

# THE RELATIVE EFFECTIVENESS OF TWO DIFFERENT APPROACHES TO ADJUST A FIXATED SEGMENT IN THE TREATMENT OF FACET SYNDROME IN THE CERVICAL SPINE

by

Karen Inez Cilliers

*Dissertation submitted to the Faculty of Health  
Services in the partial compliance  
with the requirements for the  
Master's Degree in Technology:  
Chiropractic,  
at Technikon Natal.*

*I, Karen Inez Cilliers,  
do hereby declare  
that this dissertation  
represents my own work  
in both conception  
and execution.*

---

Karen Inez Cilliers

27/11/96  
Date

*Approved for final submission*

---

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

27/11/1996  
Date

## DEDICATION

I would like to dedicate this work to my husband and best friend, Jacques. Thank you for all your love and support.

## ACKNOWLEDGEMENTS

I would personally like to thank the following people for their assistance:

Dr. A.G. Till for his inspiring dedication to the profession.

Dr. C. Penter for all his good advice when it came to supervising this study.

Mr Worku for his incredible patience and expertise in the performance of the statistical analysis.

The staff in the Technikon Natal library and radiography department.

Mrs Hilary Ralf for proof reading this document so well with all the merciless time constraints.

All the patients who participated in this study without whom this study would not have been possible.

My parents for all their love and support throughout the years. For sacrificing what could have been theirs for the sake of my future.

Finally, my wonderful saviour and best friend, Jesus Christ. If it had not been for His incredible encouragement and help, none of this would have been possible.

## ABSTRACT

The aim of this investigation was to determine the relative efficacy of two approaches to adjusting for facet syndrome in the cervical spine. It was hypothesised that by adjusting the top segment of a primary fixation in the direction of the restriction, as well as the bottom segment in the opposite direction, there would be a significantly greater improvement than by only adjusting the top segment of a primary fixation in the direction of restriction.

Thirty subjects, diagnosed as having cervical facet syndrome, were randomly divided into two treatment groups, each consisting of fifteen patients. The first treatment group received a single adjustment in the direction of the restriction only. The second treatment group had a bilateral adjustment: the top segment of the fixation in the direction of the restriction as well as the bottom segment in the opposite direction. Soft tissue therapy was used in both treatment groups as a pre-adjustment procedure.

The research project was carried out where both groups received a maximum of eight treatments over a minimum of four weeks. After a follow-up period of a month the patients were re-assessed. Measurements of the cervical spine ranges of motion with the CROM goniometer and the completion of the Numerical Rating Scale 101, CMCC Neck Disability Index and the McGill Short Form questionnaires were performed before the first, fourth and final treatments as well as at the month follow-up consultation.

The data were then analysed statistically, using a 95% confidence level. Analysis within each group was performed, using the Wilcoxin Signed Rank test and compared various readings. The reading taken before the first treatment was compared with the reading taken before the final treatment. The initial reading was then again compared with the reading taken at the month follow-up consultation.

Comparison of the results of both treatment groups was statistically evaluated, using the Mann-Whitney U-Test. The comparison was made using the readings of the first, fourth and final treatments, as well as the month follow-up. This was done for all measurement parameters.

The results indicated that the first treatment group achieved significant improvements with regard to right rotation at the final treatment and right lateral flexion at the month follow-up ( $p < 0.05$ ). The second treatment group achieved significant improvements in extension and right and left lateral flexion at the final treatment, as well as at the month follow-up ( $p < 0.05$ ). Right rotation was only significantly improved at the month follow-up consultation, whereas left rotation was only significantly improved at the final treatment ( $p < 0.05$ ). Both treatment groups had significant improvement in disability and pain intensity, at the final treatment and at the month follow-up consultation ( $p < 0.05$ ). The only statistically significant difference noted between the two treatment groups was at the month follow-up consultation for the forward flexion range of motion measurement ( $p < 0.05$ ).

From the results, it is apparent that both approaches to adjusting the cervical spine are effective in treating cervical facet syndrome. However, it appears that the

second method of treatment is more effective than the first. Future studies in this field are recommended to confirm or refute the results of this study.

**TABLE OF CONTENTS**

**CHAPTER ONE**

1.0 INTRODUCTION.....1

1.1 The problem and its setting.....1

1.2 The statement of the problem.....2

1.3 Hypotheses.....4

1.4 Significance of study.....5

**CHAPTER TWO**

2.0 REVIEW OF THE RELATED LITERATURE.....6

2.1 Prevalence and incidence of neck pain.....6

2.2 Efficacy and cost-effectiveness of chiropractic.....8

2.3 Anatomy of cervical spine facet joints.....10

2.4 Biomechanics of cervical spine rotation.....11

2.5 Facet syndrome.....13

2.6 Fixation complex.....14

2.7 Possible complications resulting from adjusting.....16

2.8 Effect of adjusting.....17

2.9 Opinion on segment choice and direction of thrust.....19

2.10 Conclusion.....21

## CHAPTER THREE

3.0 MATERIALS AND METHODS.....	23
3.1 Introduction.....	23
3.2 The data.....	23
3.3 Method of measurement.....	24
3.4 The location of the data.....	27
3.5 Study design.....	28
3.6 Statistical analysis.....	35

## CHAPTER FOUR

4.0 THE RESULTS.....	39
4.1 Introduction.....	39
4.2 The hypotheses.....	39
4.3 The analysed data.....	40
4.3.1. Non-parametric paired hypothesis tests.....	41
4.3.2. Non-parametric unpaired hypothesis tests.....	50
4.4 Age and gender of patients.....	58
4.5 Conclusion.....	61

## CHAPTER FIVE

5.0 DISCUSSION OF STUDY.....	62
5.1 Introduction.....	62
5.2 Intra-treatment comparison.....	63
5.2.1 The Objective Data.....	63



5.2.1.1 Cervical range of motion.....	63
5.2.2 The subjective Data.....	64
5.2.2.1 Questionnaires.....	64
5.3 Inter-treatment comparison.....	64
5.3.1 The Objective Data.....	64
5.3.1.1 Cervical Range of Motion.....	64
5.3.2 The subjective Data.....	66
5.3.2.1 Questionnaires.....	66
5.4 Discussion.....	66
5.5 Limitations of this study.....	67
5.6 Comparison of the results with other research.....	68

## CHAPTER SIX

6.0 RECOMMENDATIONS AND CONCLUSIONS.....	75
6.1 Recommendations.....	75
6.2 Conclusions.....	76
6.3 References.....	78
6.4 Addenda.....	87

## **LIST OF ADDENDA**

- A. CMCC Neck disability index.**
- B. Mc Gill pain questionnaire - short form.**
- C. Numerical Rating Scale 101.**
- D. CROM Procedure manual**
- E. Random Sampling Technique**
- F. Case history form.**
- G. Physical examination form.**
- H. Regional examination - cervical spine**
- I. Patient consent form.**

LIST OF TABLES

4.1 One sample analysis of flexion comparing tx1, tx3 and tx4 of Group  
1.....41

4.2 One sample analysis of flexion comparing tx1, tx3 and tx4 of Group  
2.....41

4.3 One sample analysis of extension comparing tx1, tx3 and tx4 of Group  
1.....42

4.4 One sample analysis of extension comparing tx1, tx3 and tx4 of Group  
2.....42

4.5 One sample analysis of right rotation comparing tx1, tx3 and tx4 of Group  
1.....43

4.6 One sample analysis of right rotation comparing tx1, tx3 and tx4 of Group  
2.....43

4.7 One sample analysis of left rotation comparing tx1, tx3 and tx4 of Group  
1.....44

4.8 One sample analysis of left rotation comparing tx1, tx3 and tx4 of Group  
2.....44

4.9 One sample analysis of right lateral flexion comparing tx1, tx3 and tx4 of  
Group 1.....45

4.10 One sample analysis of right lateral flexion comparing tx1, tx3 and tx4 of  
Group 2.....46

4.11	One sample analysis of left lateral flexion comparing tx1, tx3 and tx4 of Group 1.....	46
4.12	One sample analysis of left lateral flexion comparing tx1, tx3 and tx4 of Group 2.....	47
4.13	One sample analysis of CMCC Neck Disability Index comparing tx1, tx3 and tx4 of Group 1.....	47
4.14	One sample analysis of CMCC Neck Disability Index comparing tx1, tx3 and tx4 of Group 2.....	48
4.15	One sample analysis of Numerical Pain Rating Scale comparing tx1, tx3 and tx4 of Group 1.....	48
4.16	One sample analysis of Numerical Pain Rating Scale comparing tx1, tx3 and tx4 of Group 2.....	49
4.17	One sample analysis of McGill Short-Form Questionnaire comparing tx1, tx3 and tx4 of Group 1.....	49
4.18	One sample analysis of McGill Short-Form Questionnaire comparing tx1, tx3 and tx4 of Group 2.....	50
4.19	Two sample analyses of flexion measurements comparing both treatment groups.....	50
4.20	Two sample analyses of extension measurements comparing both treatment groups.....	51
4.21	Two sample analyses of right rotation measurements comparing both treatment groups.....	52
4.22	Two sample analyses of left rotation measurements comparing both treatment groups.....	52

4.23 Two sample analyses of right lateral flexion measurements comparing both treatment groups.....53

4.24 Two sample analyses of left lateral flexion measurements comparing both treatment groups.....54

4.25 Two sample analyses of CMCC Neck Disability measurements comparing both treatment groups.....56

4.26 Two sample analyses of Numerical Pain Rating Scale measurements comparing both treatment groups.....57

4.27 Two sample analyses of McGill Short-Form Questionnaire measurements comparing both treatment groups.....57

4.28 Prevalence of age.....58

4.29 Gender distribution.....58

**LIST OF FIGURES**

4.1 Comparison of the Increase in median measurements.....55

4.2 Most frequent levels of primary fixations -Group 1.....59

4.3 Most frequent levels of primary fixations -Group 2.....60

5.1 Comparison of improvement in rotation and lateral flexion in degrees with  
Howe et al's. (1983) study on cervical manipulation.....69

5.2 Comparison of Cassidy et al's. (1992) mean increase in range of motion  
after manipulation with increase in median measurements of this  
study.....71

5.3 Comparison of mean improvement in NRS 101 scores with study by  
Cassidy et al. (1992).....72

## LIST OF ABBREVIATIONS

Z = two-tailed probability of equalling or exceeding Z

(sig) = significance

ns = no significant difference in the medians

s = significant difference in the medians

tx1 = first consultation

tx2 = fourth consultation

tx3 = eighth consultation

tx4 = month follow-up consultation

Grp1 = treatment group 1

Grp2 = treatment group 2

If  $P = < 0.05$  = significant difference

If  $P = > 0.05$  = No significance

## DEFINITION OF TERMS

### Adjustment(Chiropractic)

A spinal adjustment is a passive, manual manoeuvre during which an articular element is suddenly carried beyond the usual, physiological limit of movement without however exceeding the boundaries of anatomical integrity. The usual, but not obligate, characteristic of an adjustment is the thrust which is a brief, sudden and carefully controlled minimal dose or impulse of force and amplitude delivered at the end of the normal passive range of movement and which can be accompanied by a cracking noise (Sandoz 1976).

### End Feel

The consistency which describes the resistance to further stretch which is encountered at the end of a joint's passive range of motion (Bryner 1987:18).

### Facet syndrome

Facet syndrome is characterised by the following symptoms and signs:

- pain over the affected joint;
- positive Kemp's test;
- joint dysfunction at the affected level;
- local tenderness;
- diminished spinal range of motion, especially extension

(Schaefer and Faye 1990:217 ; Haldeman 1992:207).



### Fixation

- 1) A state whereby a vertebra or pelvic bone has become temporarily immobilised in a position which it may normally occupy during any phase of physiological spinal movement (Bryner 1987:19).
- 2) The immobilisation of a vertebra in a position of movement when the spine is at rest, or in a position of rest when the spine is in movement (Bryner 1987:19).

### Vertebral motion segment

The consideration of the anatomical and functional relationships of two consecutive vertebrae, the mechanical integration of their articular processes, and the related musculature, ligaments and synovial membranes (Bryner 1987:38).

## CHAPTER ONE

### 1.0 INTRODUCTION

#### 1.1. The problem and its setting

Neck pain with some limitation of movement seems to be a common complaint. It affects 40-50% of the population at some time in their lives (Kelsey 1982:146).

Bland (1994:6) reports that working individuals between 25 and 29 years of age have a 25% to 30% incidence of one or more attacks of stiff neck. This figure rises to 50% for those over 45 years of age, and 45% of working men have had at least one attack.

Spinal adjustments have been shown to be effective in reducing cervical pain, headaches, and other spine-related syndromes (Haldeman 1992:421,423). In a pilot study done by Howe et al. (1983) it was reported that patients with pain in the neck, pain or paraesthesia in the shoulder and stiffness of the neck showed significant improvement in their symptoms after having had the cervical spine adjusted.

Manual therapy, in the form of spinal mobilisation and adjustment, has been shown to be more effective in improving physical functioning when compared with treatment by a general medical practitioner, physiotherapy, and placebo therapy for patients with chronic non-specific back and neck complaints (Koes et al. 1992). Using subgroup analysis, Koes et al. (1993) again reported that manual therapy was more

effective than physiotherapy in chronic patients.

Musculoskeletal injuries are responsible for the greatest number of employee injuries sustained in the workplace (Wiesel et al. 1992:1). Chiropractic treatment of work-related sprains and strains, including neck pain, has been shown to reduce the number of work days lost, as well as the amounts of disability compensation and provider cost, when compared with medical and osteopathic care for the same conditions (Johnson et al. 1989).

A literature review by Bergman (1993) revealed that very little has been written about techniques which are classified as manual force, mechanically-assisted articular chiropractic techniques that utilise either short-lever contacts or a combination of short- and long-lever contacts. Controlled prospective clinical trials to evaluate the relative efficacy of these techniques are non-existent.

## 1.2. The statement of the problem

The purpose of this study was to assess the relative efficacy of two adjustive techniques in the treatment of facet syndrome in the cervical spine in terms of the patient's perception of the pain intensity and disability, as well as the objective findings.

### 1.2.1. The first sub-problem

The first sub-problem was to evaluate the effects of adjusting the top segment of a fixation into the restriction of motion in terms of the patient's perception of the pain and disability, as well as the objective responses in order to determine the effectiveness of this approach in the treatment of facet syndrome in the cervical spine.

### 1.2.2. The second sub-problem

The second sub-problem was to evaluate the effects of adjusting the top segment of a fixation into the restriction of motion and adjusting the bottom segment in the opposite direction in terms of the patient's perception of the pain and disability, as well as the objective responses, in order to determine the effectiveness of this approach in the treatment of facet syndrome in the cervical spine.

### 1.2.3. The third sub-problem

The third sub-problem was to integrate the data of Sub-problems One and Two to establish the relative efficacy of those two treatment protocols in the management of cervical facet syndrome.

### 1.3 Hypotheses

#### 1.3.1 The first hypothesis

By adjusting the top segment of a fixation into the restriction of motion there will be a statistically significant difference in the subjective and objective clinical findings on analysis of the data, showing that this treatment protocol was effective.

#### 1.3.2 The second hypothesis

By adjusting the top segment of a fixation into the restriction of motion and adjusting the bottom segment in the opposite direction there will be a statistically significant difference in the subjective and objective clinical findings on analysis of the data, indicating that this treatment protocol was effective.

#### 1.3.3 The third hypothesis

On integration of the data of Treatment Group One with Treatment Group Two, there would be a statistically significant difference in the subjective and objective clinical findings, indicating that the second treatment protocol was more effective.

#### 1.4 Significance of study

Pain in the spinal column accompanied by movement limitation can lead to a great deal of frustration, especially if disablement and interference with free activity occurs, resulting in pain and consequently depression, together with loss of occupational effectiveness (Grieve 1989 :185).

