

THE EFFICACY OF SPINAL MANIPULATIVE THERAPY IN THE TREATMENT OF MECHANICAL NECK PAIN

by

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DEDICATION

This dissertation is dedicated to my parents, Mr and Mrs I.P. Smith, for their patience and generosity which has enabled me to become a doctor of chiropractic.

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ABSTRACT

There have been few substantiated studies done to investigate the efficacy of spinal manipulative therapy for cervical syndromes [Vernon et.al. (1990: 13), Sloop et.al. (1982: 532) and Cassidy et.al. (1992: 495)]. Therefore, more conclusive evidence is needed to verify the success of manipulation, especially in terms of chiropractic treatment methods.

The purpose of this investigation was to evaluate cervical spine manipulation and combined cervical and thoracic spine manipulation, according to subjective and objective clinical findings, in order to determine the efficacy of each approach in the management of mechanical neck pain.

It was hypothesized that cervical spine manipulation, and combined cervical and thoracic spine manipulation would both be effective in the treatment of mechanical neck pain.

However, it was proposed that combined cervical and thoracic spine manipulation would be more effective than just cervical spine manipulation, in terms of subjective and objective clinical findings.

This study consisted of a controlled trial of a sample population diagnosed with joint dysfunction (cervical and thoracic facet syndrome). Thirty subjects were randomly divided into two groups: the control group and the experimental group. The control group was treated with cervical adjustments only and the experimental group received combined cervical and thoracic adjustments.

Soft tissue therapy was used on the patients as a pre-adjustment procedure.

All the subjects were subjectively monitored using the Numerical Pain Rating Scale, the McGill Short-Form Pain Questionnaire and the CMCC Pain Disability Index. The objective responses to the treatments were recorded by algometer readings (Wagner Force Dial) and cervical spine ranges of motion (Cervical Range of Motion instrument) - flexion, extension, lateral flexion and rotation.

Each subject was treated twice weekly for a period of 3 weeks, or until symptom free, not exceeding 6 weeks.

The results were analyzed at a 90% confidence level as follows:

1. The median of the data obtained from the CMCC Pain Disability Index, the Numerical Pain Rating Scale, the McGill Short-Form Pain Questionnaire, range of motion readings and the algometer readings were statistically evaluated using the non-parametric Wilcoxon Signed Rank test. The median values of the first, fourth and last treatments were utilised.
2. The average difference between the "before" and "after" treatment range of motion values for each of the six treatments were taken. This data was then diagrammatically represented for visual interpretation and was statistically assessed using paired analysis.
3. Comparison of the results of the experimental group with that of the control group was statistically evaluated

using the Mann-Whitney U test. The comparison was made using the median values of the first, fourth and last treatments. This was done for each of the measurement parameters.

The average number of treatments for both the control and experimental groups was 6 treatments per patient.

The results, for both subjective and objective data, indicated that there was a significant improvement within both treatment groups ($P < 0.1$) and that the rate of improvement was similar. There was no significant difference in the efficacy when comparing the two treatment groups ($P < 0.1$). However, subjectively, in terms of average pain relief, the experimental group showed a greater improvement than the control group (71.26% - experimental and 54.12% - control), but this did not demonstrate any statistical relevance.

An attempt was made to identify during which treatment interval (early or latter part of the treatment period) the most improvement was shown, but due to lack of statistical evidence no conclusions could be derived in this regard.

In conclusion it must be stated that both treatment methods produced favourable and similar results. Age and duration of symptoms were not taken into consideration during analysis of the data.

This study not only identifies a relationship between increase in cervical range of motion and decrease in neck pain, but also supports the use of manipulation for mechanical neck pain.

There is sufficient clinical appraisal to conclude that both treatment groups showed significant improvement within the natural progression of the conditions.

In further studies a larger sample size is necessary to identify subtle changes in the measurement parameters and to add to the validity of the results. The patient characteristics (eg. age, gender and level of joint dysfunction) should also receive greater attention in future studies.

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LIST OF ABBREVIATIONS

- 2.1 H - Head Problems
 N - Neck Problems
 U/M B - Upper/Mid-Back Problems
 LB - Low Back Problems
 Ext - Extremity Problems
 Oth - Other Problems
- 2.2 Marked - Marked Improvement
 Mod - Moderate Improvement
 Mild - Mild Improvement
 No Imp - No Improvement
 Tot - Total Number of Patients
- 2.3 MT - Manual Therapy
 Phys - Physiotherapy
 Diff. - Difference
- 3.1 E-Group - experimental group
 C-Group - control group
 IC - initial consultation
 FC - final consultation
 4C - fourth consultation
- 4.1 test stat = large sample test statistic
 P = two-tailed probability of equalling or exceeding
 the significant value

(sig) = significance

ns = no significant difference in the medians

s = significant difference in the medians

tx1 = first treatment

txF = final consultation

tx4 = fourth consultation

contr = control group

exp = experimental group

DEFINITION OF TERMS

ADJUSTMENT

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

CERVICAL SPINE

In the context of this study the cervical spine consists of the vertebrae making up the bony skeleton of the neck (C0 to C7) including the intervertebral discs, zygapophyseal joints and accompanying soft tissue.

FIXATION

The state whereby articulation has become temporarily immobilized in a position that it may normally occupy during any phase of physiological movement (Haldeman 1992: 623). Fixation is caused by muscular spasm, a shortened ligament, or by intra-articular blocking (Gatterman 1990: 408).

GONIOMETER

An instrument for measuring angles, used for measuring the range of motion of a joint or set of joints in degrees (Gatterman 1990: 408).

MANIPULATION

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

FACET SYNDROME (JOINT DYSFUNCTION)

Mechanical neck pain, is neck pain not due to organic causes, but is associated with degenerative changes of the spine. Associated with phase one joint degeneration (dysfunction) eg. facet joint syndrome, hypomobility and early disc degeneration (Kirkaldy-Willis 1992: 63).

