-15 G

MOUNTING

Your FORCE DIAL may be mounted with three #6 (.138 in/3.5 mm O.D.) sheet metal screws using the hole pattern shown below. The three dimples on the rear housing will assist in starting the screws. Sturdy posts are located internally behind the dimples to accept the screws. The screws should penetrate no more than 3/8 inches or 10 mm.



PARTS



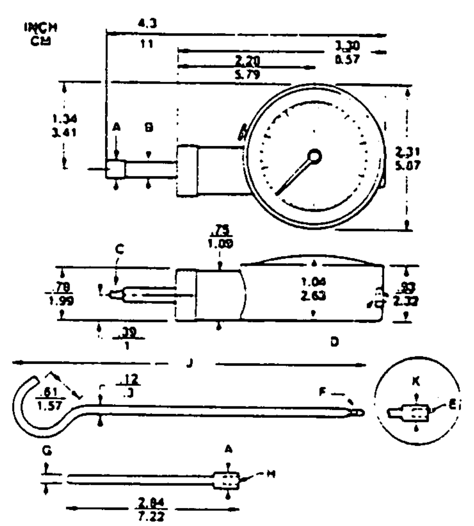
(1) Retainer
(2) Plunger
(3) Disc
(4) Clip
(5) Calibration Washers
(6) Plate
(7) Spring
(8) Case
(9) Push Button
(10) Crystal *
(11) Pointer *

ACCESSORIES: *

(12) Flat Tip (thru 2 LB / 1000 G / 10 N)
(13) Flat Tip (5 LB / 2500 G / 20 N & up)
(14) Long Rod (thru 2 LB / 1000 G / 10 N)
(15) Long Rod (5 LB / 2500 G / 20 N & up)
(16) Pull Hook (thru 2 LB / 1000 G / 10 N)
(17) Pull Hook (5 LB / 2500 G / 20 N & up)

* Not shown in diagram.

DIMENSIONS



High and low capacity models differ slightly in design. The lettered dimensions above, along with the corresponding neasurements and comments shown below identify these small variations.

All dimensions are approximate.

Low Capacity (thru 2 LB / 1000 G)			**High Capacity** (5 LB / 2500 G & up)		
A	.19"	.45 cm	A	.26"	.65 cm
B	.12"	.3 cm	B	.24"	.6 cm
C	M 3	male	C	M 4	male
D	M 3	male	D	M 3	female
E	M 3	female	F	M 3	male
G	.12"	.3 cm	G	.14"	.35 cm
H	M 3	female	H	M 4	female
J	2.8"	7.1 cm	J	3.4"	8.6 cm
K	.19"	.45 cm			

Complete list of available FORCE DIALS

FDK

DECIMAL POUND / GRAM GRADUATIONS

Model	Capacity/Graduations			
FDK 025	.25 LB x	.002 LB/	100 G x	1 G
FDK 050	.50 LB x	.005 LB/	200 G x	2 G
FDK 1	1 LB x	.010 LB/	500 G x	5 G
FDK 2	2 LB x	.020 LB/	1000 G x	10 G
FDK 5	5 LB x	.050 LB/	2500 G x	25 G
FDK 10	10 LB x	.100 LB/	5 KG x	50 G
FDK 20	20 LB x	.250 LB/	10 KG x	100 G
FDK 40	40 LB x	.500 LB/	20 KG x	200 G
FDK 60	60 LB x	.500 LB/	28 KG x	250 G

OUNCE / GRAM GRADUATIONS

Model	Capacity/Graduation			
FDK 4	4 OZ x	1/32 OZ/	100 G x	1 G
FDK 8	8 OZ x	1/16 OZ/	200 G x	2 G
FDK 16	16 OZ x	1/8 OZ/	500 G x	5 G
FDK 32	32 OZ x	1/4 OZ/	1000 G x	10 G
FDK 80	5 LB x	1 OZ/	2500 G x	25 G
FDK 160	10 LB x	2 OZ/	5 KG x	50 G

FDN

NEWTON / GRAM GRADUATIONS

Model	Capacity/Graduation			
FDN1	1N x	.01N/	100G x	1G
FDN2	2N x	.02N/	200G x	2G
FDN5	5N x	.05N/	500G x	5G
FDN10	10N x	.1N/	1000G x	10G
FDN20	20N x	.2N/	2000G x	20G
FDN50	50N x	.5N/	5KG x	50G
FDN100	100N x	1N/	10KG x	100G
FDN200	200N x	2N/	20KG x	200G
FDN300	300N x	2.5N/	30KG x	250G

PATIENT PAIN THRESHOLD (ALGOMETER READINGS)

PATIENT NAME: ....

FILE NUMBER: ....

INTERN: ....

DATE: ....

Treatment 1	
Treatment 2	
Treatment 3	
Treatment 4	
Treatment 5	
Treatment 6	
Treatment 7	
Treatment 8	
Treatment 9	
Treatment 10	
Treatment 11	
Treatment 12	

AVERAGE OF ALL ALGOMETER READINGS: ....