Chiropractic has already been shown to be the most effective (Koes et al. 1993) and cost-effective (Johnson et al. 1989) means of treating neck pain. However, very little literature is available to show which form of chiropractic treatment is best (Bergman 1993). By evaluating the relative effectiveness of the two treatment protocols, valuable information was obtained from this study. This will allow for improved chiropractic treatment and therefore greater relief of pain and dysfunction associated with facet syndrome in the cervical spine.

A quicker recovery will shorten the patient's period of indisposition, thus facilitating a minimal loss in productivity at the workplace - an economic saving for the patient, place of employment and the government.

## CHAPTER TWO

### 2.0 REVIEW OF THE RELATED LITERATURE

#### 2.1 Prevalence and incidence of neck pain

About 40-50% of the population will have neck pain with some limitation of movement at some time in their lives (Kelsey 1982:146). Aryanpur and Ducker (1989:320) cite Lawrence (1969) as reporting that the prevalence of neck pain, with or without referral of pain into the upper extremities, during any given month, affects 10 % of the population.

Early epidemiological studies on neck pain were conducted by Hult (1954) who reports that the prevalence of neck pain in industrial and forest workers ranged from 35-71% , and 5,4% of the workers had experienced work loss as a result of neck pain. Bland (1994:3) and Porterfield & De Rosa (1995:2) agree with this.

As mentioned in chapter one, there is a 25-30% incidence of one or more attacks of neck pain in working individuals between 25 and 29 years of age (Bland 1994:6). For those over 45 years of age this figure rises to 50% , and 45% of working men have had at least one attack.

A study done by Lee et al. (1985) showed that 16% of the population suffered from arthritis, rheumatism or back, limb, or joint disorders. In 21% there was a limitation of activity with an average of 11 disability days per person per year. The majority

(53%) consulted general medical practitioners, but a substantial number (34%) consulted chiropractors.

In 1985 the British Arthritis and Rheumatism Council reported that rheumatic disease affects more or less 20 million people in the United Kingdom and is the greatest single cause of disability. About 6-8 million people are significantly affected by rheumatism. About 46% of rheumatic disease is found in the spine, the area most commonly involved being the lumbosacral region. The second most commonly involved area is the cervical spine (Grieve 1989:185,186). Surveys from various countries record the incidence of neck pain as ranging from 18% - 67% (Hagburg 1982).

In a comparative study done by six chiropractic colleges it was found that the main presenting problems were low back pain, followed by neck pain (Nyiendo et al. 1989). Bland (1994:6) states that cases of cervical spine pain occur only slightly less frequently than low back pain.

The most common symptoms treated by chiropractors are musculoskeletal and spinal pain. Most research into the effectiveness of manipulation and chiropractic care has looked at pain relief as a primary indicator of successful care (Haldeman 1992:165).



## 2.2 Efficacy and cost-effectiveness of chiropractic

Success rates have been reported in clinical series involving spinal adjustments for cervical pain, headache, and other spine-related syndromes. Since 1977 at least seven randomized clinical trials on cervical pain and/or headache have been conducted. In almost all the studies, spinal adjusting has been shown to be of some value (Haldeman 1992:421,423).

Adjusting the cervical spine has been shown to be beneficial in relieving the symptoms of pain in the neck, pain or paraesthesia in the shoulder and stiffness of the neck (Howe et al. 1983). There was a nearly significant improvement in those with pain/paraesthesia in the arm or hand. Movements in the adjusted group at one and three weeks were significantly better than before being adjusted, unlike the controls where there was no significant difference (Howe et al. 1983).

A blinded randomized clinical trial compared the effectiveness of manual therapy (which involved adjusting and mobilising the spine), physiotherapy, treatment by the general medical practitioner, and a placebo therapy for patients with chronic non-specific back and neck complaints. The results indicated that manual therapy had a faster and larger improvement in physical functioning compared to the other three therapies (Koes et al. 1992). Koes et al. (1993) used subgroup analysis to assess the relative efficacy of physiotherapy and manual therapy. The results indicated that manual therapy was more effective than physiotherapy in chronic pain patients.

There is relative agreement that adjusting the spine is a fairly safe therapeutic approach that in many cases offers more immediate relief than any other forms of conservative therapy (Haldeman 1992:420). This is confirmed by Gatterman (1990:399) who reports: "Compared with other forms of conservative treatment, adjusting brings faster relief of pain and improved function".

As mentioned before, the greatest number of employee injuries sustained in the workplace are musculoskeletal (Wiesel et al. 1992:1). In a study comparing chiropractic, medical and osteopathic care for work-related sprains and strains, including neck pain, Johnson et al. (1989) reported that "generally fewer work days were lost and lower amounts of disability compensation and provider cost paid when chiropractic care was included in the care pattern".

While chiropractic may be intensive at the onset, it can produce immediate therapeutic results. A number of studies have demonstrated that patients treated by chiropractic lose less time away from work than those treated by other disciplines (Gatterman 1990:400). In a study done by Stano (1993) it was found that chiropractic patients with common musculoskeletal disorders have substantially lower costs than patients treated by medical physicians.

Overcoming the patient's fear of activity, with a gradual return to recreational and work activities, enhances the quality of life and is invaluable. No amount of monetary compensation can make up for loss of function and fear of leading an inactive life (Gatterman 1990:401).

### 2.3 Anatomy of cervical spine facet joints

The neck is the most mobile section of the spine. It is in motion about 600 times an hour, 24 hours a day (Bland 1994:3). The cervical spine forms a long lever with the head, which is about 10% of the body weight (Gatterman 1990:205). The cervical spine is therefore very vulnerable as stability is compromised for the sake of mobility.

The facet joints of the cervical spine are formed by the paired articular processes of each vertebral motion segment. The surfaces of the joints are ovoid, being reciprocally concave and convex. The facet surfaces are lined with articular cartilage. The total surface area of these joints is about two-thirds of the articular area of the vertebral bodies, helping to share the load of the head (Grieve 1989:7).

The articular processes incline medially in the coronal plane and obliquely in the sagittal plane so that they are approximately 45 degrees to the vertical (Schafer 1987:328,329). The superior facets of the cervical vertebrae face posterior and superior, and the inferior facets face anterior and inferior (Porterfield and De Rosa 1995:89).

The superior and inferior articular processes form the articular pillar that is prominent at the junction of the pedicle and lamina. The cervical facet joints can be palpated as small 'domes' about 2 cm lateral to the spinous processes through the

overlying trapezius and cervical muscles (Porterfield and De Rosa 1995:89).

The capsular ligaments which bind the articular processes together are short, thick, and dense. Their fibres are firmly bound to the periosteum of the articular processes and are arranged at a 90 degree angle to the plane of the facet. This allows maximum laxity when the facets are in a position of rest. The posterior joint capsules are richly supplied with nociceptors and mechanoreceptors (Schafer 1987:329).

All the posterior joints contain meniscoids which are formed by tongue-like fringes of synovium which project into the joint space (Grieve 1989:7).

#### 2.4 Biomechanics of cervical spine rotation

The facet joints and the discs are the elements of the spine which are responsible for mobility. They each contribute to the degree and pattern of motion. The joint spaces form part of a circle with the instantaneous centre of motion as the midpoint (Sherk et al. 1989:33).

During rotation, the occipital condyles and the atlas initially move as one unit. Near the end of range of motion, the condyles rotate 8-10 degrees. C1 rotation occurs about the dens of C2, which acts as a pivot. Approximately 50% of total neck rotation occurs between the atlantoaxial joints (capable of 80-100 degrees rotation) before any rotation occurs elsewhere in the cervical spine. After the atlas rotates about 30 degrees on the dens, the body of the axis begins to rotate, followed by

progressively diminishing rotation in the rest of the cervical spine (Schafer 1878:317). Aside from the atlantoaxial articulation, the midcervical region displays the largest amount of rotation (Porterfield and De Rosa 1995:93).

In the cervical spine, C2 and caudal, rotation is coupled with lateral flexion because of the inclination of the facet joints. When left rotation of the head on the neck takes place, the inferior facets on the right side glide in an anterior and superior direction, whereas those on the left side of the column glide in a posterior and inferior direction. This causes the spinous process to rotate to the right and the right side of each vertebrae to elevate. It is this tilting which causes lateral bending (Haldeman 1992:142; Porterfield and De Rosa 1995:93).

The axis of rotation in the lower cervical spine is found anterior to the body of C3 and moves posteriorly in the lower cervicals, so that the axis of rotation for C7 lies in the anterior aspect of the centrum of C7 (Schafer 1987:333).

Spinal rotation is limited by the planes of the articular facets, the thickness of the intervertebral discs, and the resistance of the fibres of the anulus and the vertebral ligaments under torsion (Schafer and Faye 1990:87).

## 2.5 Facet syndrome

This syndrome is caused by rotational strain to both facet joints and anulus fibrosus. Dysfunction of the facet joints produces most of the symptoms, and treatment is mainly directed at these joints (Kirkaldy-Willis 1988:251). Impairment of movement of the joint is associated with the sensation of pain which in turn increases loss of function (Zohn 1988:22).

In upper cervical facet syndrome the pain radiates to the occiput, temporal area, and retro-orbital area (Bland 1994:287). The C2-3 pain pattern extends up to the head; the C3-4 pain pattern is over the region of the levator scapulae muscle yet not extending over the occiput; the C5-6 pattern extends over the superior aspect of the scapula above the level of the scapula spine; and the C6-7 level extends inferiorly toward the inferior angle of the scapula (Porterfield and DeRosa 1995:104).

There are no conclusive neurologic signs (Schafer and Faye 1990:217). Pain from an irritable facet joint may be detected by local tenderness over a facet, with confirmation by manoeuvres to 'pinch' or compress the facet joint as in Kemp's Test.

The area of tenderness is relatively circumscribed (Mayer et al. 1991:127).

Abnormal quality on resistance to motion; abnormal end feel of facet joint capsule; and reproduction of pain, either referred or local, when passive accessory movements are tested; are other clinical features of cervical facet syndrome (Jull et al. 1988). Favourable responses to manipulation over 7-10 days may confirm the diagnosis (Gatterman 1990:163; Kirkaldy-Willis 1988:209). Relief of pain by facet

joint injection is regarded as the distinguishing diagnostic test (Mayer et al. 1991:128).

## 2.6 Fixation complex

The characteristics of the manipulable lesion have been described by Haldeman (1992:459) to include 1) vertebral malposition, 2) abnormal vertebral motion, 3) abnormal joint play or end feel, 4) soft tissue abnormalities and 5) muscle contraction or imbalance.

A vertebral segment may be fixed, totally or partially, in its neutral position, or anywhere within its physiological range of motion. The earlier a fixation is corrected the less chance there is for chronic degeneration to set in and a greater change of mobility can be noticed after an adjustment according to Schafer (1987:278).

According to Gillet (1963), there are three stages of joint fixation, which begin with muscular hypertonicity, progresses to ligamentous shortening, and result in articular adhesions.

While the primary function of muscles is to produce movement, muscles can also restrict motion. Movement at the segmental level is produced by short intersegmental muscles, the interspinales, intertransversarii, rotatores, and deep fibres of the multifidus, which are all involuntary muscles. They appear to serve as vertebral motion segment stabilisers during spinal motion and have been implicated

by a number of authors as factors in spinal articular blockage (Sandoz 1981). Grice (1974) has demonstrated decreased muscle activity following manipulation, which supports this theory.

Korr (1975) attributes the intersegmental muscle spasms and fixation of joints to aberrant muscle-spindle activity. He concludes that the muscle spindle as the co-ordinator of muscle activity may increase or decrease muscle contraction.

Accordingly, if the vertebral attachments of the spinal muscles are approximated by unguarded movement and silence annulospiral receptor activity, the lack of input to the central nervous system then results in a turning up of the gamma-motorneuron 'gain', increasing the intensity of the muscle contraction, producing the muscle spasm. Due to this contraction, the vertebral attachments cannot resume their normal position, and the muscle spasm is perpetuated.

Other causes of joint fixation include: ligamentous shortening; articular adhesions; and intra-articular jamming. Ligamentous shortening occurs with chronic muscle hypertonicity, in which the adjacent vertebrae are pulled together. Fibrous adhesions may result from both trauma and immobilisation. Intra-articular jamming may be due to entrapped meniscoids, pinching of the synovial tissue due to redundancy of the capsule, hypertrophic villi, tabs of synovial tissue, and fibrous invaginations of the dorsal and ventral capsule. It is possible, in the case of meniscoid structures, that aberrant receptor feedback involving the arthrokinetic reflex produces muscle spasm, an additional theory on the mechanism of muscular fixation of a joint (Gatterman 1990:45,46).



Greenman (1989:61) explains the cause of joint hypomobility as a lack of congruency between the joint surfaces leading to an incorrect tracking mechanism causing a movement restriction. Another explanation to clarify movement restriction is that the physical and chemical properties of the synovial fluid and surfaces has changed, causing the opposing surfaces to become "sticky".

Unfortunately there is no single, conclusive theory to explain the phenomenon of the fixation complex, which manifests as joint dysfunction and pain.

## 2.7 Possible complications resulting from adjusting

Contra-indications to adjustive therapy include: inflammation/infection; severe degeneration; neoplasms; intoxication; osteoporosis; certain congenital malformations; trauma; and psychogenic disturbances. Complications occurring due to failure of recognition of contra-indications is more common than those due to poor application of an adjustment (Haldeman 1992:554,572).

Adjusting in the upper cervical region can cause a vertebrobasilar artery accident, which could be fatal, or at least debilitating. Some patients have recovered with no residual side-effects (Haldeman 1992:552).

A functional vascular test which can be used to screen for potential risk patients is the Wallenberg Test which involves holding the patient's head in rotation and extension. The patient must be observed for any signs and symptoms of brainstem

ischemia. It must always be kept in mind, however, that this test is not foolproof and can give false negatives (Haldeman 1992:592).

Other problems commonly seen after adjusting the upper cervical region include: transient vertigo; lightheadedness; nausea; dizziness; or loss of consciousness, which are all exceeding reactions (Haldeman 1992:572).

Complications in the lower cervical region often result from negligent or inadequate diagnostic measures and are most likely to occur when rotatory techniques are applied. This can result in herniated discs that cause nerve root entrapment or spinal cord compression (Haldeman 1992:572).

A review of the literature by Dabbs and Lauretti (1995) revealed that cervical manipulation is much safer than NSAIDs for the treatment of neck pain, by a factor of several hundred times. Although the relative efficacy of both treatment protocols has not been researched, there is no evidence to suggest that NSAID use is any more effective than cervical manipulation for neck pain.

## 2.8 Effect of adjusting

Adjustments have two uses: firstly, they are used for the relief of pain arising from joint dysfunction; secondly, they are used to restore the range of motion to a joint whose function is impaired (Mennell 1960:110).

An adjustment separates the articular surfaces which may release entrapped intra-articular structures such as synovial folds, menisci, or part of the capsule. It also stretches the segmental muscles, initiating spindle mediated reflexes that relieve the state of hypertonicity. In more chronic cases, manipulation might break intra-articular adhesions that have been observed in the posterior joints (Kirkaldy-Willis 1988:289; Cailliet 1988:129).

Golgi tendon end organs (GTO) may provide the mechanism whereby muscle spasm-producing joint fixation is relieved by manipulation. A high-velocity manipulative thrust performed at the extreme of the restricted joint's motion may stimulate the Golgi tendon organs causing reflex inhibition of muscle activity, thereby reducing muscle spasm (Sandoz 1981).

Another possible mechanism to explain the reduction in pain following a manipulative thrust could be that afferent input from the nociceptors (Type IV receptors) is inhibited by static and dynamic mechanoreceptors (Type 1 and 2 receptors). This inhibition may be a form of presynaptic inhibition. If stimulation of Type 1 and/or Type 2 receptors inhibits Type IV nociceptors, stretching of the apophyseal joint (as would occur in an adjustment) would reduce the nociceptive input at the anterolateral spinothalamic tract and thereby reduce pain (Wyke 1973). The report by Vernon et al. (1986) of a release of beta endorphins following spinal manipulation has indicated that this theory may be correct.