MOBILIZATION

A form of manipulation applied within the physiological passive range of joint motion and is characterized by non-thrust passive joint manipulation (Haldeman 1990: 624).

MYOFASCIAL TRIGGER POINTS

A focus of hyper-irritability in a muscle or its fascia that is symptomatic with respect to pain. It refers a pattern of pain at rest and/or on motion specific for that muscle (Travell and Simons 1983: 3).

RADICULOPATHY

The inflammation or disease of the spinal nerve roots causing the interruption of normal nerve transmission (Gatterman 1992: 411).

RELEASE (CAVITATION)

The audible "crack" or "pop" heard after the application of an adjustment to a particular articulation.

SOFT TISSUE TECHNIQUES

The systematic therapeutic friction, stroking, and kneading of the body. Manoeuvres performed by hand on the skin of the patient and through the skin of the patient on the subcutaneous tissue (Haldeman 1990: 624). Effleurage, a form of massage using slow, rhythmic stroking, executed with the minimum of force and light pressure.

THORACIC SPINE

In the context of this study the thoracic spine consists of all the vertebrae making up the bony skeleton from T1 to T7 including the intervertebral discs, zygapophyseal joints and accompanying soft tissue.

FUNCTIONAL SPINAL UNIT

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

CHAPTER ONE

1.1 INTRODUCTION

1.1.1 Background To The Problem

There have been few randomized clinical trials conducted on cervical pain and/ or headache (Vernon et.al. 1990: 13). In almost all of the recent research it has been shown that spinal manipulative therapy has some value (Haldeman 1990: 423), but few have taken into consideration the vast number of treatment protocols which can be applied eg. manipulation, mobilization, soft-tissue therapy, interferential current therapy, trigger point therapy, pharmaceutical intervention or a combination of the above. Many of these studies have also been of low statistical power (Haldeman 1992: 433).

The occurrence of mechanical neck pain may produce profound effects on muscle and posture because of the diversity of cervical spine innervation, by affecting the reflexes that underlie static and dynamic posture (Gatterman 1992: 253). When disturbed, these reflexes may have an extensive effect upon muscle tone in the neck, trunk and limbs (Gatterman 1992: 253). This highlights how the diverse aetiologies of neck pain may produce differing signs and symptoms by altering reflex activity. The resultant abnormal reflex responses may, therefore, produce disturbances in muscle tone and posture.

Each treatment protocol may also produce different results due to this reflex activity (Leach 1986: 132).

Therefore, it is important to discover the role of spinal manipulative therapy in the treatment of neck pain owing to the multiple aetiological factors and the diversity of treatment protocols. This study would thus further enhance scientific insight into the treatment of mechanical neck pain.

Manipulation of the cervical spine has become a rather common form of treatment for mechanical neck pain, though rationales for its use are controversial and indications are based on theoretical neurobiologic mechanisms, rather than proof of efficacy (Sloop et. al. 1982: 532).

This study would further scientific insight into the efficacy of cervical manipulation. Furthermore, manipulation of the neck has received little detailed analysis due to the inadequate design of studies previously conducted (Howe et.al. 1983: 574).

Leach (1986: 206) states that it has been shown that chiropractic needs not only broad clinical studies, but also basic research. Leach (1986: 207) suggests that research should be directed to three primary areas:

- (1) evaluation of chiropractic therapy,
- (2) diagnostic technique and,
- (3) relative basic science.

1.1.2 Statement of The Problem

The purpose of this investigation was to evaluate cervical spine manipulation and combined cervical and thoracic spine manipulation, according to subjective and objective clinical findings, in order to determine the efficacy of each approach in the treatment of mechanical neck pain.

1. The First Subproblem

The first subproblem was to evaluate cervical spine manipulation, in terms of subjective and objective clinical findings, in order to determine the efficacy of this approach in the treatment of mechanical neck pain.

2. The Second Subproblem

The second subproblem was to evaluate combined cervical and thoracic spine manipulation, in terms of subjective and objective clinical findings, in order to determine the efficacy of this approach in the treatment of mechanical neck pain.

3. The Third Subproblem

The third subproblem was to interpret the data obtained during this study, in terms of the subjective and objective data collected, in order to determine which of the treatment methods are more appropriate and/ or effective in the treatment of mechanical neck pain.

1.1.3 Need For a Solution To The Problem

The aim of this study was to determine more effective ways to treat mechanical neck pain in order to reduce patient morbidity and reduce treatment cost.

Furthermore, this study may show that chiropractic offers a superior alternative to other forms of treatment, by alleviating the signs and symptoms experienced by a patients eg. a reduction in pain and an increase in the cervical range of motion.

Past studies by Cassidy et.al. (1992), Howe et.al. (1983) and Sloop et.al. (1982) have supported the efficacy of manipulation with regards to the reduction in pain intensity.

1.1.4 Benefits

The results of this project were to support the efficacy of spinal manipulative therapy as a viable treatment regime for mechanical neck pain. Also, this study may provide further insight into the relationship between the cervical and thoracic spine in terms of biomechanical links between motion segments and different areas of the spine, as described by Gatterman (1992: 253) and Haldeman (1990: 243).

It is proposed that there could be a biomechanical link between the cervical and thoracic spines which influences the symptoms experienced by the patients.

CHAPTER TWO

REVIEW OF THE RELATED LITERATURE

2.1 Introduction

Mechanical neck problems are considered to be common and have been shown to cause pain and limitations of movement (Cassidy et.al. 1992: 495). This literature review provides an outline of the aetiologies, pathophysiology and clinical characteristics of joint dysfunction, in order to validate the diagnosis of mechanical neck pain.

The purpose of the literature review was also to give a brief explanation of the current biomechanical principles which provide the rationale for manipulation. It was important to include an overview of the subluxation/ fixation complex to define the pertinent clinical considerations, objectives and the scientific basis of this study.

The popularity of chiropractic care is indicative of its success, even though much research is still required (Gatterman 1990: xv). Past research showing the efficacy of manipulation is also discussed, in order to gain a historical perspective on the treatment protocols and to determine the short-comings of past research, but nevertheless, to provide proof of the efficacy of spinal manipulation.