OTHER INFORMATION: ....

....

ADDENDUM F:

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

CASE HISTORY

Patient:________________________________ Date:______________

Age:__________ Sex:_________ Occupation:____________________

Intern/Clinician:___________________ Signature:______________

Case History:

1. Source of History:
2. Chief Complaint:

3. Present Illness:
   Location
   Onset
   Duration
   Frequency
   Pain (character)
   Progression
   Aggrevating factors
   Relieving factors
   Assosiated signs & symptoms
   Previous occureneces
   Past treatment and outcome

4. Other complaints:

5. Past History:
   General health status
   Childhood illnesses
   Adult illnesses
   Psychiatric illnesses
   Accidents/ injuries
   Sugery
   Hospitalization

6. Current health status and life-style:
   Allergies
   Screening tests
   Environmental hazards
   Safety measures

Exercise and leisure
Sleep patterns
Diet
Current medication
Tobacco
Alcohol
Social drugs

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

8. Psychosocial history:
    Home situation
    Daily Life
    Important experiences
    Religious beliefs

9. Review of the systems:
    General
    Skin
    Head
    Neck
    Breasts
    Respiratory
    Cardiac
    Gastro-intestinal
    Urinary
    Genital
    Vascular
    Musculoskeletal
    Neurologic
    Haematologic
    Endocrine
    Psychiatric

ADDENDUM G:

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

Patient: ______________________________ Date: ____________

Intern/Clinician: __________________ Signature: ____________

VITAL SIGNS:

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:

Thoracic/ Lumbar spine: Flexion 90'
Extension 50'
Right Lateral Flexion 30'
Left Lateral Flexion 30'
Right Rotation 35'
Left Rotation 35'

ROM Diagram:

Flex

L. Rot R. Rot

L.Lat F. L.Lat F.

Ext

/ = pain-free limitation // = painful limitation

Romberg's sign
Scapula winging
Spasticity/ rigidity
Trendelenburg's sign

Half Squat
Muscle tone
Pronator drift

Gait:

rhythm
on heels
tandem

pendulousness
on toes

Shoulder:

skin
symmetry
ROM: glenohumoral
scapulo-thoracic
acromioclavicular
elbow
wrist

Chest measurement:

inspiration

expiration

Visual acuity

Breast examination:

Inspection:
skin
contour
arm overhead
leaning forward

size
nipples
hands on hips

Palpation:
axillary lymph nodes
supraclavicular

SEATED EXAMINATION:

Spinal posture

Head:

scalp
face

skull
skin

Eyes:

conjunctiva
eyebrows
lacrimal glands
alignment

sclera
eyelids
nasolacrimal duct
corneal reflex

ocular movement:

	L			R	
	III	IV	VI	III	IV	VI

visual fields
iris
red reflex
vessels
vitreous
lens

accommodation
pupils
optic disc
general background
macula

Ears:

auricle
drum
Weber test

ear canal
auditory acuity
Rinne test

Nose:

external
internal
- septum
- turbinates
- olfaction

Sinuses (frontal and maxillary):

tenderness
transillumination

Mouth and Pharynx:

lips
gums/ teeth
tongue:
- inspection
- taste

pharynx:
- inspection
- CN X

buccal mucosa
roof
- movement
- palpation

Neck:

posture
swelling
discolouration
ROM:

size
scars
hair line

Cervical spine:
Flexion 45'
Extension 55'
Right Lateral Flexion 40'
Left Lateral Flexion 40'
Right Rotation 70'
Left Rotation 70'

ROM Diagram:

Flex

L. Rot   R. Rot

L.Lat F.   L.Lat F.

Ext

/ = pain-free limitation   // = painful limitation

lymph nodes   trachea
thyroid   carotid arteries
CN V   CN VII
CN VIII   CN IX
CN XI

Temporomandibular Joint:

Inspection:
ROM   deviation
Palpation:
crepitus   tenderness

Neurological Examination:

Dermatomes:
C5   C6
C7   C8
T1
Tendon Reflexes:
biceps   triceps
brachioradialis
Myotomes:
C5   C6
C7   C8
T1
Co-ordination:
point-to-point
dysdiadochokinesia

Thorax:

Chest:
Inspection:
skin   shape
distress   effort
depth   rhythm
intercostal/ supraclavicular retraction
Palpation:
tenderness   masses
resp. expansion   tactile fremitus

Percussion:
- lungs
- kidney punch
- diaphragmatic excursion

Auscultation:
- breath sounds:
  - vesicular
  - bronchial
- adventitious sounds:
  - crackles
  - wheezes
- voice sounds:
  - bronchophony
  - egophony
  - whispered pectoriloquy

Cardiovascular:
- inspection:
- auscultation:
  - aortic
  - mitral
  - pulmonary
  - tricuspid
  - general
  - carotids
  - rear chest
- Allen's test

SUPINE EXAMINATION

JVP
PMI

Cardiovascular:

- inspection:
- auscultation:
  - aortic
  - mitral
  - pulmonary
  - tricuspid
  - general
  - carotids
  - lateral recumbent
- percussion:
- palpation:
  - RVI
  - apex
  - heart size

Respiratory excursion
Breast palpation

Abdomen:

- Inspection:
  - skin
  - umbilicus
  - contour
  - peristalsis
  - pulsations
  - hernias
- Auscultation:
  - bowel sounds
  - bruit
- Percussion:
  - general
  - liver
  - spleen
  - diaphragm

Palpation:

reflexes, cough
light, rebound tenderness
deep, liver
spleen, kidneys
aorta, intra-/retro-abdominal mass
shifting dullness, fluid wave

Acute Abdomen:

original site of pain, cough
tenderness, guarding
rebound tenderness, Rovsing's sign
psoas sig, obturator sign
cutaneous hyperaesthesia
PR, Murphy's sign

Male Genitals:

Inspection:

skin, prepuce
glans, meatus
nits/ lice, scrotum
inguinal bulge, femoral bulge

Palpation:

penis, testes
epididymis, inguinal canal
femoral canal, cremasteric reflex

Auscultation:

scrotal mass

Peripheral Vasculature:

Inspection:

skin, nail bed
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:
Plant Flex: 45′ Dorsiflex: 20′
Inversion: 30′ Eversion: 20′
Leg length:
actual L: ______ R: ______
apparent L: ______ R: ______

Neurological examination:

Dermatomes:
L1 L2
L3 L4
L5 S1
Myotomes:
hip flexion knee extension
ankle dorsiflexion plantar flexion
Tendon Reflexes:
patellar achilles
Plantar reflex

Rectal examination (PR):

Inspection:
sacrococcygeal and perianal areas
faeces after palpation
fistulas
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
fascial expression, affect
Speech and language:
quantity rate
volume fluency
rate (prn)
Mood
Thought processes
Memory and orientation:
orientation (time, place, person)
recent & remote memory
new learning ability
Higher cognitive functions:
information and vocabulary
abstract thinking

ADDENDUM H:

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

CERVICAL SPINE REGIONAL EXAMINATION

Patient:________________________________ Date:______________

Intern/ Clinician:________________________ Signature:___________

OBSERVATION:

Posture
Scars
Hair-line
Bony/ soft tissue

Swellings
Discolouration
Muscle spasm
Expression (face)

RANGE OF MOTION:

Flex: 45'
L/R Rot: 70'

Ext: 70'
L/R Lat Flex: 45'

Flex

L. Rot

R. Rot

L. Lat Flex

R. Lat Flex

Ext

KEY: / = painless limitation // = painful limitation

PALPATION:

Lymph nodes
Thyroid Gland
AC joint

Trachea
Clavicle
Scapula

ORTHOPAEDIC EXAMINATION:

Tenderness
Active Myofascial Trigger Points:

SCM
Scalenii
Posterior Cervical

Trapezius
Levator Scapulae
Supraspinatus

Doorbell sign	Cervical compression
Kemp's test	Lateral compression
Cervical distraction	Adson's test
Halstead's test	Costoclavicular test
Hyperabduction test	Eden's (traction) test
Shoulder abduction test	Shoulder depression test
Dizziness rotation test	Lhermitte's test
Brachial plexus tension	O'Donoghue's test

Remarks: ____________________

____

NEUROLOGICAL EXAMINATION:

Dermatomes:

C2	L: ______	R: ______	C3	L: ______	R: ______
C4	L: ______	R: ______	C5	L: ______	R: ______
C6	L: ______	R: ______	C7	L: ______	R: ______
C8	L: ______	R: ______	T1	L: ______	R: ______

Myotomes:

C1	L: ______	R: ______	C2	L: ______	R: ______
C3	L: ______	R: ______	C4	L: ______	R: ______
C5	L: ______	R: ______	C6	L: ______	R: ______
C7	L: ______	R: ______	C8	L: ______	R: ______
T1	L: ______	R: ______			

Reflexes:

C5 (biceps)	L: ______	R: ______
C6 (brachioradialis)	L: ______	R: ______
C7 (triceps)	L: ______	R: ______

VASCULAR EXAMINATION:

Blood Pressure: L: ____/____ R: ____/____

Carotids:
auscultation palpation

Subclavians:
auscultation palpation

WALLENBERG'S TEST L: ______ R: ______

Comments: ____________________

____

MOTION PALPATION:

C0	C1
C2	C3
C4	C5
C6	C7
T1	T2
T3	T4

ADDENDUM I:

PATIENT CONSENT FORM

Patient: ____

Intern/Clinician: ______________________ Signature: ______________

I, ____, give my informed consent to be examined, treated and/ or x-rayed at the Technikon Natal Chiropractic Day Clinic under the discretion of the intern/ resident, and will comply with the instructions stipulated by the intern/ resident pertaining to his/ her research project.

Signature: ____________________________

Date: _________________