In a study done by Howe et al. (1983), there was a significant increase in cervical spine rotation after manipulation, which was maintained for three weeks as well as immediate improvement in lateral flexion that was not maintained.

A study done by Yeomans (1992) assessing cervical intersegmental mobility before and after adjustments, revealed that post-manipulative mobility is significantly greater than before manipulation.

A pilot study to determine the effect of manipulation on pain and range of motion in the cervical spine, showed a correlation between an increase in cervical rotation and a decrease in pain, which is clinically instructive (Cassidy et al. 1992).

Although there are many theories as to how manipulation achieves its effect, the general consensus is that the effect of manipulation at the appropriate level is to diminish pain, stiffness, and muscle spasm (Kenna and Murtagh 1989:47).

## 2.9 Opinion on segment choice and direction of thrust

According to Grieve (1989:642), the emphasis of the movement should be to the lower vertebra of the tight segment. Adjustments should be made to both sides, unless a technique with a bilateral effect is employed. In the case of asymmetrical restriction of movement, where the opposite movement is free, the techniques employed should free the restricted movement only. Grieve (1989:358) also specifically states that mobilisation or manipulation of the occipitoatlantal joint on

the painful side frequently relieves the signs and symptoms of traumatic occipitoatlantal 'block'.

Schneider et al. (1988:6) determine in which direction to adjust by first performing provocative tests. The adjustment is then performed in the direction in which pain and nociceptive reactions are diminished, i.e., in the pain-free direction.

This is confirmed by Kenna and Murtagh (1989:48). This generally means that manipulation causes a gapping or opening up of the painful side.

Greenman (1989:44,45) mentions two methods of adjusting: the Direct method and the Exaggeration method. In the Direct method the thrust is applied to the side of restricted movement to "move the restrictive barrier closer to the normal physiological barrier to active movement". In the Exaggeration method the thrust is applied in the direction opposite to the restriction of motion which is normally on the pain-free side.

In a study done by Nansel et al.<sup>1</sup> (1989) it was found that subjects which received lower cervical adjustments on the most restricted side had a dramatic reduction in asymmetry. When subjects were adjusted on the less restricted side the reduction in asymmetry was marginal.

According to Schafer and Faye (1990:56,126) once motion restrictions have been found, the joint should be adjusted with the force directed into the restriction of

movement. Since manipulative therapy introduces motion in the spine, it would be logical to apply it to the joint site where motion is limited (Schafer 1987:280).

An interesting point reported by Schafer and Faye (1990:230,56) is that restricted clockwise motion of the motion unit's superior process is the same as restricted counterclockwise motion of the inferior process, and vice versa, for facet motion is relative to the gliding positions of the articulating surfaces. Also, in any joint exhibiting a fixation, it is often necessary to adjust in more than one direction if more than one plane of motion is restricted or blocked.

Very little has been written about techniques which are classified as manual force, mechanically-assisted articular chiropractic techniques that utilise either short-lever contacts or a combination of short- and long-lever contacts. Controlled prospective clinical trials to evaluate the relative efficacy of these techniques are non-existent (Bergman 1993).

## 2.10 Conclusion

Neck pain with some limitation of movement seems to be a common complaint (Kelsey 1982:146). The neck is the most mobile section of the spine and is, therefore, very vulnerable to injury as stability is compromised for the sake of mobility (Bland 1994:3).

As can be seen from numerous studies, chiropractic is undoubtedly invaluable in the treatment of neck pain as it is both the most effective and cost effective means of treating neck pain (Howe et al. 1983; Johnson et al. 1989; Stano 1993; Manga et al. 1993:11; Koes et al. 1993; Tuchin et al. 1995; Stano & Smith 1996). Adjusting the cervical spine has even been shown to be much safer than the use of NSAIDs for neck pain (Dabbs & Lauretti 1995).

Numerous theories are available to explain the phenomenon of the spinal joint fixation and how an adjustment helps to relieve the patient's pain and also restore joint mobility. However, there is little evidence of any research concerning the relative effectiveness of different chiropractic adjustive techniques, especially in the cervical spine (Bergman 1993).

## **CHAPTER THREE**

### **3.0 MATERIALS AND METHODS**

#### **3.1 Introduction**

This chapter deals with the details of the research study undertaken. This includes the study design, the subjects used, and a detailed account of the interventions used. Measurements and observations obtained as well as statistical procedures for assessment of data are discussed.

#### **3.2 The data**

##### **3.2.1 The primary data**

###### **General Data:**

This consisted of observation findings of the patient and was collected once, before the first treatment, and included patient information (details of patient), the case history and physical examination, regional cervical examination, soap notes (used for clinical evaluation), and X-rays (used only to exclude other serious pathology, if suspected).



The subjective measurement parameters for this study:

The patient's perception of disability (CMCC Neck Disability Index);

The patient's perception of the sensory dimension of the pain (Mc Gill Pain Questionnaire - Short Form);

The patient's perception of the pain intensity (Numerical Rating Scale 101 Form).

The objective means of measurement used for this study:

The range of motion in the cervical spine as measured with a goniometer (CROM).

### 3.2.2. The secondary data

This consisted of the literature review. Documents were obtained that covered topics which consisted of previous studies similar to this one or studies which contained applicable information relating to this study.

### 3.3 Method of measurement

#### 3.3.1 CMCC Neck Disability Index (Addendum A)

This questionnaire indicates how the everyday life of the patient is affected by the neck pain that is experienced. The patient has to answer 10 questions. Each question scores a maximum of 5 and a minimum of 0. The total score is therefore

out of 50 and is represented as a percentage.

A study done by Vernon and Mior (1991) assessing the reliability and validity of the Neck Disability Index (NDI) showed that it achieved a high level of reliability and internal consistency. It also appeared to be sensitive to the levels of severity of complaint, and to changes in severity in the course of the treatment.

The NDI was found to be applicable to a wide age range, and was unaffected by gender. It was also found to have an acceptable level of validity (Vernon & Mior : 1991).

### **3.3.2 McGill Pain Questionnaire - Short Form (Addendum B)**

This questionnaire assesses the patient's perception of the sensory dimension of the pain. The short form was used to eliminate patient fatigue through having to fill out many forms for research purposes. The questionnaire consists of fifteen words which describe pain. Each description was ranked on an intensity scale of 0 = none, 1 = mild, 2 = moderate, 3 = severe (Melzack & Katz 1992:162).

The McGill Short Form Questionnaire correlates very highly with the sensory, affective, and total indices of the McGill Long Form Questionnaire. The McGill Short Form is sensitive to traditional clinical therapies and has been used in studies of chronic pain of diverse etiology (Melzack and Katz 1992:163). The McGill Short Form Questionnaire is one of the most widely used tests for the evaluation of pain

(Melzack 1987).

### **3.3.3 Numerical Pain Rating Scale (101 Scale) (Addendum C)**

This questionnaire assesses the patient's perception of the intensity of the pain. The patient is required to indicate by means of a percentage the intensity of the pain experience prior to a treatment when (i) it is at its worst, and (ii) when it is at its lowest. The average between these two figures indicates the average pain intensity that the patient is experiencing.

In a study comparing six methods of measuring clinical pain intensity it was found that the NRS 101 is the superior measure. It has practical advantages over the other measures. It is simple to administer and score, and can be used in a verbal or written form. It has limited response options and does not appear to be associated with incorrect responding more than any other scale. The scale also seems to be unaffected by age (Jenson et al. 1986).

### **3.3.4 Cervical Spine Range of Motion (addendum D)**

The range of motion in the cervical spine was measured with a Cervical Range of Motion goniometer (CROM). The six ranges of motion measured were forward flexion, extension, right and left rotation, and right and left lateral flexion. The amount of motion was measured in degrees.

A study comparing three methods of measuring cervical range of motion showed that the CROM device had good to high reliability when used on patients with orthopaedic disorders. When different physiotherapists measured the same patients the CROM device was found to be the most reliable testing instrument (Youdas et al. 1991).

### 3.4 The location of the data

The primary data were obtained before the first treatment, fourth treatment, last treatment, and at the follow-up consultation a month later.

The subjective primary data was obtained by means of the CMCC Neck Disability Index, McGill Pain Questionnaire - Short Form, and N.R.S. 101 Forms which were filled in, unaided, by the patients. The objective primary data were obtained by means of assessing the cervical spine ranges of motion using a goniometer.

The secondary data were obtained by using the facilities of the Technikon Natal library. This included keeping up to date by means of reading current journals, books and abstracts which related to the research topic.

### 3.5 Study design

#### 3.5.1 The allocation of the subjects

Advertising informed the public about this study at the Technikon Natal Chiropractic Day Clinic. The subjects were randomly selected from the population of patients attending the Technikon Natal Chiropractic Day Clinic, complaining of neck pain. These patients were examined to determine if the cause of their neck pain was cervical facet syndrome, and only those found otherwise fit were included in this study.

The patients were randomly divided, using the Random Sampling Technique (Addendum E) into the two treatment groups. Each group consisted of a minimum of 15 patients. The first treatment group was treated by adjusting the top segment of the fixation into the restriction of motion, and the second group was treated by adjusting the top segment of the fixation into the restriction of motion, as well as the bottom segment in the opposite direction.

#### 3.5.2 Patient screening procedure

Only patients older than 14 years and literate were considered for this study.

All patients had to go through the following procedure: a full case history (Addendum F); physical examination (Addendum G); and a full cervical regional

examination (Addendum H) to ensure the diagnosis of cervical facet syndrome. All chosen subjects had to give their informed consent (Addendum I).

Patients were treated for facet syndrome in the cervical spine, and any other myofascial pain dysfunction that co-existed that may have aggravated their cervical pain was not treated.

Any patients with an organic cause of cervical pain or who had had surgery to their cervical spine were not considered for this study (X-rays were taken only if an organic cause of cervical pain was suspected). Any patient who presented with a positive Wallenberg's test was not included in this study.

Patients were asked to refrain from taking any medication or other treatment that may have influenced the outcome of this study, eg, analgesics or physiotherapy. If the pain was so severe that analgesics had to be used, the patient was excluded from this study.

An audible release is not necessary for a satisfactory adjustment and patients remained in this study even when no audible releases were experienced (Sandoz, 1976).

If the data, at any time during this study, did not satisfy the criteria set forth, it was not included in the results and the patient was dismissed from this study.

### 3.5.3 Interventions

The primary data were collected before the first treatment, fourth treatment, last treatment, and at the month follow-up. The patient had to fill in the CMCC Neck Disability Index Questionnaire, the McGill Short Form Questionnaire, and the Numerical Rating Scale 101. The cervical spine ranges of motion were also measured at these consultations.

Each group received a maximum of eight treatments for no more than 4 weeks. A month after the last treatment each patient had a follow-up consultation.

The adjustive technique employed was the Diversified Technique. Only cervical rotary adjustments were used (index contact, thumb contact, bench TM, sitting cervical).

The techniques used are described as follows by Szaraz (1990:46;50;60;76) :

#### **I. Cervical Rotary - index contact**

This technique is indicated for rotatory type lesions, from atlas to C7. The patient is supine with the headpiece slightly elevated. The doctor squats at the head of the patient towards the side of the lesion. An index contact is taken with the contact hand against the articular process of the involved vertebra. The indifferent hand cups the patient's ear with the fingers hooked against the occipital rim to provide

rotation and cephalad traction. The segment, as well as the head and cervical spine are then rotated until the segment reaches restriction in motion. A sudden, short amplitude, pectoral thrust is given at the point of restriction in a rotary direction.

## **ii. Cervical Rotary - thumb extension**

This technique is indicated for rotary type lesions, from C1-C4. The patient is supine with the headpiece above the horizontal. The doctor squats at the side of the lesion facing cephalad. The cupped fingers of the indifferent hand are secured against the rim of the occiput, rotating the occiput and cervical spine. The palmer aspect of the the thumb of the contact hand is placed against the posterior arch of the atlas or posterior articular process of the involved vertebra. The fingers are spread wide and placed lightly against the patient's cheek. Traction is applied with the indifferent hand and fingers of the contact hand. The cervical spine is rotated until the thumb centres the force over the involved segment. The thrust is a single, short amplitude, high velocity pronator impulse with rotary action of the forearm of the contact hand, under traction.

## **iii. Thumb Move**

This technique is indicated for a rotary type lesion, from C6-T3. The patient is prone lying with the headpiece below the horizontal. The doctor takes a low Fencer's stance, on the side of the lesion, facing cephalad. The thumb of the contact hand contacts on the ipsilateral side of the spinous-lamina junction of the involved



vertebra. The arm of the contact hand is maintained as close to the horizontal as possible. The cupped indifferent hand, with the web secured against the rim of the occiput, fingers pointing cephalad resting against the temporal bone, rotate the occiput and cervical spine and provide sufficient traction. The patient's face is rotated away from the lesion side with the indifferent hand until rotation is felt under the contact hand. While the indifferent hand provides cephalad traction, the contact hand takes up joint slack in a rotatory plane using the spinous process as a lever. The line of drive is in a transverse plane. The thrust is a high velocity, single, pectoral, impulse type thrust, under traction. An alternate contact that can be used is the pisiform contact.

#### **iv. Sitting Cervical**

This technique is indicated for a rotary type lesion, from C2-C6. The patient sits unsupported. The doctor stands at the opposite side of the lesion, at the level of the patient's shoulder. The palmar aspect of the middle finger of the contact hand is placed over the posterior aspect of the TVP of the involved vertebra. This is done by reaching over in front of the patient. The contact hand is cupped with the adjacent digits reinforcing the contact finger and the thenar aspect of the hand resting against the patient's chin. The indifferent hand is placed with a web contact against the rim of the occiput to provide cephalad traction. The segment is rotated under traction. A single thrust is given in a rotary direction, under traction.

Both groups received a five minute massage, with oil, before the adjustment. This was done to loosen and relax the area prior to a more specific Chiropractic adjustment (Haldeman 1992 : 525).

The fixated segment was determined by using Kemp's test, motion palpation findings, and local tenderness.

In the case of more than one fixation in the cervical spine, only the primary fixation was adjusted (Schafer and Faye 1990:15).

Motion-based palpation of the cervical spine (lateral flexion) may not be a valid predictor of vertebral dysfunction (Nansel et al.<sup>2</sup> 1989). In this study, patients were only palpated for rotary fixations. However, because of the dubiousness of the validity of motion palpation, the primary tool used to assess for the most fixated segment was local tenderness.

Palpation for pain has been shown to be the only spinal assessment procedure to show consistent reliability in a number of studies (Boline et al. 1993). In a study done by Hubka and Phelan (1994) it was found that palpation for cervical spine tenderness is a highly reliable examination tool.

### 3.5.4 The specific treatment of each sub-problem

#### 3.5.4.1 The first sub-problem

The first sub-problem was to evaluate the effects of adjusting the top segment of a fixation into the restriction of motion, in terms of the patient's perception of the pain and disability as well as the objective responses in order to determine the effectiveness of this approach in the treatment of facet syndrome in the cervical spine.

#### 3.5.4.2 The second sub-problem

The second sub-problem was to evaluate the effects of adjusting the top segment of a fixation into the restriction of motion, as well as adjusting the bottom segment in the opposite direction, in terms of the patient's perception of the pain and disability as well as the objective responses in order to determine the effectiveness of this approach in the treatment of facet syndrome in the cervical spine.

#### 3.5.4.3 The third sub-problem

The third sub-problem was to integrate the data of Sub-problem One and Two in order to establish the relative efficacy of these two treatment protocols in the management of cervical facet syndrome.

### 3.6 Statistical analysis

#### 3.6.1 Treatment of the data

The subjective data were treated as follows:

- a) After the questionnaires were completed by the patients, they were checked to see that they were filled in correctly.
- b) The figures obtained from the three questionnaires were converted to percentages which were recorded separately for the two treatment groups.
- c) The data were then analysed statistically using a 95% confidence interval.

The objective data were treated as follows:

- a) The cervical spine ranges of motion, recorded in degrees, were recorded separately for the two treatment protocols.
- b) The data were then analysed statistically using a 95% confidence interval.