Leach (1986: 207) suggests that research should be directed to the evaluation of chiropractic therapy. The success of manipulative therapy was also emphasised by reviewing aspects of manipulative therapy previously investigated, in order to expose gaps in knowledge and to show the need for continued investigation.

This review attempted to furnish clinical evidence supporting the efficacy of manipulative therapy, by supporting the science and rationale of this treatment regime.

2.2 A Brief Summary of the Relevant Anatomy and Biomechanics of the Cervical Spine.

The human neck is a remarkable structure, possessing a wide range of mobility in nearly every direction (Moore 1985: 570). Situated between the relatively heavy skull and the relatively immobile trunk, the neck has the ability of incurring injuries, which in other parts of the body would have minimal sequelae (Haldeman 1990: 137). The cervical spine consists of several joints and it is an area that sacrifices stability for mobility, hence the vulnerability of the cervical spine to injury (Magee 1992: 34).

The cervical vertebrae are divided into two anatomical and distinct parts (Kapandji 1974: 170):

1. The suboccipital segment - consisting of the atlas and axis, and

2. the inferior segment - stretching from the inferior surface of the axis to the superior surface of T1.

Functionally, these two segments are complementary to allow the pure movements of rotation, lateral flexion and extension of the head and neck (Kapandji 1974: 170).

The atlanto-occipital joints (C0-C1) are the two uppermost joints and provide the principle movements of flexion-extension (Magee 1992: 34). The atlanto-axial joints (C1-C2) constitute the most mobile articulation in the spine, where it is capable of flexion-extension, lateral flexion, but primarily rotation (Magee 1992: 34).

The motion segments of the lower cervical spine produce movement by acting as a unit. Movements of rotation, side bending and flexion-extension are capable (Haldeman 1990: 139). The pronounced combination of movements is evident, particularly between lateral flexion and rotation (Haldeman 1990: 137).

An important phenomenon is the "coupling" of intervertebral motion segments. Panjabi and White (1990: 537) explain that physiological movements of the spine are inherently connected. This phenomenon of joint coupling is due to the geometry of the individual vertebrae, the connecting ligaments and discs, as well as the curve of the spine (Panjabi and White 1990: 537).

Coupling is also described as "...motion in which rotation or translation of a rigid body about or along one axis, is

associated with the simultaneous rotation or translation about or along another axis." (Plaughner 1993: 34). The disturbed kinematics of an injured functional spinal unit could lead to unequal movements of the joints and thus may alter the normal coupling mechanism (Plaughner 1993: 15). Apparent abnormal coupling patterns may be noted as soft tissue dysfunction, which may respond favourably to manipulation, or due to aberrant facet geometry, which sometimes occur in the upper cervical spine (Plaughner 1993: 34).

Often, when analysing the pathogenesis of spinal degeneration, it is relevant to note that single joint injury may lead to multiple levels of involvement due to the articulation with adjacent functional spinal units (Schafer and Faye 1989: 4).

It was suspected that abnormal kinematics, caused by joint dysfunction, may affect multiple levels due to the alteration of normal joint coupling. The principle of adjusting more than one level, i.e. combined cervical and thoracic spines, could be substantiated for the alleviation of multi-level fixations.

The chiropractic adjusting techniques used in this study (Diversified) were also based on spinal biomechanics and thus may have colluded with the phenomenon of joint coupling.

2.3 Mechanisms of Cervical Spine Posture

The shape and extent of the cervical spine, which is lordotic, depends on the configuration of the vertebrae and the discs,

which are in turn shaped by the stress of muscle pull (Gatterman 1990: 260). Thus, inadequate muscle tone or muscular spasm may cause changes in the cervical spine posture (Gatterman 1990: 260). Gatterman (1990: 260) emphasises that posture is the result of a moment-by-moment modification of neural circuits that control cervical shape and posture. Some of these patterns are present at birth and others appear as the nervous system develops and matures (Gatterman 1990: 260).

Posture of the cervical spine is as a result of reflex activity which is specific in maintaining the cervical spine shape (Gatterman 1990: 260). The applicable reflexes are: (1) the stretch reflex and (2) the flexion/extension reflex (withdrawal reflex). These reflexes are activated by neural innervation of the cervical musculature, ligaments, zygapophyseal joints and related structures (Gatterman 1990: 260). Muscle spindle activity, cutaneous receptors and the golgi tendon organs are responsible for initiating these reflexes (Gatterman 1990: 260).

To emphasise the importance of these reflex activities it has been shown in a study by Nansel et.al. (1993: 91) that cervical spine manipulation does have significant effects on the tone of lumbo-pelvic musculature, presumably by facilitating tonic neck reflexes involving intersegmental spinal pathways. This is an indication that cervical spine fixations may indeed contribute toward neural reflex phenomena, causing changes in the cervical posture.

It is also suggested by Gatterman (1990: 220) that compensatory segmental fixation from altered postural habits may occur. Injury or degeneration to motion segments may alter this complex reflex activity, as described by Gatterman (1990: 220). Further joint dysfunction at adjacent levels may result due to the alteration in normal cervical posture and abnormal joint coupling (Gatterman 1990: 220). Schafer and Faye (1989: 28) also reported that chronic secondary muscular fixations elsewhere in the spine may be as a result of somato-somatic reflexes initiated by primary fixations.

2.4 The Subluxation Complex and Reasons for Joint Dysfunction

2.4.1 The Subluxation Complex

" A subluxation is an aberrant relationship between adjacent articular structures that may have functional or pathological sequelae, causing an alteration in the biomechanics and/ or neurophysiological reflections of these articular structures. " (Haldeman 1992: 627).

The subluxation complex is an intricate concept that is multifaceted, but, in general, encompasses the following components (Gatterman 1990: 415) :

1. The partial or incomplete dislocation of a facet joint,

2. the restriction of a joint in a position exceeding normal physiologic motion, although the anatomical limits have not been exceeded, and
3. the anomalous relationship between adjacent articulations which may have functional or pathological consequences.

Schafer (1987: 12) describes the possible anatomical mechanisms responsible for spinal fixations and joint dysfunction: (1) muscular, (2) ligamentous, (3) intra-articular, and (4) osseous.

The pathophysiological components of the subluxation complex encompasses the following elements (Gatterman 1990: 39):

1. Neuropathophysiology - subluxation causes irritation and/or compression of the neural components of motion segments, and
2. kinesiopathology - restriction in movement of motion segments due to muscle hypertonicity, joint stabilization, muscle spindle-muscle spasm cycle, joint sprain-muscle spasm and articular locking.

These pathophysiological elements may be corrected by spinal manipulation and the prognosis for the patient depends upon the reversibility of these pathophysiological factors (Gatterman 1990: 39).

The subluxation hypothesis, stated by Haldeman (1992: 250), suggests that the spine is in a continuous state of balance, either dynamic or static.

A functional spinal unit may behave inappropriately when an external stress causes a strain on a motion segment or when the segment's motion is impeded. The result is internal blocking of motion by meniscoids or synovial tags (Haldeman 1992: 250).

Schafer (1987: 12) and Haldeman (1992: 250) both agree, however, that it is probable that no single circumstance is responsible for joint dysfunction. The mechanisms causing fixation are often varied and controversial, and it is the interplay between these causes that encompass fixation (Schafer (1987: 12) and Haldeman (1992: 250)).

Plaughner (1993: 70) emphasises that the practical application of chiropractic has developed empirically after clinical observation, but that further studies into the mechanism involved in the subluxation complex is required.

Due to the complexities of the subluxation complex and the many subsequent clinical presentations that may be seen, it is important to further the understanding of this entity via specific research focusing on the efficacy of chiropractic treatment.

2.4.2 Aetiology of Joint Dysfunction

The causes of joint dysfunction (facet syndrome) can be classified into three types (Hourigan 1989: 293):

1. Traumatic: inflammation of the capsule with associated acute pain and producing interfacet pressure eg. cervical sprain or strain (overstretching or overuse) and whiplash injuries.
2. Pathologic: degenerative thinning of the intervertebral disc with approximation of the articular facets which become roughened and sclerosed eg. aging (degenerative joint disease, degenerative disc disease and osteoarthritis), and inflammatory disease (rheumatoid arthritis, ankylosing spondylitis and psoriatic arthritis).
3. Postural: including damage to structures due to unguarded movement or when paraspinal musculature is compromised eg. muscle contractures, muscular imbalance, abnormal structural support and poor sleeping posture.

Grieve (1988: 176) states that, in the absence of minor injury, degenerative changes in the cervical spine accounts for the greatest incidence of neck pain. Ironically, many of the diagnoses of cervical problems are just labels and say little about the true aetiology (Grieve 1988: 176). The original cause of the problem may often precede the appearance of the clinical signs and symptoms by a considerable period of time eg. months or years (Grieve 1988: 176).

2.5 Incidence and Prevalence of Mechanical Neck Pain

Cassidy et.al. (1992: 570) states that neck pain is a common complaint which affects 40-50% of the general population at some time during their lives. Cassidy et.al. (1992: 570) also

indicates that 5% of workers have been incapacitated from work due to neck pain.

Grieve (1988: 190) states that it has been found that there was an 18% incidence of neck pain among 2500 randomly selected men and women. A slight sex difference was noted - 20% of the women as compared to 16% of men experienced neck pain. Other surveys reveal a 18-67% incidence range of neck pain (Grieve 1988: 190).

In a group of 1137 working men between the ages of 25-54 it was found that less than half engaged in light work, whereas most engaged in heavy work. Attacks of neck stiffness occurred in about 27% of those below 30 years, and in 50% of those over 50 years of age (Grieve 1988: 190).

Epidemiological studies in Canada have shown that 16% of patients complaining of musculoskeletal disorders had arthritis, back or joint disorders, with a greater prevalence among females and in the older population (Helewa et.al. 1985: 169). The majority of health consultations were with a physician (53%), with a substantial number consulting chiropractors (34%) (Helewa et.al. 1985: 169).

In the USA a comparative study between six chiropractic college clinics indicated that the number of patients seen for neck pain ranged between 19-27% and that the number of upper and mid-back patients ranged between 10-15% (Nyiendo et.al. 1989: 83).

TABLE 2.1 The results from six chiropractic colleges (Nyiendo et.al. 1989: 83):

	H	N	U/M B	LB	Ext	Oth
LACC n=205	0	27	10	41	17	5
Palmer-West n=344	5	24	15	34	19	4
WSCC n=218	4	20	14	37	19	6
Pasedena n=48	0	19	11	39	19	14
Cleveland n=199	5	25	12	31	22	5
Life-West n=275	2	25	14	34	27	8

Abbreviations: H - Head Problems

N - Neck Problems

U/M B - Upper/Mid-Back Problems

LB - Low Back Problems

Ext - Extremity Problems

Oth - Other Problems

2.6 Mechanisms and Pathophysiology of Mechanical Neck Pain

Gatterman (1990: 220) states that biomechanical disorders of the cervical spine commonly result from external forces that act on the head and neck, most common of which is trauma (eg. motor vehicle accidents, sports injuries and falls). This, along with soft tissue involvement, may precipitate joint dysfunction in the cervical spine (Gatterman 1990: 220). Gatterman (1990 : 232) also states that mechanical neck pain includes cervical joint sprain and early disc degeneration due to trauma, postural irregularities and joint degeneration.

Plaucher (1993: 52) describes mechanical neck pain to be a result of the following:

1. Positional Dyskinesia (misalignment of adjacent vertebrae) - due to daily activity (influence of gravity and posture). The mechanism of injury can be either sudden (macrotrauma) or over a period of time (microtrauma).
2. Fixation Dysfunction - this describes the restriction in motion of a functional spinal unit with associated inflammation, as a result of disc or joint degeneration, localized muscle spasm, meniscoid entrapment and articular adhesions.