### 3.6.2 Statistical analysis of the data

#### 3.6.2.1 Non-Parametric paired hypothesis tests

##### The subjective data

The data of the questionnaires (recorded in percentages) were compared within each of the two treatment groups and analysed statistically, using the Wilcoxon Signed Rank Test.

The initial and the final treatment percentages, as well as the initial and month follow-up percentages were compared to assess if there was a significant subjective improvement within each treatment group.

##### The objective data

Each plane of cervical spine range of motion (measured in degrees) was compared within each of the two treatment groups and analysed statistically, using the Wilcoxon Signed Rank Test.

The initial and final treatment measurements, as well as the initial and month follow-up measurements were compared to assess if there was a significant objective improvement within each treatment group.

As the sample size of each treatment group was smaller than 30, the parametric paired t-test could not be used. The Wilcoxin Signed Rank Test was used as it has less restrictive assumptions and near equivalence in sensitivity to the parametric t-test (Siegel 1956:312).

#### 3.6.2.2 Non-Parametric unpaired hypothesis tests

##### The subjective data

The recordings (in percentages) for the initial, fourth, final, and month follow-up consultations were compared between the two treatment groups and analysed statistically, using the Mann-Whitney U-test.

##### The objective data

Each plane of cervical range of motion (measured in degrees) for the initial, fourth, final, and month follow-up consultations were compared between the two treatment groups and analysed statistically, using the Mann-Whitney U-Test.

Again, the sample sizes were too small to validate the use of the parametric unpaired t-test. As with the Wilcoxin Signed Rank Test, the Mann-Whitney U Test was used because of its less restrictive assumptions and near equivalence in sensitivity to the unpaired t-test (Siegel 1956:312).

All statistical analyses were performed on the "Statgraphics Plus" Version 6, supplied by Manugistics Incorporated.

## **CHAPTER FOUR**

### **4.0 THE RESULTS**

#### **4.1 Introduction**

The results discussed in this chapter deal with the subjective and objective findings of both treatment groups. The subjective data were obtained from the questionnaires discussed in Chapter Three. Cervical range of motion measurements were used to obtain the objective data.

Both the intra-treatment as well as the inter-treatment data were considered, and have been statistically analysed. The null and alternate hypotheses were either rejected or accepted, based on the statistical criteria for each measurement parameter.

Furthermore, demographic data obtained from the patients has also been obtained by analysing the age and gender distribution of both treatment groups. The most frequent levels of primary fixation of each treatment group have also been analysed.

#### **4.2 The Hypotheses**

The null hypothesis used for Sub-problems One and Two (stated in chapter 1) is the same for both treatment groups and is defined as follows:



**Ho:** There would be no statistical difference in the subjective and objective clinical findings on analysis of the data, showing that this treatment protocol was ineffective.

The hypothesis used for these sub-problems is again the same for both treatment groups and is defined as follows:

**Ha:** There would be a statistical difference in the subjective and objective clinical findings on analysis of the data, showing that this treatment protocol was effective.

In order to integrate the two sub-problems, a third hypothesis and a null hypothesis are required, and these are defined as given below:

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

**Ha:** There would be a statistical difference in the subjective and objective clinical findings on analysis of the inter-group data, showing that the two treatment protocols were not equally effective.

#### **4.3 The analysed data**

The data were statistically analysed at a 95% confidence interval.

4.3.1 Non-parametric paired hypothesis tests

4.3.1.1 Objective data - range of motion

FORWARD FLEXION

TABLE 4.1 One sample analysis of flexion comparing tx1, tx3 and tx4 of Group 1

	tx1 - tx3	tx1 - tx4
Z Value	0.789264	0.422676
P Value (sig)	0.394632 (ns)	0.211338 (ns)

The null hypothesis is accepted for Group 1, as there was no statistically significant difference between the first, final, and follow-up consultations, indicating that there was no significant improvement as a result of the treatment.

TABLE 4.2 One sample analysis of flexion comparing tx1, tx3 and tx4 of Group 2

	tx1 - tx3	tx1 - tx4
Z Value	0.181449	0.267256
P Value (sig)	0.0907245(ns)	0.133628 (ns)

There was no statistically significant difference between the first, final, and follow-up consultations and thus the null hypothesis is accepted for Group 2 indicating that there was no significant improvement as a result of the treatment at a 95%

confidence level.

EXTENSION

TABLE 4.3 One sample analysis of extension comparing tx1, tx3 and tx4 of Group 1

	tx1 - tx3	tx1 - tx4
Z Value	0.422676	0.301698
P Value (sig)	0.211338 (ns)	0.150849 (ns)

Once again, there was no statistically significant difference between the first, final, and follow-up consultations. The null hypothesis is therefore accepted for Group 1, indicating that there was no significant improvement as a result of the treatment.

TABLE 4.4 One sample analysis of extension comparing tx1, tx3 and tx4 of Group 2

	tx1 - tx3	tx1 - tx4
Z Value	0.00982331	0.0388669
P Value (sig)	0.0049116 (s)	0.0194334 (s)

The null hypothesis is rejected for Group 2 as there was a statistically significant difference between the consultations being evaluated. This finding indicates that there was improvement as a result of the treatment.

RIGHT ROTATION

TABLE 4.5 One sample analysis of right rotation comparing tx1, tx3 and tx4 of Group 1

	tx1 - tx3	tx1 - tx4
Z Value	0.0161569	0.181449
P Value (sig)	0.0080784 (s)	0.0907245(ns)

The null hypothesis is rejected for the first and final consultation, as there was a statistically significant difference, indicating that there was improvement as a result of the treatment. The null hypothesis was accepted for the first and follow-up consultation as there was no statistically significant difference, indicating no long term improvement as a result of the treatment.

TABLE 4.6 One sample analysis of right rotation comparing tx1, tx3 and tx4 of Group 2

	tx1 - tx3	tx1 - tx4
Z Value	0.121335	0.00982331
P Value (sig)	0.0606675(ns)	0.0049116(s)

For Group 2 the null hypothesis is accepted for the first and final consultation because of no statistically significant difference, indicating that the treatment resulted in no significant improvement. The null hypothesis is rejected for the first

and month follow-up consultation as there was a statistically significant difference, showing a long term improvement.

LEFT ROTATION

TABLE 4.7 One sample analysis of left rotation comparing tx1, tx3 and tx4 of Group 1

	tx1 - tx3	tx1 - tx4
Z Value	0.181449	1
P Value (sig)	0.0907245(ns)	0.5 (ns)

In Group 1 the null hypothesis is accepted for left rotation, as there was no statistically significant difference between the first, final, and follow-up consultations, indicating that there was no significant improvement due to the treatment.

TABLE 4.8 One sample analysis of left rotation comparing tx1, tx3 and tx4 of Group 2

	tx1 - tx3	tx1 - tx4
Z Value	0.0613685	0.181449
P Value (sig)	0.0306847(s)	0.0907245(ns)

The null hypothesis is rejected for Group 2 for the first and final consultation, as there was a significant difference, indicating an improvement as a result of the

treatment. The null hypothesis was accepted for the first and month follow-up consultation as a result of no statistically significant difference, indicating only short term improvement as a result of the treatment protocol used.

RIGHT LATERAL FLEXION

TABLE 4.9 One sample analysis of right lateral flexion comparing tx1, tx3 and tx4 of Group 1

	tx1 - tx3	tx1 - tx4
Z Value	0.789264	0.0158613
P Value (sig)	0.394632 (ns)	0.0079306(s)

For right lateral flexion the null hypothesis is accepted for the first and final consultation, as there was no significant difference, indicating no significant improvement. The null hypothesis is rejected for the first and month follow-up consultation, as there was a statistically significant difference in the measurements taken. This indicated that there was long-term improvement as a result of the single adjustment only.

TABLE 4.10 One Sample Analysis of right lateral flexion comparing tx1, tx3 and tx4 of Group 2

	tx1 - tx3	tx1 - tx4
Z Value	0.000512096	0.00194591
P Value (sig)	0.000256 (s)	0.0009729 (s)

The statistical analysis of the second treatment protocol resulted in the null hypothesis being rejected, as there was a significant difference between the consultations considered, indicating that there was improvement as a result of this approach.

LEFT LATERAL FLEXION

TABLE 4.11 One sample analysis of left lateral flexion comparing tx1, tx3 and tx4 of Group 1

	tx1 - tx3	tx1 - tx4
Z Value	0.422676	0.267256
P Value (sig)	0.211338 (ns)	0.133628 (ns)

Table 4.11 shows that the null hypothesis is accepted for this group, as there was no statistically significant difference in the left lateral flexion measurements between the first, final, and follow-up consultations, indicating that there was no significant improvement as a result of the treatment.

TABLE 4.12 One sample analysis of left lateral flexion comparing tx1, tx3 and tx4 of Group 2

	tx1 - tx3	tx1 - tx4
Z Value	0.0161569	0.00554577
P Value (sig)	0.0080784 (s)	0.0027728 (s)

The null hypothesis is rejected for the measurements taken for left lateral flexion in Group 2, as there was a statistically significant difference between the first, final, and follow-up consultations, indicating that there was improvement as a result of the treatment.

4.3.1.2 Subjective Data - Questionnaires

CMCC NECK DISABILITY INDEX

TABLE 4.13 One sample analysis of CMCC Neck Disability Index comparing tx1, tx3 and tx4 of Group 1

	tx1 - tx3	tx1 - tx4
Z Value	0.000512096	0.00328359
P Value (sig)	0.000256 (s)	0.0016417 (s)

The null hypothesis is rejected for Group 1, as there was a statistically significant difference between the first, final, and follow-up consultations, indicating that there



was improvement as a result of the treatment.

TABLE 4.14 One sample analysis of CMCC Neck Disability Index comparing tx1, tx3 and tx4 of Group 2

	tx1 - tx3	tx1 - tx4
Z Value	0.00328359	0.000512096
P Value (sig)	0.0016417 (s)	0.000256 (s)

As with Group 1 the null hypothesis is rejected, as there was a significant difference between the consultations, indicating an improvement as a result of the treatment.

NUMERICAL PAIN RATING SCALE

TABLE 4.15 One sample analysis of Numerical Pain Rating Scale comparing tx1, tx3 and tx4 of Group 1

	tx1 - tx3	tx1 - tx4
Z Value	0.000512096	0.00194591
P Value (sig)	0.000256 (s)	0.0009729 (s)

In the statistical analysis of the NRS 101 questionnaire the null hypothesis is rejected for this group, as there was a significant difference between the consultations considered, indicating that there was improvement as a result of this treatment protocol.

TABLE 4.16 One sample analysis of Numerical Pain Rating Scale comparing tx1, tx3 and tx4 of Group 2

	tx1 - tx3	tx1 - tx4
Z Value	0.00554577	0.000300669
P Value (sig)	0.00277 (s)	0.00015 (s)

In Table 4.16 the null hypothesis is rejected for the second group, because of a statistically significant difference between the first, final, and follow-up consultations, indicating that the treatment was effective in reducing the symptoms of cervical facet syndrome.

McGILL SHORT-FORM QUESTIONNAIRE

TABLE 4.17 One sample analysis of McGill Short-Form Questionnaire comparing tx1, tx3 and tx4 of Group 1

	tx1 - tx3	tx1 - tx4
Z Value	0.00328359	0.00194591
P Value (sig)	0.0016417 (s)	0.0009729 (s)

In the statistical analysis of this questionnaire for Group 1 the null hypothesis is rejected, because of a significant difference between the consultations, indicating an improvement.

TABLE 4.18 One sample analysis of McGill Short-Form Questionnaire comparing tx1, tx3 and tx4 of Group 2

	tx1 - tx3	tx1 - tx4
Z Value	0.000512096	0.000300669
P Value (sig)	0.0025604 (s)	0.0001503 (s)

For Group 2 the null hypothesis is rejected, as there was a statistically significant difference between the first, final, and follow-up consultations, once again indicating that there was improvement as a result of the treatment.

### 4.3.2 Non-parametric unpaired hypothesis tests

#### 4.3.2.1 Objective data - range of motion

#### FLEXION

TABLE 4.19 Two sample analyses of flexion measurements comparing both treatment groups

	tx1	tx2	tx3	tx4
Z value	0.170402	0.108939	0.176632	0.0549957
P value	0.085201 (ns)	0.0544695 (ns)	0.088316 (ns)	0.0274978 (s)

The null hypothesis is accepted for the first, fourth, and eighth consultations, as there was no significant difference between the groups, indicating that there was no statistical difference in the efficacy of the two treatment protocols. The null hypothesis is rejected for the follow-up consultation, as there was a significant difference between the groups, indicating a difference in the efficacy of the two treatment protocols.

### EXTENSION

TABLE 4.20 Two sample analyses of extension measurements  
comparing both treatment groups

	tx1	tx2	tx3	tx4
Z value	0.382564	0.723585	0.647689	0.288635
P value	0.191282 (ns)	0.3617925 (ns)	0.3238445 (ns)	0.1443175 (ns)

In this comparison of the two treatment groups the null hypothesis is accepted, as there was no statistically significant difference between the consultations considered for both groups. This indicated that both treatment protocols were equally effective.

RIGHT ROTATION

TABLE 4.21 Two sample analyses of right rotation measurements comparing both treatment groups

	tx1	tx2	tx3	tx4
Z value	0.404845	0.503764	0.21738	0.21935
P value	0.2024225 (ns)	0.251882 (ns)	0.10869 (ns)	0.109675 (ns)

Table 4.21 indicates that the null hypothesis is accepted for right rotation measurements, as there was no significant difference between the first, fourth, final, and follow-up consultations of both groups. This indicates that there was no statistically significant difference in the efficacy of the two treatment protocols.

LEFT ROTATION

TABLE 4.22 Two sample analyses of left rotation measurements comparing both treatment groups

	tx1	tx2	tx3	tx4
Z value	1	1	0.916954	0.413796
P value	0.5 (ns)	0.5 (ns)	0.458477 (ns)	0.206898 (ns)

As with right rotation the null hypothesis is accepted, as there was no significant difference between the consultations of both groups, indicating that there was no significant difference in the efficacy of the two treatment protocols.

RIGHT LATERAL FLEXION

TABLE 4.23 Two sample analyses of right lateral flexion measurements comparing both treatment groups

	tx1	tx2	tx3	tx4
Z value	0.327529	0.900313	0.478667	0.629328
P value	0.1637645 (ns)	0.4501565 (ns)	0.2393335 (ns)	0.314664 (ns)

The null hypothesis is accepted for right lateral flexion, as there was no significant difference between consultations of both groups. This result indicated that there was no difference in the efficacy of the two treatment protocols investigated in this study.