" Mechanical neck pain is primarily caused by joint dysfunction, the product of intrinsic joint stress that occurs at an unguarded moment when the joint is active within its normal range of motion." (Schafer and Faye (1989: 27)).

Schafer and Faye (1989: 25) explain that another cause of joint dysfunction may be that of extrinsic joint stress following a definite but minor trauma and which is often classified as a sprain or a strain.

The pathophysiology of joint dysfunction is described by Haldeman (1990: 206) as a process where the synovial folds in zygapophyseal joints may become entrapped within the joint or interfere mechanically with joint movement, causing pain, muscle spasm and inflammation.

The two main pain mechanisms that arise from synovial fold pinching are (Haldeman 1990: 206):

1. Traction on pain-sensitive tissues such as the synovial folds or joint capsule, and
2. synovial fold traumatic synovitis with associated tissue damage and cell rupture.

2.7 Clinical Considerations and Differential Diagnosis of Mechanical Neck Pain.

2.7.1 Clinical Signs and Symptoms of Mechanical Neck Pain

Schafer (1987: 349) and Hourigan and Basset (1989: 294) explain that the signs and symptoms of mechanical neck pain are varied and individualised. Patients may reveal any number and combination of these signs and symptoms.

According to Grieve (1988: 378) mechanical neck pain may present with the following clinical presentations:

1. Localised acute or chronic cervical pain, with or without arm pain, arising from overstressed cervical segments,
2. a chronic condition with spondylitic changes of the cervical spine with hypomobility,
3. symmetrical neck pain, brought on by movements and activities.

The paravertebral musculature is palpably tender and movement is restricted,

4. unilateral occipital and neck pain, and
5. painful and restricted rotation and lateral flexion.

Schafer (1987: 349) and Hourigan and Basset (1989: 294) describe the possible signs and symptoms of cervical motion unit dysfunction below:

TABLE 2.2 Signs and symptoms of joint dysfunction (Schafer (1987: 349) and Hourigan and Basset (1989: 294)):

<u>Symptoms:</u>	<u>Signs:</u>
Articular grating	Altered reflexes
Possible visceral effects	Boggy tissues
Stiffness	Fibrosis
Tenderness	Hyperaemia
Hypertonic/flaccid muscles	Hypertonic/flaccid muscles
Headaches (occipital)	Segmental atrophy
Numbness	Trigger point development
Pain (especially on motion)	Visual postural imbalance
Possible somatic effects	Palpable malalignment
Weakness	FSU motion alterations
	Possible wry-neck

2.7.2 Differential Diagnoses of Mechanical Neck Pain

It is important to consider other mechanical or pathological conditions that may mimic the clinical presentation of joint dysfunction, many of which are contra-indications to manipulation (Gatterman (1990: 232) and Schafer (1987: 348)).

Below is a list of common differential diagnoses which should be considered when assessing neck pain (Gatterman (1990: 232) and Schafer (1987: 348)) :

1. Muscular syndromes - cervical sprain and postural strain.
2. Biomechanical Disorders - facet joint fixation, cervical joint facet sprain, cervical disc herniation, degenerative disc disease, cervical spondylosis, and fracture.
3. Inflammatory Disease - Rheumatoid Arthritis, Ankylosing Spondylitis, spondylosis, and spondyloarthrosis.
4. Congenital Abnormalities - cervical rib, congenital stenosis, and facet tropism.
5. Systemic Disease - anaemia, leukaemia, Paget's Disease, and osteoporosis.
6. Tumours - primary and secondary (eg. prostate, breast).

2.7.3 Contra-indications and Complications of Manipulation

Haldeman (1992: 557), Gatterman (1990: 67) and Grieve (1988: 647) provide a comprehensive summary of the contra-indications to spinal manipulation:

1. Vascular Complications - vertebral artery insufficiency, atherosclerosis, and aneurysm.
2. Tumours - lung, thyroid, breast and bone.
3. Bone Infections - osteomyelitis and tuberculosis.
4. Traumatic Injuries - fractures, joint instability or hypermobility, severe strains or sprains, and unstable spondylolisthesis.

5. Arthritis - rheumatoid arthritis, osteoarthritis and psoriatic arthritis, and ankylosing spondylitis.
6. Psychological Considerations - malingering and hysteria.
7. Metabolic Disorders - clotting disorders, osteopaenia (osteoporosis and osteomalacia).
8. Neurologic Complications - sacral nerve root involvement from major disc protrusion, advanced disc lesion (with advanced neurologic deficits), and space-occupying lesions.
9. Congenital Malformations.

Haldeman (1992: 552) states that an investigation into the occurrence of complications after cervical manipulation, done by the Swiss Medical Society, revealed that after 1,535,000 manipulations in one year there were 1255 reported cases of complications.

Jaskoviak (1980: 216) and Haldeman (1992: 552) state that the immediate sequelae of cervical manipulation may be the following:

1. Increased pain at the involved segment, muscle spasm and hypomobility,
2. syncope, dizziness, vertigo and loss of consciousness,
3. nystagmus, diplopia, blurred vision,
4. vomiting and nausea,
5. ataxia, weakness, paralysis and plegia,
6. headache, and
7. coma.



Vascular accidents are considered to be the most serious of all complications of cervical manipulation (Gatterman 1990: 55). To prevent vertebral artery syndrome, patients with aneurysms in major cervical blood vessels and patients with a high risk of embolism (eg. aged, post-partem women, atherosclerosis, hypertension and osteoarthritis) are not to be manipulated, but referred for specific medical attention (Gatterman 1990: 55).

TABLE 2.3 The signs and symptoms of vertebral artery syndrome
(Jaskoviak (1980: 216) and Haldeman (1992: 552)):

<u>Symptoms:</u>	<u>Signs:</u>
Dizziness	Nystagmus
Vertigo	Cyanosis
Blurred vision	Ocular signs
Ataxia	Horner's syndrome
Drop attacks	Dysarthria
Headaches	Dysphagia
Tinnitus	Syncope
	Vomiting
	Paresis

The mechanism of pathology of vertebral artery insufficiency is described by Jaskoviak (1980: 217) as being orientated around the mechanical injury of the vertebral arteries due to their relationship to neighbouring bony structures and ligaments.

However, considering that at least 75 million adjustments are performed yearly in the USA alone, the frequency of vertebral artery insufficiency are extremely low (Jaskoviak 1980: 217).

2.8 Comparison of Manipulation to Alternative Treatment for Mechanical Neck Pain

Grieve (1988: 521) states that there are a number of treatment protocols that can be utilized for mechanical neck pain including: medication, manipulation and physiotherapy (eg. mobilization, stretching, traction, TENS, interferential current and ultrasound).

Reports show that there have been a significant decrease in the severity of neck pain following cervical spine manipulation as compared to analgesia or no treatment (Howe et.al. 1983: 579) (table 2.4).

TABLE 2.4 The number of patients that experienced regression of symptoms (Howe et.al. 1983: 579):

Pain in Neck	Control	Manipulation
Immediate relief	6%	68%
After 1 week	60%	74%
After 3 weeks	58%	75%

There also seems to be sufficient evidence that spinal manipulative therapy is more effective than standard medical care in the management of painful neuromusculoskeletal conditions (Brunarski (1984: 243)).

Medication for the mechanical joint pain include systemic analgesics eg. Aspirin, Paracetamol, Ibuprofen, Acupan and Fortral (Grieve 1988: 670). Non-steroidal Anti-inflammatories also function as analgesics in small doses. Anti-inflammatories are, however, rarely necessary for mechanical problems of the spine (Grieve 1988: 670).

A study by Johnson et.al. (1989: 337) compared the treatment of chiropractic, medical and osteopathic care for work-related sprains and strains of the spine. The figures indicated that 58% of the workers injured went to medical doctors. About 28% of the workers went to see chiropractors and 9% saw osteopaths (Johnson et.al. 1989: 337). It was also shown that, generally, fewer workdays were lost and lower amounts of disability compensation and provider cost was paid when chiropractic care was included in the patient care (Johnson et.al. 1989: 337).

This is indicative that chiropractic care can reduce the period of morbidity and reduce treatment costs. However, it is important to continue researching chiropractic treatment methods in order to establish concrete evidence as to its efficacy.

2.9 The Efficacy of Cervical Spine Manipulation

The chiropractic adjustment and the efficacy of manipulative therapy for joint dysfunction has been closely associated with chiropractic care, and in the past has delivered a higher degree of patient satisfaction when compared to standard medical care (Haldeman 1992: 413).

After low back pain, neck pain is the most common complaint for which manipulation is recommended (Haldeman 1993: 3). By far the majority of patients who seek manipulation do so for complaints of pain, muscle spasm, tension or stiffness. 80% to 90% of patients who seek chiropractic treatment do so for the relief of spinal pain or headaches (Haldeman 1993: 3).

Haldeman (1992: 421) also indicates that there have been a number of descriptive studies done on the effects of cervical spinal manipulation and that the patient response to this modality of treatment have been significantly better than other methods of treatment.

The mechanism for pain relief by manipulation is theorized as follows [Haldeman (1993: 3) and Vernon et.al. (1988: 13)]:

1. Manipulation of the cervical spine has also been shown to increase the local paraspinal pain threshold levels thus allowing for a greater tolerance to pain,
2. there is a release of muscle spasm which suggests that manipulation changes muscle spindle activity,

3. increased range of motion due to manipulation,
4. psychological effects of manipulation assist the alleviation of the problem and provides patient satisfaction, and
5. the reduction in disc protrusion.

Manipulation of the cervical spine has also been recommended for the symptomatic treatment of cervical spondylosis and non-specific neck pain (Sloop et.al. 1982: 532) (Table 2.5).

TABLE 2.5 Manipulation versus control group (Sloop et.al. 1982: 532):

Percentage of control patients that showed improvement	28%
Percentage of manipulated patients that showed improvement	57%

In a study conducted by Cassidy et.al. (1992: 495), patients with unilateral neck pain without neurological deficit were treated with cervical spine manipulation. It was found that there was a relationship between pain and range of motion of the cervical spine and that there was a significant increase in the cervical spine range of motion after manipulation, as well as a significant decrease in neck pain (Cassidy et.al. 1992: 495) (table 2.6).

Cassidy et.al. (1993: 279) again supports the efficacy of spinal manipulative therapy in terms of patient's pain perception and

range of motion, where it is shown to be more effective than mobilization in the treatment of mechanical neck pain (Table 2.8).

TABLE 2.6 Results of manipulative therapy (Cassidy et.al. 1992: 495):

Numerical Pain Rating Scale-101	
Pre-treatment Mean	43.7%
Post-treatment Mean	31.1%
Mean Improvement	12.0%

TABLE 2.7 Range of motion measurements (Cassidy et.al. 1992: 498):

ROM (in degrees)	Pre-Tr (mean)	Post-Tr (mean)	Mean Gain
I-Rotation	53.2	58.4	5.2
C-Rotation	55.7	59.3	3.6
Flexion	62.0	65.0	3.0
Extension	54.9	58.0	3.1
I-Lateral Flexion	36.3	40.7	4.4
C-Lateral Flexion	37.2	41.7	4.5

Abbreviations: ROM - Range of Motion

Pre-Tr - Pretreatment

Post-Tr - Post-treatment

I-Rotation - Ipsilateral Rotation

C-Rotation - Contralateral Rotation

I-Lateral Flexion - Ipsilateral Lateral Flexion

C-Lateral Flexion - Contralateral Lateral Flexion

TABLE 2.8 Manipulation versus mobilisation (Cassidy et.al. 1993: 279):

<u>Treatment Group</u>	Worse	Same	Improved
Mobilization % (n)	6 (3)	25 (12)	69 (33)
Manipulation % (n)	5 (3)	10 (5)	85 (44)

A study by Mennel (1990: 7) confirms that joint dysfunction is a manipulable condition (table 2.9). 30% of the patients treated reported cessation of symptoms, 34% had markedly improved and that 29% showed moderate improvement. Forty-four of these patients had been symptomatic for longer than a year and had received other forms of treatment, without satisfactory relief (Mennel 1990: 7).