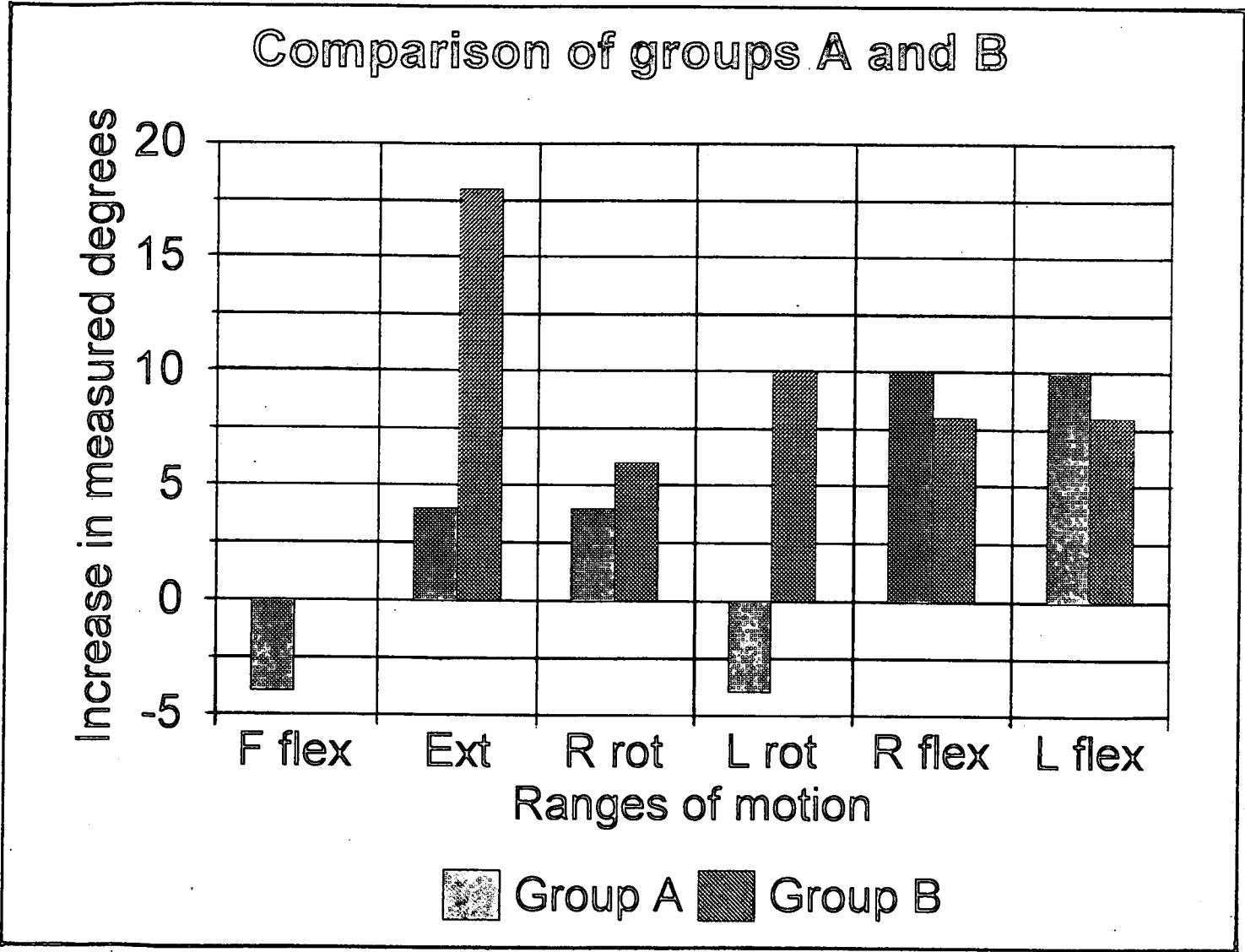
LEFT LATERAL FLEXION

TABLE 4.24 Two sample analyses of left lateral flexion measurements comparing both treatment groups

	tx1	tx2	tx3	tx4
Z value	0.755071	0.933256	0.441346	0.834719
P value	0.3775355 (ns)	0.466628 (ns)	0.220673 (ns)	0.4173595 (ns)

Once again, the null hypothesis is accepted, as there is no significant difference between the first, fourth, final, and month follow-up consultations of both groups. This fact indicated that there was no significant difference in the efficacy of the two treatment methods employed.

FIGURE 4.1 Comparison of the increase in median measurements





#### 4.3.2.2 Subjective data - questionnaires

##### CMCC NECK DISABILITY INDEX

TABLE 4.25 Two sample analyses of CMCC Neck Disability measurements  
comparing both treatment groups

	tx1	tx2	tx3	tx4
Z value	0.261261	0.601892	0.737127	0.983006
P value	0.1306305 (ns)	0.300946 (ns)	0.3685635 (ns)	0.491503 (ns)

When considering the first set of subjective data, the null hypothesis is accepted.

This can be concluded as there was no significant difference between the consultations of the two treatment groups, thus indicating no significant difference in the efficacy of both treatment protocols.

NUMERICAL PAIN RATING SCALE

TABLE 4.26 Two sample analyses of Numerical Pain Rating Scale measurements comparing both treatment groups

	tx1	tx2	tx3	tx4
Z value	0.404581	0.693028	0.917019	0.843725
P value	0.2022905 (ns)	0.346514 (ns)	0.4585095 (ns)	0.4218625 (ns)

As for the CMCC Neck Disability Index, the null hypothesis is accepted because of no statistically significant differences between the first, fourth, final, and follow-up consultations of both groups. This result indicated that there was no difference in the efficacy of the two treatment protocols.

McGILL SHORT-FORM QUESTIONNAIRE

TABLE 4.27 Two sample analyses of McGill Short-Form Questionnaire measurements comparing both treatment groups

	tx1	tx2	tx3	tx4
Z value	0.851881	0.394524	0.767228	0.311571
P value	0.4259405 (ns)	0.197262 (ns)	0.383614 (ns)	0.1557855 (ns)

In Table 4.27 the null hypothesis is accepted for the results of the McGill Short Form Questionnaire, as there was no significant difference between the consultations of the groups, thus indicating that both treatment protocols were equally effective.

4.4 Age and gender of patients

TABLE 4.28 Prevalence of age

AGE INTERVALS	TREATMENT GROUP 1	TREATMENT GROUP 2
10 - 19	1 (6.6%)	1 (6.6%)
20 - 29	7 (46.6%)	9 (60%)
30 - 39	3 (20%)	2 (13%)
40 - 49	2 (13%)	1 (6.6%)
50 - 59	1 (6.6%)	1 (6.6%)
60 - 69	0 (0%)	1 (6.6%)
70 - 79	1 (6.6%)	0 (0%)

The average age (mean) for Treatment Group 1 was 33. The average age (mean) for Treatment Group 2 was 29.3. The average age overall was 31.2.

TABLE 4.29 Gender distribution

GENDER	TREATMENT GROUP 1	TREATMENT GROUP 2
MALES	8 (53.3%)	4 (26.6%)
FEMALES	7 (46.6%)	11 (73.3%)

The overall male:female ratio was 2:3.

FIGURE 4.2 Most frequent levels of primary fixations -Group 1

## Group A

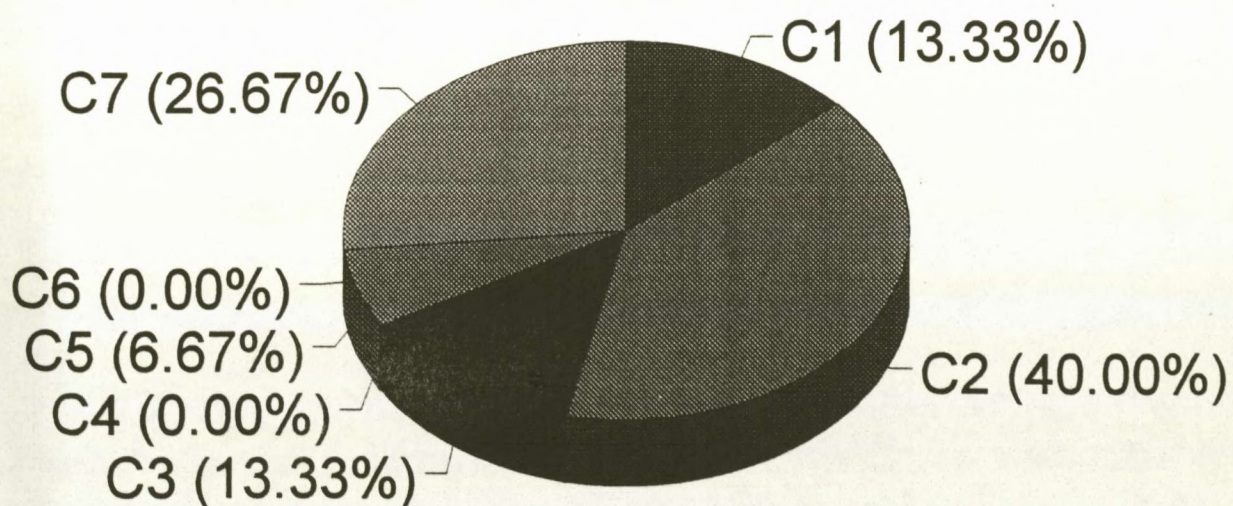
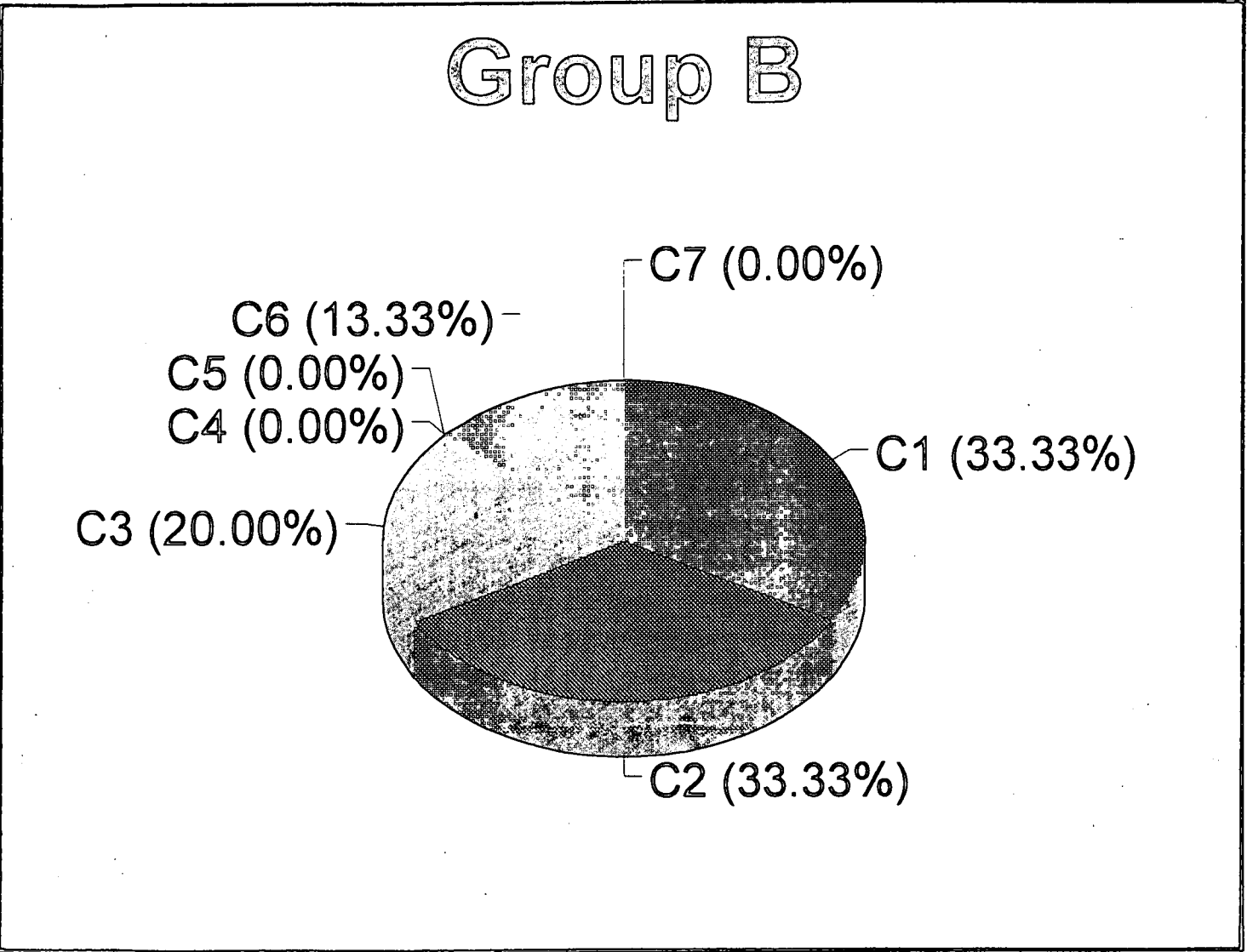


FIGURE 4.3 Most frequent levels of primary fixations -Group 2



#### 4.5 Conclusion

The results given in this chapter, which summarise the statistical analysis done on the data gathered in this study, show that a number of significant differences exist within each group. However, only one statistically significant difference can be found between the two treatment protocols, and occurred for the measurement taken in forward flexion.

Furthermore, the analysis done on the demographics of the two treatment groups showed that there was a reasonably similar spread in the age distribution. However, the gender distribution between the two groups differed considerably. The distribution of the levels of primary fixations were reasonably similar between the two groups for most levels.

## **CHAPTER FIVE**

### **5.0 DISCUSSION OF STUDY**

#### **5.1 Introduction**

This chapter involves the discussion of the results obtained from the range of motion readings and the questionnaires.

Firstly, the objective and subjective intra-treatment results are discussed to assess the efficacy of each treatment protocol in alleviating the signs and symptoms of cervical facet syndrome.

Secondly, the discussion studies the objective and subjective inter-treatment results.

This is to assess whether there is a significant difference in the two treatment protocols, thereby indicating which treatment protocol is more effective for the treatment of cervical facet syndrome.

## **5.2 Intra-treatment comparison**

### **5.2.1 The objective data**

#### **5.2.1.1 Cervical range of motion**

The first treatment group demonstrated no statistically significant differences in forward flexion, extension, left rotation, and left lateral flexion. However, a statistically significant difference was found for right rotation (Table 4.5) at the final treatment and right lateral flexion (Table 4.9) at the month follow-up, suggesting that there was a clinically significant improvement in these ranges of motion.

The second treatment group demonstrated a significant improvement in extension (Table 4.4), right rotation (Table 4.6) left rotation (Table 4.8), right lateral flexion (Table 4.10) and left lateral flexion (Table 4.12), indicating a clinically significant increase in almost all the ranges of motion. The significant improvement in extension and right and left lateral flexion was at the final treatment and month follow-up consultation. Right rotation was only significantly improved at the month follow-up consultation and left rotation only at the final treatment.

From these results it would appear that the second treatment group had a greater improvement in range of motion than the first treatment group.



## **5.2.2 The subjective data**

### **5.2.2.1 Questionnaires**

The statistical analysis for all three questionnaires used (CMCC Neck Disability Index (Addendum A), Numerical Rating Scale 101 (Addendum C), McGill Short Form (Addendum B)) revealed that both treatment groups demonstrated a statistically significant improvement from the first to the last treatment, and from the first treatment to the month follow-up consultation (Tables 4.13 - 4.18).

This suggests that patients from both treatment groups felt that their disability, as well as pain intensity and quality, were improving throughout the duration of the treatment as well as after a month of treatment.

## **5.3 Inter-treatment comparison**

### **5.3.1 The objective data**

#### **5.3.1.1 Cervical range of motion**

With extension (Table 4.20), right (Table 4.21) and left (Table 4.22) rotation, and right (Table 4.23) and left (Table 4.24) lateral flexion, there was no statistically significant difference between the two treatment groups. This indicates that both treatments were equally effective in treating cervical facet syndrome.

However, it was found that with forward flexion (Table 4.19) there was a statistically significant difference between the two treatment groups, but only at the month follow-up. This indicates that the two treatment protocols were not equally effective as far as increasing the forward flexion range of motion is concerned.

Possibly this could be explained as being due to a decrease in posterior cervical spine muscle spasm. The fact that the significant difference was only at the month follow-up could be due to the effect of the treatment protocol taking a while to set in.

However, it can be shown graphically (Fig 4.1) that the second treatment group responded with greater improvements in cervical range of motion than the first treatment group. This would indicate that the second approach (Group 2) of adjusting the primary fixation in the direction of restriction, as well as the level below in the opposite direction, is preferential to just adjusting the primary fixation in the direction of restriction only (Group 1).

One must be prudent when making this assumption, as only the forward flexion measurements were shown to be significantly different between the two treatment groups, and not the extension measurements as would be expected.

### **5.3.2 The subjective data**

#### **5.3.2.1 Questionnaires**

The statistical comparison of the initial, fourth, final, and month follow-up measurements revealed no significant difference between the two treatment groups, for all three questionnaires.

This indicates that at the onset both treatment groups experienced the same disability (CMCC Neck Disability Index - Addendum A), pain intensity (NRS 101 - Addendum C), and sensory dimension of their pain (McGill Short Form Questionnaire - Addendum B).

The fact that there was still no statistically significant difference at the fourth, final, as well as the month follow-up consultations, indicates that both treatment protocols were equally effective according to the subjective data.

### **5.4 Discussion**

It was hypothesised that both treatment groups would show favourable results in terms of the subjective and objective findings.

The results indicate that both treatment groups responded favourably to their respective treatment protocols and that each treatment method acted with

equivalent efficacy and that the rate of patient improvement was similar.

The first two hypotheses, which state that there would be an improvement as a result of each respective treatment protocol, are accepted. The third hypothesis, stating that there would be a difference in efficacy between the two treatment groups, is rejected for all data, except for the forward flexion range of motion measurement, for which the hypothesis must be accepted. This would indicate that the second treatment protocol was more effective than the first, in terms of range of motion in the forward flexion direction.

### 5.5 Limitations of this study

The objective measurements, in the form of the goniometer readings, may be subject to human error. This is a result of the fact that the callibrations are only in increments of two degrees, which may make the instrument insensitive to subtle changes in cervical motions. Added to this is the possible risk of incorrect user methods.

The subjective measurements, in the form of the three questionnaires, may also have had their limitations. The patient may have felt the need to please the researcher and record an improvement which was beyond that which was actually felt.

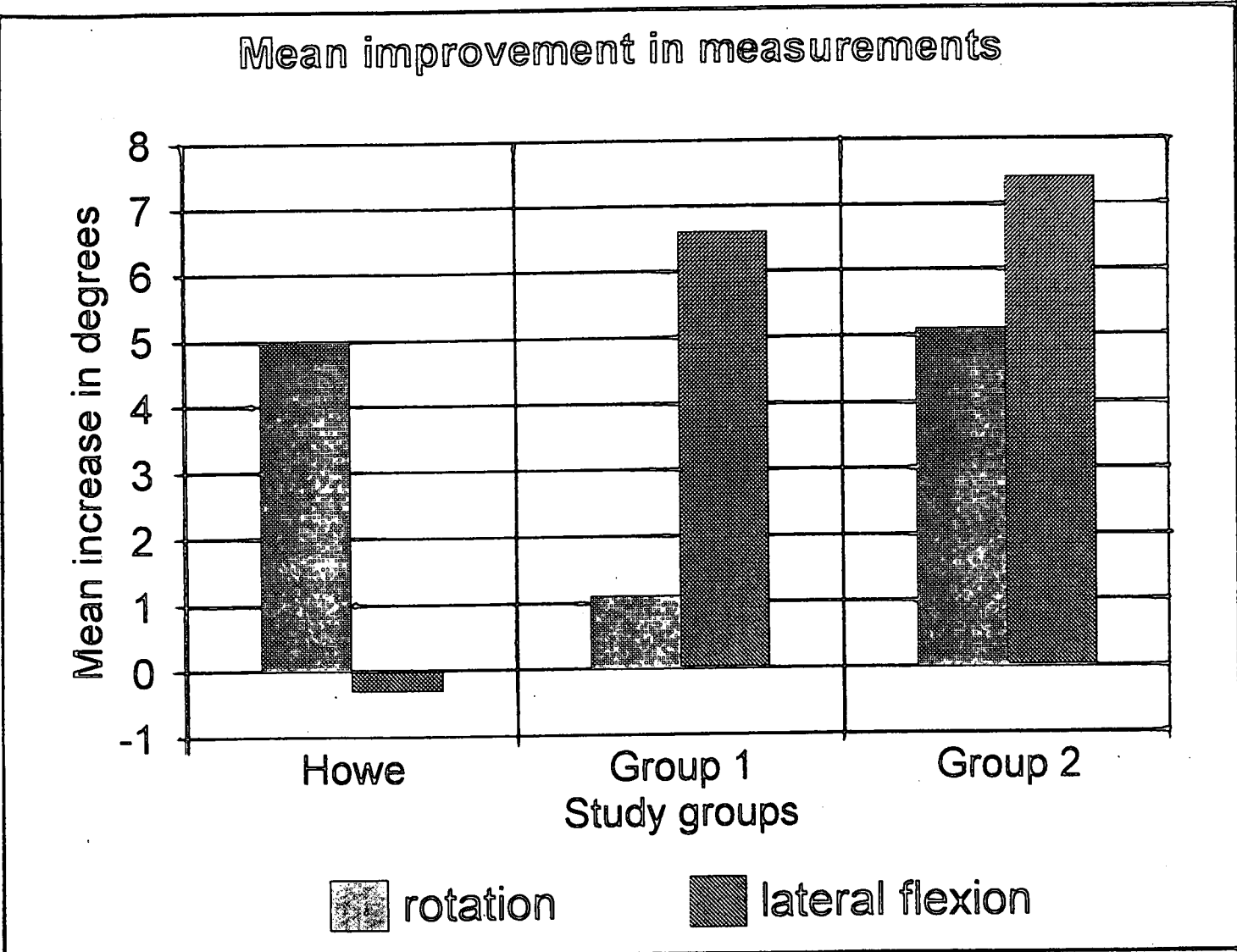
The gender distribution between the two treatment groups, particularly of male patients, could have been closer, which would have given more representative results. However, the male-to-female ratio within each group corresponds to the research done by Nyiendo et al. (1989).

Other weaknesses of this study include the sample size being too small, which could result in a Type 2 error (Bajpai et al. 1978 : 212). This is when the null hypothesis is accepted as true when it is actually false.

#### 5.6 Comparison of the results with other research

The results of a pilot study assessing the effectiveness of adjusting the cervical spine for minor disorders of the neck revealed that pain in the neck, pain or paraesthesia in the shoulder and stiffness of the neck were all improved significantly (Howe et al. 1983). The adjustments produced a highly significant immediate improvement in rotation and lateral flexion. The significant increase in cervical spine rotation was maintained for three weeks, unlike lateral flexion that was not maintained.

FIGURE 5.1 Comparison of improvement in rotation and lateral flexion in degrees with Howe et al's. (1983) study on cervical manipulation.



As can be seen from Fig. 5.1, there appears to be a greater improvement in the lateral flexion measurements of both Group One and Two of this research study, compared to those of the study conducted by Howe et al. (1983). However, the mean improvement in rotation seems to be similar for Group Two and the study by Howe et al. (1983), unlike Group One which appears to have a minimal increase.

A study done by Yeomans (1992), assessing cervical intersegmental mobility before and after adjustments, revealed that post-manipulative mobility is significantly greater (with the exception of the C1 segment) than before spinal manipulative therapy. The average frequency of spinal manipulative therapy was three per week, with the therapy continuing for as long as six months, and as short as three weeks.

In a pilot study by Cassidy et al. (1992) determining what effect adjusting the cervical spine has on pain and range of motion, a correlation between an increase in cervical rotation and a decrease in pain was found. The patients received a single rotary adjustment and there was no follow-up consultation. As the results of this study were not controlled, no conclusions can be made concerning the clinical efficacy of adjusting the cervical spine for neck pain.

FIGURE 5.2 Comparison of Cassidy et al's. (1992) mean increase in range of motion after manipulation with increase in median measurements of this study.

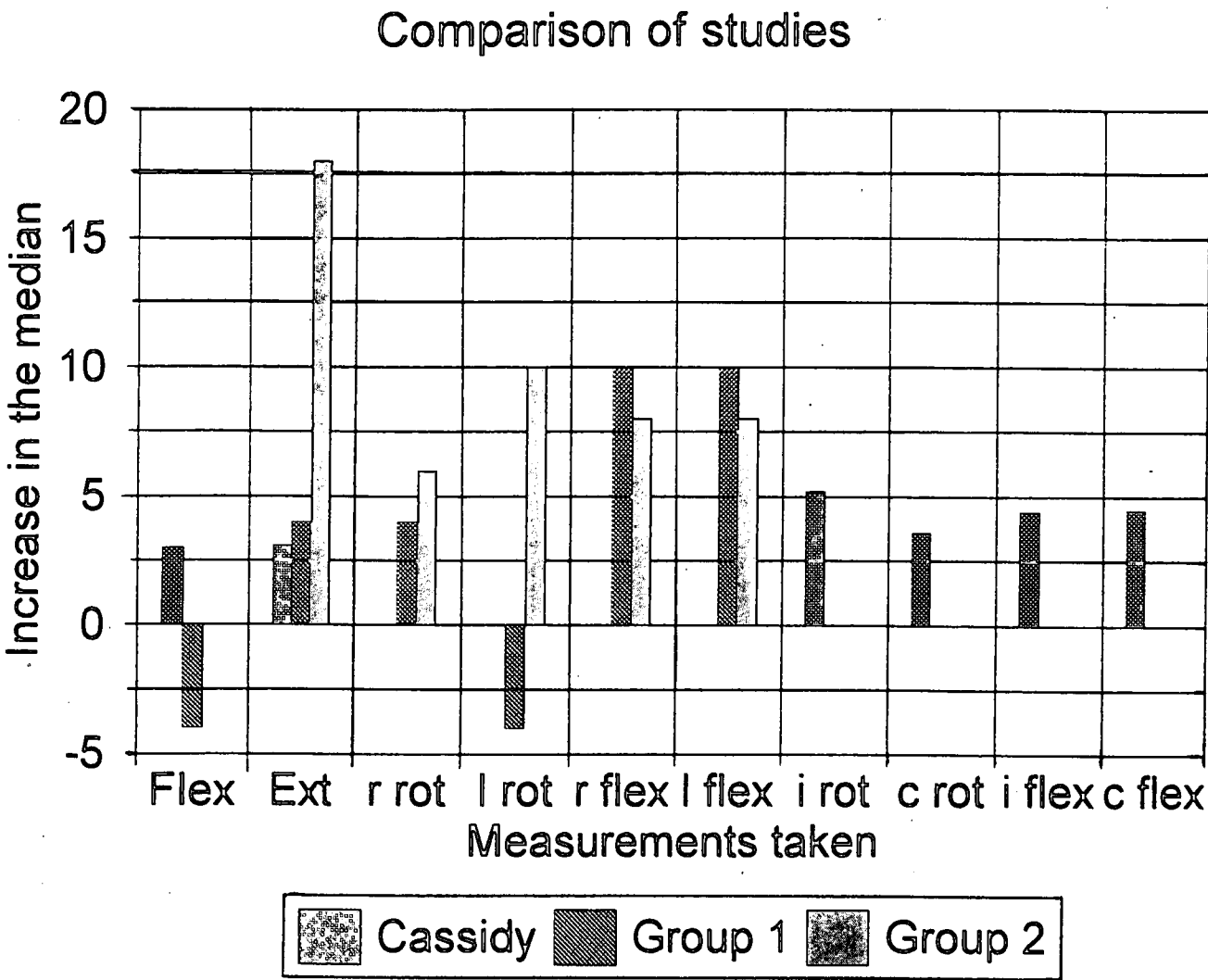
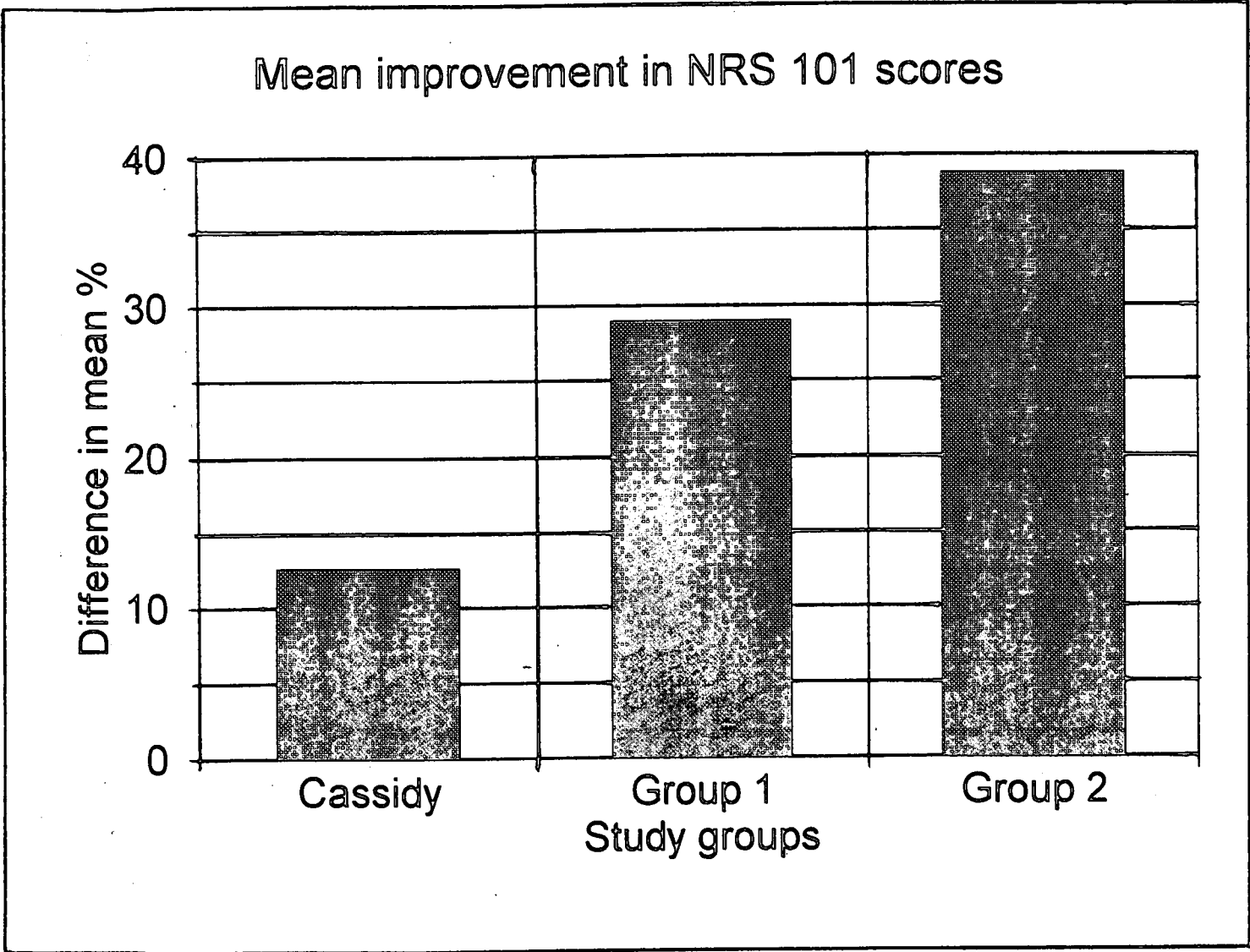




FIGURE 5.3 Comparison of mean improvement in NRS 101 scores with study by Cassidy et al. (1992).



The graph (Fig.5.2) comparing the increase in range of motion of this study with that of the study conducted by Cassidy et al. (1992), appears to be similar for right rotation. Group Two appears to have a greater improvement in extension and left rotation, unlike Group One which appears to be similar to Cassidy for extension. Group One and Two appear to be greater for lateral flexion, especially Group One. The only measurement for which Cassidy has a greater improvement is forward flexion.

The graph (Fig.5.3) comparing the mean improvement in the NRS 101 scores with those of Cassidy et al. (1992), seems to indicate that the patients in Group One experienced a greater improvement than those in Cassidy's study, and that Group Two experienced an even greater improvement than Group One.

Using physical functioning as a measurement modality, a blinded randomized clinical trial was done by Koes et al. (1992) comparing the effectiveness of manual therapy (adjusting and mobilising the spine), physiotherapy (exercises, massage, and physical therapy modalities), treatment by the general practitioner (medication and postural advice), and a placebo therapy (de-tuned ultrasound and shortwave diathermy). This was performed on patients with chronic non-specific back and neck complaints. All treatments were given for a maximum duration of three months. The results indicated that manual therapy had a faster and greater improvement compared to the other three therapies.