TABLE 2.9 Improvement in patients treated with manipulation (Mennel 1990: 7):

	Marked	Mod	Mild	No Imp	Tot
Pain in Neck	15	13	7	2	37

Abbreviations: Marked - Marked Improvement

Mod - Moderate Improvement

Mild - Mild Improvement

No Imp - No Improvement

Tot - Total Number of Patients

A randomized clinical trial of manual therapy and physiotherapy for chronic back and neck complaints suggested that manipulation showed favourable results (Koes et.al. 1993: 211) (Table 2.10).

TABLE 2.10 Manual Therapy versus Physiotherapy (Koes et.al. 1993: 211):

	MT (n=12)	Phys (n=17)	Diff.
Mean improvement: 12 month follow-up	4.5	4.1	0.4
Mean improvement in Physical Functioning	4.8	3.4	1.4

Abbreviations: MT - Manual Therapy

Phys - Physiotherapy

Diff. - Difference

There seems to be sufficient evidence that spinal manipulative therapy is more effective than standard medical care in the management of painful neuromusculoskeletal conditions (Brunarski 1984: 243). Brunarski (1984: 247) states that bias against manipulation may have missed important differences in treatment efficacy. The implications and challenge for further research in chiropractic is to produce better randomized control trials.

However, not all research has shown favourable results supporting manipulative therapy. Haldeman (1992: 423) states that many studies on cervical manipulation have addressed only short-term results. Brunarski (1984: 246) indicates that measurement outcomes have been influenced by bias and inaccuracy in measurement (eg. spinal ranges of motion and palpation can be subjective). Furthermore, Brunarski (1984: 243) states that much of the research done on spinal manipulation has been criticised due to poor methodology and design.

Howe et.al. (1983: 578) reported that, although neck pain was improved after manipulation, there was no statistical difference after one and three weeks due to spontaneous remission. This questions the long-term efficacy of cervical manipulation.

Also, Sloop et.al. (1982: 534) indicated that the significant therapeutic effects of manipulation were not confirmed, as a whole, in the study which he conducted, indicating that the use of a single manipulation is questionable.

Nevertheless, Brunarski (1984: 247) states that, overall, there is sufficient clinical appraisal and evidence to indicate that spinal manipulative therapy has greater efficacy than standard medical care. Also, the substantial results accumulated by Howe et.al. (1983: 574), Cassidy et.al. (1992: 570), Sloop et.al. (1982: 532) and Cassidy et.al. (1992: 495) confirm the efficacy of manipulation of the cervical spine.

2.10 Conclusions

Fixations in the cervical spine may cause biomechanical alterations and precipitate neurological reflexes that could cause changes in cervical spine posture (Gatterman 1990: 260). This is due to the fact that the biomechanical and anatomical characteristics of the cervical spine is vital in the maintenance of correct cervical posture (Gatterman 1990: 260).

It is also clear that the sequelae of cervical spine fixations and joint dysfunction are complex, and that the anomalies encountered with subluxation and fixation are more profound than initially anticipated (Haldeman 1992: 627). It is thus proposed that fixations (primary) in the cervical spine may cause compensatory (secondary) fixations in the upper thoracic spine due to their biomechanical association and the vertebral coupling principle (Schafer and Faye 1989: 4).

Cassidy et.al. (1992: 495) and Haldeman (1993: 3) have shown that chiropractic manipulation of cervical spine does bring about pain relief and an increase in the range of motion. Manipulation is also known to reduce muscle spasm, meniscoid entrapment and nerve root irritation (Haldeman 1993: 3).

However, even though there have been studies showing the efficacy of manipulation in certain areas of the spine, there has been no research which investigates the efficacy of combined areas of treatment which may be biomechanically linked, as in this study.

This study, which incorporated the use of biomechanically based chiropractic techniques, would highlight the efficacy of spinal manipulative therapy in this regard.

Continued investigation into the area of cervical manipulation is necessary as there is still speculation with regards to the efficacy of cervical manipulation, as the majority of evidence to support this treatment approach is based on anecdotal findings and poor research (Brunarski 1984: 243).

Furthermore, although much has been written about the principles of manipulation in the treatment of neck pain, still little is understood concerning the mechanism and aetiology of such pain (Grieve 1988: 521).

The evolution of chiropractic has indicated that it is not just a phenomenon, but is a clinical science of worldwide acceptance. As chiropractic evolves, the continued growth in research is anticipated (Haldeman 1992: 414).

CHAPTER THREE

MATERIALS AND METHODS

3.1 INTRODUCTION

This chapter covers the process of locating, the description and collection of the data. A description of each questionnaire used and the validity of each measurement parameter is assessed.

The treatment interventions are discussed in detail, describing the techniques used, so that they may be accurately replicated in further studies.

The systematic process of statistical analysis is discussed, explaining the exact manner in which the data was evaluated.

3.2 MEASUREMENT AND OBSERVATIONS

3.2.1 THE DATA

The data of this study consisted of primary and secondary data, the nature of which is given below:

The primary data

- The patient's perception of their pain level (Numerical Pain Rating Scale - 101).
- The patient's perception of their disability (CMCC Neck Disability Index).
- The patient's perception of the sensory dimension of their pain (McGill Short-Form Pain Questionnaire).

- The patient's cervical spine range of motion (Goniometer).
- The patient's pain/ pressure threshold at the level of joint dysfunction (Algometer).

The secondary data

- Current documentation pertaining to chiropractic manipulation of the cervical and thoracic spines were used as required.
- Recognised diagnostic and evaluative criteria pertaining to perception of pain, spinal ranges of motion and disability.