Koes et al. (1993) used sub-group analysis to assess the relative efficacy of physiotherapy and manual therapy in treating chronic patients with non-specific back and neck complaints, who had not received physiotherapy or manual therapy during the past two years. The results suggested that manual therapy was more effective than physiotherapy in treating these conditions.

The results of these studies cannot be compared directly with this research project as they all involved assessing the efficacy of spinal manipulative therapy for neck pain. The purpose of this project was to assess the relative efficacy of two approaches to adjusting the cervical spine.

What can be correlated is the fact that both treatment groups of this study, especially the second group, showed a significant improvement in cervical spine range of motion as a result of the treatment. The patients from both treatment groups also reported a significant improvement in pain intensity and quality of life. This confirms the above research studies, in that spinal manipulative therapy is an effective treatment protocol for neck pain.

## CHAPTER SIX

### 6.0 RECOMMENDATIONS AND CONCLUSIONS

#### 6.1 Recommendations

Future studies in which a comparison is to be made should use a random sampling technique which takes into account the patient's gender, age and, possibly, physique. In order to make the study more valid, other factors should also be more congruent. This would include factors such as the levels of dysfunction, the duration of the complaint, and the dismissal of subjects with other co-existing complaints.

An important factor to consider would be the sample size. With treatment groups of only 15, one could only consider this as a pilot study. For further studies in this regard, sample sizes of at least 30 would be recommended so that paired and unpaired t-tests could be performed. This would make a trend in results more apparent and sensitive to the subtle changes in data. With samples this size a statistical quality control test could also be performed.

Both treatment groups received a five-minute massage, with oil, by hand. A suggestion for further research purposes in this field is that the massage be done using a mechanical device for a fixed period of time, to ensure equal preparation of all patients to minimise any possible subjectivity influencing the results.

Relating to the great differences in anatomy and biomechanics in the upper and lower cervical spine, a study specific to each of these regions is also recommended. Other factors to consider would be to use only one form of adjustment, as there may be subtle differences in the rotary techniques which have not yet been revealed.

## 6.2 Conclusions

This study consisted of 30 patients who were randomly divided into two treatment groups of 15 each. All the patients were diagnosed as having cervical facet syndrome after providing an intensive medical history, and an orthopaedic examination was performed on them.

Both treatment groups were given eight treatments over a period of four weeks, with a month follow-up consultation.

The results show that there is a statistically significant improvement in both treatment groups, indicating that both treatment protocols are effective for the treatment of cervical facet syndrome. Both treatment groups were shown to be equally effective, except for the difference in median measurement of the forward flexion range of motion in which Treatment Group 2 was shown to have a significantly greater improvement at the month follow-up consultation.

Having a month follow-up consultation would indicate which treatment protocol has the longest "holding power", an important factor to consider when treating patients

for whatever condition. The author feels it was significant that the only statistically significant difference between the two treatment groups could be elicited at the month follow-up consultation.

The findings are significant in that patients who receive the second method of treatment could require fewer subsequent treatments, which would be both economically and therapeutically sound.

To conclude, the study successfully compared two approaches to adjusting facet syndrome in the cervical spine, and showed that some statistically significant differences do exist between the two treatment protocols.

### 6.3 REFERENCES

Aryanpur, J. and Ducker, T.B. 1989. Differential Diagnosis and Management of Cervical Spine Pain. In Tollison, C.D. (ed): Handbook of Chronic Pain Management. Baltimore : Williams & Wilkins pp 320-334.

Bajpai, A.C. Calus, I.M. Fairley, J.A. 1978. Statistical Methods For Engineers and Scientists. Chichester : John Wiley & Sons.

Bergmann, T.F. 1993. Manual Force, Mechanically Assisted Articular Chiropractic Technique Using Long and/or Short Lever Contacts. Journal of Manipulative and Physiological Therapeutics. 16 (1):33-36.

Bland, J.H. 1994. Disorders of the Cervical Spine - Diagnosis and Medical Management. 2nd ed. Philadelphia : W.B. Saunders Company.

Boline, P.D. Haas, M. Meyer, J.J. Kassak, K. Nelson, C. Keating, J.C. 1993. Interexaminer Reliability of Eight Evaluative Dimensions of Lumbar Segmental Abnormality : Part ii. Journal of Manipulative and Physiological Therapeutics. 16(6) : 363-374.

Bryner, P. 1987. Glossary of Chiropractic Terminology. 2nd ed. Victoria : Pit Press.

- Cassidy, J.D. Quon, J.A. Lafrance, L. Yong-Hing, K. 1992. The Effect of manipulation on Pain and Range of Motion in the Cervical Spine : A Pilot Study. Journal of Manipulative and Physiological Therapeutics. 15(8):495-500.
- Calliet, R. 1988. Low back Pain Syndrome. 4th ed. New York : F.A.Davis Company.
- Dabbs, V. and Lauretti, W.J. 1995. A Risk Assessment of Cervical Manipulation vs. NSAIDs for the Treatment of Neck Pain. Journal of Manipulative and Physiological Therapeutics. 18(8)530-536.
- Gatterman, M.I. 1990. Chiropractic Management of Spine related disorders. Baltimore,Md : Williams and Wilkins.
- Gillet, H. 1963. The Anatomy and Physiology of Spinal Fixations. J Natl Chiro Assoc. 33(12):22-24,63-66.
- Greenman, P.E. 1989. Principles of Manual Medicine. Baltimore: Williams & Wilkins.
- Grice, A.S. 1974. Muscle Tonus Change Following Manipulation. J Can Chiro Assoc. 18(4):29-31.



Grieve, G.P. 1989. Common Vertebral Joint Problems. 2nd ed. Hong Kong :  
Churchill Livingstone.

Hagberg, M. 1982. Work-Related Pain in Neck and Shoulder. Swedish Work  
Environment Fund Report. In Grieve, G.P. 1989. Common Vertebral Joint  
Problems. 2nd ed. Hong Kong : Churchill Livingstone.

Haldeman, S. 1992. Principles and Practice of Chiropractic. 2nd ed. Norwalk :  
Appleton and Lange.

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

Hubka, M.J. and Phelan, S.P. 1994. Interexaminer Reliability of Palpation for  
Cervical Spine Tenderness. Journal of Manipulative and Physiological  
Therapeutics. 17(9) : 591-595.

Hult, L. 1954. Cervical Dorsal and Lumbar Syndromes. Acta Orthop Scand Suppl.  
17 : 7-102.

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

Johnson, M.R. Schultz, M.K. Ferguson, A.C. 1989. A Comparison of Chiropractic, Medical and Osteopathic Care for Work-Related Sprains and Strains. Journal of Manipulative and Physiological Therapeutics. 12(5) 335-343.

Jull, G. Bogduk, N. Marsland, A. 1988. The Accuracy of Manual Diagnosis for Cervical Zygapophyseal Joint Pain Syndromes. M J Aust. 148:233-6.

Kelsey, J.L. 1982. Epidemiology of musculoskeletal Disorders. New York : Oxford University Press.

Kenna, C. and Murtagh, J. 1989. Back Pain and Spinal Manipulation - A Practical Guide. Sydney : Butterworths.

Kirkaldy-Willis, W.H. 1988. Managing Low Back Pain. 2nd ed. New York : Churchill Livingstone.

Koes, B.W. Bouter, L.M. Van Mameren, H. Essers, A.H.M. Verstegen, G.M.J.R.

Hofhuizen, D.M. Houben, J.P. Knipschild, P.G. 1992. A Blinded Randomized Clinical Trial of Manual Therapy and Physiotherapy for chronic Back and Neck Complaints : Physical Outcome Measures. Journal of Manipulative and Physiological Therapeutics. 15 (1) 16-23.

Koes, B.W. Bouter, L.M. Van Mameren, H. Essers, A.H.M. Verstegen, G.M.J.R.

Hofhuizen, D.M. Houben, J.P. Knipschild, P.G. 1993. A Randomized Clinical Trial of Manual Therapy and Physiotherapy for Persistent Back and Neck Complaints : Subgroup Analysis and Relationship Between Outcome Measures. Journal of Manipulative and Physiological Therapeutics. 16 (4) 211-219.

Korr, I.M. 1975. Proprioceptors and Somatic Dysfunction. J Am Osteopathic Assoc. 74:638-50.

Lawrence, J. 1969. Disc Degeneration, its frequency and Relationship to Symptoms. Ann Rheum Dis. 28:121.

Lee, P. Helewa, A. Smythe, H.A. Bombardier, C. Goldsmith, C.H. Epidemiology of Musculoskeletal Disorders (Complaints) and Related Disability in Canada. J Rheumatol. 1985; 12(6) : 1169-73.

Mayer, T.G., Mooney, V., Gatchel, R.J. 1991. Contemporary Conservative care for Painful Spinal Disorders. Philadelphia : Lea and Febiger.

Melzack, K.R. 1987. The Short Form McGill Pain Questionnaire. Pain. 30:191-197.

Melzack, R. and Katz, J. 1992. Handbook of Pain Assessment. The McGill Questionnaire : Appraisal and Current Status. Ed by Turk, D.C. Melzack, R. New York : the Guilford Press.

Mennell, J. 1960. Back Pain - Diagnosis and Treatment Using Manipulative Techniques. Boston : Little, Brown & Co.

<sup>1</sup>Nansel, D.D. Cremata, E. Carlson, J. Szlazak, M. 1989. Effect of Unilateral Spinal Adjustments on Goniometrically-Assessed Cervical Lateral-Flexion End-Range Asymmetries in Otherwise Asymptomatic Subjects. Journal of Manipulative and Physiological Therapeutics. 12(6) : 419-427.

<sup>2</sup>Nansel, D.D. Peneff, A.L. Jansen, R.D. Cooperstein, R. 1989. Interexaminer Concordance in Detecting Joint-Play Asymmetries in the Cervical Spines of Otherwise Asymptomatic Subjects. Journal of Manipulative and Physiological Therapeutics. 12 (6) : 428-433.

Nyiendo, J. Phillips, R.B. Meeker, W.C. Konsler, G. Jansen, R. Menon, M. 1989. A Comparison of Patients and Patient Complaints at Six Chiropractic College Teaching Clinics. Journal of Manipulative and Physiological Therapeutics. 12(2) : 79-85.

Porterfield, J.A. and De Rosa, C. 1995. Mechanical Neck Pain Perspective in Functional Anatomy. Philadelphia : W.B. Saunders Company.

- Sandoz, R. 1976. Some Physical Mechanisms and Effects of Spinal adjustments. Annals of the Swiss Chiropractor's Association. vi:91-102.
- Sandoz, R. 1981. Some Reflex Phenomena Associated with Spinal Derangements and Adjustments. Annals of the Swiss Chiropractors' Association. 7:45-65.
- Schafer, R.C. 1987. Clinical Biomechanics - Musculoskeletal Actions and Reactions. 2nd ed. Baltimore : Williams and Wilkins.
- Schafer, R.C. and Faye, L.J. 1990. Motion Palpation and Chiropractic Technic - Principles of Dynamic Chiropractic. Huntington Beach, CA : The Motion Palpation Institute.
- Schneider, W., Dvorak, J., Dvorak, V., Tritschler, T. 1988. Manual Medicine Therapy. Stuttgart : Thieme.  
Translated from German : Manuelle Medizin - Therapie.
- Sherk, H.H. Dunn, E.J. Eismont, F.J. Fielding, J.W. Long, D.M. Ono, K. Penning, L. Raynor, R. 1989. The Cervical Spine. 2nd ed. Philadelphia : J.B. Lippincott Company.
- Siegel, S. 1956. Non-Parametric Statistics for the Behavioral Science. New York : McGraw-Hill Book Company Incorporated.

Stano, M. 1993. A Comparison of Health Care Costs for Chiropractic and Medical Patients. Journal of Manipulative and Physiological Therapeutics. 16 (5) 291-299.

Szaraz, Z.T. 1990. Compendium of Chiropractic Technique. Toronto : Technical Publications.

Vernon, H.T. Dhami, M.S.I. Howley, T.P. Annett, R. 1986. Spinal Manipulation and Beta-endorphin : a Controlled Study of the Effect of a Spinal Manipulation on Plasma Beta-endorphin Levels in Normal Males. Journal of Manipulative and Physiological Therapeutics. 92:115-123.

Vernon, H. and Mior, S. 1991. The Neck Disability Index : A Study of Reliability and Validity. Journal of Manipulative and Physiologic Therapy. 14 : 409-415.

Wiesel, S. Boden, S. Borenstein, D. Feffer, H. 1992. Neck Pain. 2nd ed. Charlottesville : The Michie Company.

Wyke, B.D. 1973. Articular Neurology : a Review. Physiotherapy. 58:94-100.

Yeomans, S.G. 1992. The Assessment of Cervical Intersegmental Mobility before and after Spinal Manipulative therapy. Journal of Manipulative and Physiological Therapeutics. 15(2) 106-114.

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

Zohn, A.Z. 1988. Musculoskeletal Pain, Diagnosis and Physical Treatment.  
Boston : Little, Brown and Co.

# ADDENDUM A

## 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 your 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.

Copyright Vernon/ Hagiae 1987, modified from Fairbanks et.al. Physiotherapy. 1980.

# ADDENDUM B

## SHORT-FORM MCGILL PAIN QUESTIONNAIRE (SF-MPQ) RONALD MELZACK

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

DATE \_\_\_\_\_

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

## ADDENDUM C

### NUMERICAL RATING SCALE

Please indicate on the line below the number between 0 and 100 that best describes the pain of your major problem at this point, 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.

0 \_\_\_\_\_ 100

Please indicate on the line below, the number between 0 and 100 that best describes the pain of your major problem at this point, 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.

0 \_\_\_\_\_ 100

**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 an acceptable means of measurement, existing devices were evaluated and the following design criteria established:

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

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

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

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

- CROM Instrument, including the rotation arm and the forward head arm
- magnetic yoke
- vertebra locator
- tape measure
- recording sheets
- procedure manual



The **CROM Instrument** is aligned on the nose bridge and ears and is fastened to the head by a velcro strap (see figure 1).

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

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

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



Figure 1: CROM with rotation arm and magnetic yoke

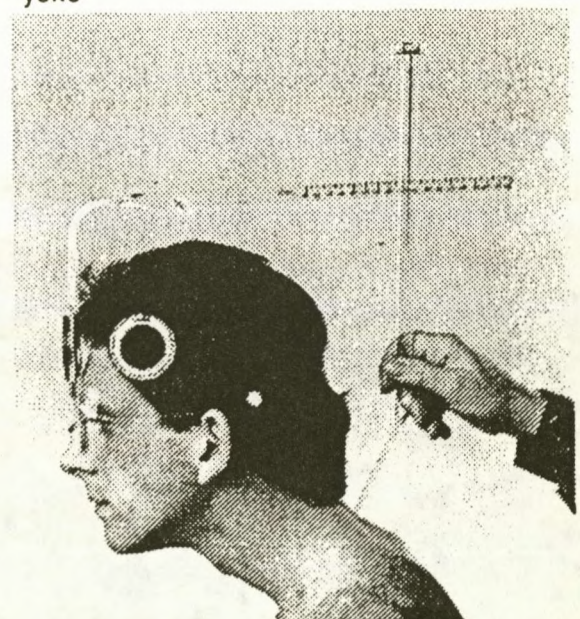


Figure 2: CROM with forward head arm and vertebra locator



## Suboccipital Flexion and Extension

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



Figure 3: Resting posture

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



Figure 4: Flexion

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



Figure 5: Extension

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



## Cervical Flexion and Extension

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

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



Figure 6: Cervical flexion

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



Figure 7: Cervical extension



## Lateral Flexion

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

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



Figure 8: Left lateral flexion

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



Figure 9: Right lateral flexion



## Rotation

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

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

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

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

\*You can find magnetic (map) north by noting the direction of the red needle on the rotation meter when it is at least four feet from the magnetic yoke. 6

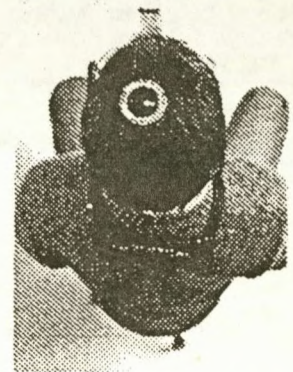


Figure 10: Magnetic yoke pointing north



Figure 11: Left rotation



Figure 12: Right rotation



## Forward Head

Instruct the subject to sit erect in a straight-back chair with the sacrum against the back of the chair, the thoracic spine away from the back of the chair, arms hanging at side and feet flat on the floor. You will need to use the CROM instrument plus the forward head arm and the vertebra locator for this measurement, but not the magnetic yoke nor the rotation arm.

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

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

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

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

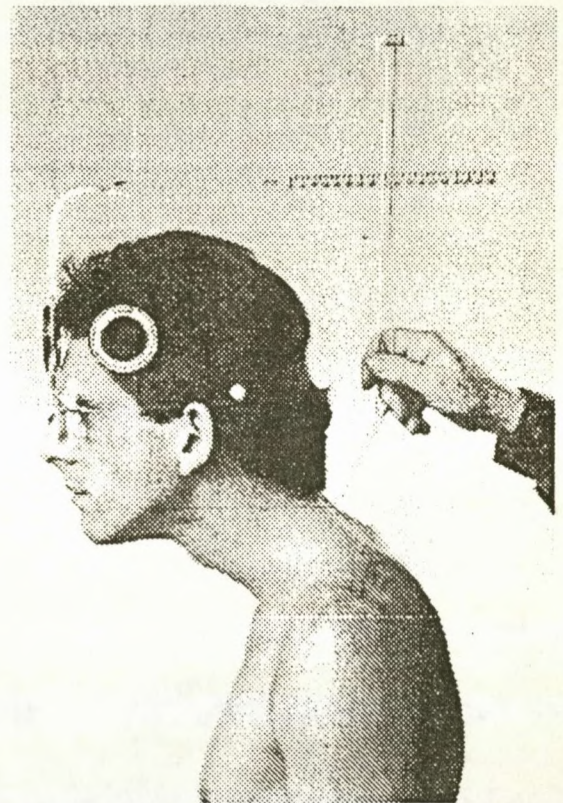


Figure 13: CROM with forward head arm and vertebra locator

## CROM Recording Sheet

Name: \_\_\_\_\_ Date of Initial Evaluation: \_\_\_\_\_  
 Facility: \_\_\_\_\_ Examiner: \_\_\_\_\_

### DATES

--	--	--	--	--	--	--	--

### MEASUREMENTS

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						

## ADDENDUM E

### RANDOM SAMPLING METHOD

As taught by Mr. K. Reich, statistician.

1. Consider the patients satisfying the delimitations of the study.
2. Suppose we choose blocks of size 4.
3. Then divide the patients into blocks of 4 which have 2A (Treatment Group 1) and 2B (Treatment Group 2).
4. For blocks of size 4 there are  $(4+2) = 6$  blocks, namely:
  - 1 - AABB
  - 2 - ABAB
  - 3 - ABBA
  - 4 - BBAA
  - 5 - BAAB
  - 6 - BABA
5. Then choose a sequence of random numbers between 1 and 6 (use a dice)  
The results results were: 6 (BABA), 3 (ABBA), 4 (BBAA), 2 (ABAB), 3 (ABBA), 1 (AABB), 2 (ABAB), 4 (BABA).
6. This leads to the allocation:

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

# ADDENDUM F

## TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

### CASE HISTORY

Patient: \_\_\_\_\_ Date # \_\_\_\_\_  
File #: \_\_\_\_\_  
X-ray #: \_\_\_\_\_  
Age: \_\_\_\_\_ Sex: \_\_\_\_\_ Occupation: \_\_\_\_\_  
Intern: \_\_\_\_\_ Signature: \_\_\_\_\_

### FOR CLINICIAN'S USE ONLY

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

### Case History:

#### Examination:

Previous: TN  
Other

Current: TN  
Other

#### X-ray Studies:

Previous: TN  
Other

Current: TN  
Other

#### Clinical path. lab.:

Previous: TN  
Other

Current: TN  
Other

#### Case status:

PTT: Conditional: Signed off: Final sign out:

### Recommendations:

History and Physical

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

3. Present illness:

Location

Onset

Duration

Frequency

Pain (character)

Progression

Aggravating factors

Relieving factors

Associated S & S

Previous occurrences

Past treatment and outcome



4. Other complaints:

5. Past history:

General health status

Childhood illnesses

Adult illnesses

Psychiatric illnesses

Accidents/injuries

Surgery

Hospitalizations

6. Current health status and life-style:  
Allergies

Immunizations

Screening tests

Environmental hazards  
(home, school, work)

Safety measures  
(seat belts, condoms)

Exercise and leisure

Sleep patterns

Diet

Current medication

Tobacco

Alcohol

Social drugs

7. Family history:

Immediate family:

Age

Health

Cause of death

DM

Heart disease

TB

HBP

Stroke

Kidney disease

CA

Arthritis

Anemia

Epilepsy

Thyroid disease

Epilepsy

Mental illness

Alcoholism

Drug addiction

Other

0. Psychosocial history:

Home situation

Daily life

Important experiences

Religious beliefs

1. Review of systems:

General

Skin

Head

Eyes

Ears

Nose/throat

Mouth/throat

Neck

Thorax

Respiratory

Cardiac

Gastro-intestinal

Urinary

Genital

Vascular

Musculoskeletal

Neurologic

Hematologic

Endocrine

Psychiatric.

# ADDENDUM C

## TECHNIION NATAL CHIROPRACTIC DAY CLINIC

### PHYSICAL EXAMINATION

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

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

Last name

First name

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

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

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

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

Rate: Heart: \_\_\_\_\_ Pulse: \_\_\_\_\_ Respiration: \_\_\_\_\_

Blood pressure: Arms: L / R /

Legs: L / R /

General appearance:

STANDING EXAMINATION.

Minor's sign

Skin changes

Posture

erect

Adam's

"Ranges of motion:

T/L spine: Flexion: 90 Fingers to floor

Extension: 50

R.lat.flex.: 30 Fingers down leg

L.lat.flex.: 30 Fingers down leg

Rot.to R.: 35

Rot.to L.: 35

Flex.

L.Rot.

R.Rot.

L.lat  
flex.R.lat.  
flex.

Ext.

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

Romberg's sign.

Pronator drift.

Trendelenburg's sign.

Gait.

rhythm

balance

pendulousness

on toes

on heels

tandem

Half squat.

Scapular winging.

Muscle tone.

Spasticity/Rigidity.

**Shoulder:**

skin

symmetry

ROM - glenohumeral

scapulo-thoracic

acromioclavicular

elbow

wrist

**Chest measurement**

inspiration

expiration

**Visual acuity****Breast examination:****Inspection:**

skin

size

contour

nipples

arms overhead

hands against hips

leaning forward.

**Palpation:**

axillary lymph nodes.

**SEATED EXAMINATION.****Spinal posture****Head**

scalp

skull

face

skin

**Eyes**

conjunctiva

sclera

eyebrows

eyelids

lacrimal gland

nasolacrimal duct

alignment

corneal reflex

ocular movement

L

III IV VI

R

III IV VI

visual fields

accommodation

iris

pupils

red reflex

optic disc

vessels  
general background  
macula  
vitreous  
lens

Ears:

auricle  
ear canal  
drum  
auditory acuity  
Weber test  
Rinne test

Nose:

external  
internal  
septum  
turbinates  
olfaction

Sinuses (frontal & maxillary):

tenderness  
transillumination

Mouth and pharynx:

lips  
buccal mucosa  
gums and tooth  
roof

tongue  
inspection  
movement  
taste  
palpation

pharynx  
inspection  
CN X

-Neck:

posture  
size  
swelling  
scars  
discoloration  
hair line



## ROM:

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

Flex.

L.Rot.

R.Rot.

L.Lat.  
flex.R.lat.  
flex.

Ext.

lymph nodes

trachea

thyroid

carotid arteries (thrills, bruit)

CN V

CN VII

CN VIII (nystagmus)

CN IX

CN XI

TMJ --

Inspection

ROM

deviation

Palpation

crepitus

tenderness

**Neurological:****Dermatomes**

C5

C6

C7

C8

T1

**Reflexes**

biceps

triceps

brachioradialis

**Muscle strength**

C5

C6

C7

C8

T1

**Coordination:**

point-to-point

dysdiadochokinesia

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

skin

shape

respiratory distress

rhythm (respiratory)

depth "

effort "

intercostal/supraclavicular retractions

**Palpation:**

tenderness

masses

respiratory expansion

tactile fremitus

**Percussion:**

lungs (posterior)

diaphragmatic excursion

kidney punch

**Auscultation:**

breath sounds

vesicular

bronchial

adventitious sounds

crackles (rales)

wheezes (rhonchi)

voice sounds

broncophony

whispered pectoriloquy

egophony

## Cardiovascular:

auscultation (aortic ~~curvature~~)

Allen's test

SUPINE EXAMINATION

JVP

PMI

auscultation heart (L.lat.recumbent)

respiratory excursion

percussion chest (anterior)

breast palpation

## The abdomen:

## Inspection:

skin

umbilicus

contour

peristalsis

pulsations

hernias (umbilical/incisional)

## Auscultation:

bowel sounds

bruit

## Percussion:

general

liver

spleen

## Palpation:

superficial reflexes

cough

light

rebound tenderness

deep

liver

spleen

kidneys

aorta

intra-/retro-abdominal wall mass

shifting dullness

fluid wave

## Acute abdomen:

where pain began and now

cough

tenderness

guarding/rigidity

rebound tenderness

Rovsing's sign

psoas sign

obturator sign

cutaneous hyperaesthesia

rectal exam

Murphy's sign.

## Male genitals and breasts.

## Inspection:

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

## Palpation:

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

## Auscultation:

scrotal mass.

## Peripheral vasculature:

## Inspection:

skin  
 nail beds  
 pigmentation  
 hair loss

## Palpation:

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

## Musculoskeletal:

## ROM

## hip

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

## knee

flex. 130  
 ext. 0/15

## ankle

plantar flex 45  
 dorsiflex 20  
 inversion 20  
 eversion 20

leg length

**Neurological:****dermatomes**

L1

L2

L3

L4

L5

S1

**muscle strength**

hip flexion

knee extension

ankle dorsiflexion

plantar flexion

**tendon reflexes**

patellar

Achilles

**plantar reflex****Rectal examination:****Inspection**

sacrococcygeal &amp; perianal areas

**Palpation**

sphincter tone

tenderness

induration

nodules

prostate

seminal vesicles

**Mental status****Appearance and behaviour:**

level of consciousness

posture and motor behaviour

dress, grooming, personal hygiene

facial expression

affect

**Speech and language:**

quantity

rate

volume

fluency

aphasia (prn)

**Mood****Thought processes (logical, relevant, organized)****Memory and attention:**

orientation (time, place, person)

remote memory

recent memory

new learning ability

**Higher cognitive functions:**

information and vocabulary (general &amp; specialized knowledge)

abstract thinking.

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC.

REGIONAL EXAMINATION -- CERVICAL SPINE.

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

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

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

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

OBSERVATION :

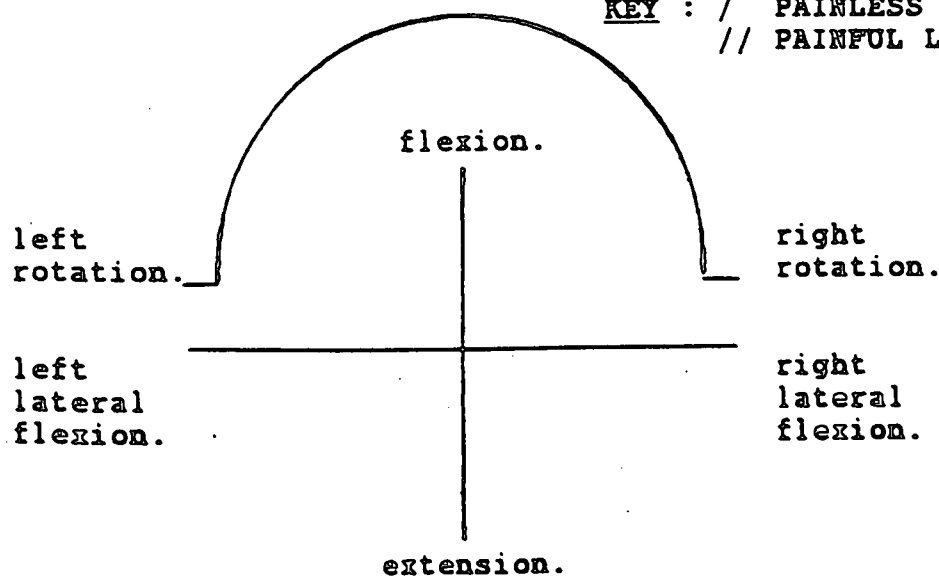
Posture  
Swellings  
Scars  
Discoloration  
Hair Line  
Bony and soft tissue contours

Shoulder position:  
Left =  
Right =  
Muscle spasm  
Facial expression

RANGE OF MOTION:

Flexion = 45 degrees.  
Extension = 70 degrees.  
L/R Rotation = 70 degrees.  
L/R Lateral flexion = 45 degrees.

KEY : / PAINLESS LIMITATION.  
// PAINFUL LIMITATION.



PALPATION : lymph nodes.  
trachea.  
thyroid gland.

**ORTHOPAEDIC EXAMINATION :**

**Tenderness**

**Active MF Trigger Points :**

- SCH.
- Trapezius.
- Scaleni.
- Levator Scapulae.
- Posterior Cervical musculature.

**Doorbell Sign**

**Kemp's Test**

**Cervical Distraction**

**Halstead's Test**

**Hyperabduction Test (Wright's)**

**Shoulder abduction Test**

**Dizziness rotation Test**

**Brachial Plexus Tension**

**Cervical Compression**

**Lateral Compression**

**Adson's Test**

**Costoclavicular Test**

**Eden's (traction) Test**

**Shoulder depression Test.**

**Lhermitte's Sign**

**O'Donoghue Manoeuvre**

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

**NEUROLOGICAL EXAMINATION :**

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

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

**VASCULAR :**

**LEFT.**

**RIGHT.**

**BLOOD PRESSURE.  
CAROTIDS.  
SUBCLAVIAN ARTERIES.  
WALLENBERG'S TEST.**

_____	_____
_____	_____
_____	_____
_____	_____

**COMMENTS:** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**MOTION PALPATION :**

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



# ADDENDUM I

## INFORMED CONSENT FORM

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

TITLE OF RESEARCH PROJECT

\_\_\_\_\_  
\_\_\_\_\_

NAME OF SUPERVISOR

\_\_\_\_\_

NAME OF RESEARCH STUDENT

\_\_\_\_\_

PLEASE CIRCLE THE APPROPRIATE ANSWER

1. Have you read the research information sheet? YES/NO
2. Have you had an opportunity to ask questions regarding this study? YES/NO
3. Have you received satisfactory answers to your questions? YES/NO
4. Have you had an opportunity to discuss this study? YES/NO
5. Have you received enough information about this study? YES/NO
6. Who have you spoken to? \_\_\_\_\_
7. Do you understand the implications of your involvement in this study? YES/NO
8. Do you understand that you are free to withdraw from this study? YES/NO
  - a) at any time
  - b) without having to give a reason for withdrawing, and
  - c) without affecting your future health care.
9. Do you agree to voluntarily participate in this study? YES/NO

PATIENT/SUBJECT\* Name \_\_\_\_\_  
(in block letters)

Signature \_\_\_\_\_

PARENT/GUARDIAN\* Name \_\_\_\_\_  
(in block letters)

Signature \_\_\_\_\_

WITNESS Name \_\_\_\_\_  
(in block letters)

Signature \_\_\_\_\_

RESEARCH STUDENT Name \_\_\_\_\_  
(in block letters)

Signature \_\_\_\_\_