3.2.2 METHOD OF MEASUREMENT

Subjective Measurement

1. **McGill Short-Form Pain Questionnaire** (addendum A) - the questionnaire is designed to define the sensory dimension of the pain experienced by the patient (Melzack and Katz 1992: 162). This questionnaire was developed for research purposes when there is limited time to obtain information from patients. The questionnaire consisted of 15 representative words (descriptors) derived from the McGill Long-Form Questionnaire. These 15 descriptors were selected on the basis of their frequency of endorsement by patients. Each descriptor was ranked on an intensity scale of: 0 = none, 1 = mild, 2 = moderate, 3 = severe (Melzack and Katz 1992: 162).

Melzack and Katz (1992: 163) stated that the questionnaire has been used in studies measuring chronic pain and the sensory

dimension of pain. The results correlated highly with that of the Long-Form Questionnaire. Melzack and Katz (1992: 164) concluded that because pain is subjective, the most accurate form of measurement is one where the patient provides a "self-report". This questionnaire has been successful in measuring the sensory dimension of pain.

Melzak (1987: 191) also states that the McGill Short-Form Questionnaire is one of the most widely used measurement tests for the evaluation of pain and is sensitive to clinical therapies.

2. Numerical Pain Rating Scale (101 Scale) (addendum B) - the patient is required to indicate by means of a percentage the intensity of the pain experience prior to a treatment when (i) it was at its worst, and (ii) when it was at its least. The average between these two figures give an indication of the average pain intensity experienced by the patient .

Jensen et al (1986: 117) conducted a study where 6 methods of judging pain intensity were compared. The methods were assessed according to five criteria: (1) ease of administration of the scoring, (2) relative rates of incorrect responding, (3) sensitivity as defined by the number of available response categories, (4) sensitivity as defined by statistical power, and (5) the magnitude of the relationship between each scale and a linear combination of pain intensity indices.

Jensen et al (1986: 125) stated that the Numerical Pain Rating Scale - 101 had practical advantages over the other measures because: (1) it was simple and practical to administer and score, (2) it can be administered in either written or verbal form, and (3) the scale does not appear to be associated with age. "... The superior measure seems to be the Numerical Pain Rating Scale - 101." (Jensen et al 1986: 125).

Cassidy et al (1992: 496) also comments that the Numerical Pain Rating Scale has been shown to be a reliable method of measurement.

3. CMCC Neck Disability Index (addendum C) - this questionnaire is designed to give the researcher an indication how the neck pain affects the patients ability to manage in everyday life. The questionnaire consists of 10 questions, each question scoring a maximum of 5 points and a minimum of 0. The questionnaire is scored out of 50 and represented as a percentage disability.

According to Vernon and Mior (1991: 409), the Neck Disability Index had a high degree of reliability and internal consistency. The questionnaire also appeared to be sensitive to changes in disability during the course of treatment and to the severity of the problem.

Vernon and Mior (1991: 414) also stated that the questionnaire is applicable to a wide age range, does not seem to be affected by gender, and has an acceptable level of validity.

Objective Measurement

1. **Cervical Spine Range of Motion** (addendum D) - the Cervical Range of Motion Instrument, a product of Performance Attainment Associates, was used for measuring neck motion. The ranges of motion were measured in bilateral rotation, bilateral lateral flexion, flexion and extension of the neck. The extent of motion was measured in degrees.

Youdas et al (1991: 98) conducted a study to determine the reliability of the Cervical Range of Motion Instrument as compared to two other instruments. It was shown that the Cervical Range of Motion Instrument demonstrated a high degree of reliability when measuring the cervical range of motion in patients with orthopaedic disorders.

The data also indicated that the Cervical Range of Motion Instrument was reliable when two physical therapists took repeated measurements on the same patient. Furthermore, the measurement procedure using this instrument did not seem to aggravate the patient's neck pain (Youdas et al 1991: 104).

2. **Algometer** (appendix 5) - using the Force Dial (push - pull force gage), a product of Wagner Instruments, measurements were taken by applying force to the spinous process of the most tender/ painful motion segment i.e. the _level of joint dysfunction. The appropriate motion segment was also selected

after the following orthopaedic tests were found to be positive: (1) joint challenge, (2) Kemp's test, and (3) joint fixation on motion palpation at the level of pain. The force readings were measured in kilograms per square centimetre. The higher the reading, the less tenderness was felt by the patient, thus indicating at higher tolerance to pain.

Fischer (1986: 836) states that pressure algometers have been used on numerous occasions to measure sensitivity in normal tissues. "Localized tenderness, as measured by pressure threshold, is a diagnostic hallmark of tender spots..." (Fischer 1986: 836). Fisher (1986: 837) also explains that the algometer's ability to measure pressure sensitivity and to identify abnormally tender areas provides a means of quantifying treatment, including manipulation, so to identify improvement.

The algometer was fitted with a one square centimetre rubber disc, as this is more suitable for the measurement of tenderness in muscle, ligaments, joint capsules and tendons (Fischer 1986: 836).

3.3 THE LOCATION OF THE DATA

The primary data was obtained from the Numerical Pain Rating Scale, the CMCC Neck Disability Index and the McGill Short-Form Pain Questionnaire, answered by the patients at the beginning of each treatment session. Furthermore, cervical spine ranges of motion and the algometer readings were recorded at the beginning

of each treatment session. The cervical spine ranges of motion were also recorded after each treatment session. All consultations were conducted at the Technikon Natal Chiropractic Day Clinic.

The secondary data was collected from current journals, text books and CD-Rom, available at the Technikon Natal.

3.4 STUDY DESIGN AND PROTOCOL

3.4.1 Object of the Study

The object of this study was to identify the efficacy of each treatment method in terms of the objective and subjective measurement. The study attempted to identify the more efficient treatment method which could be used in the future by the chiropractic profession in the treatment of mechanical neck pain.

3.4.2 Allocation of the Subjects

The sample size consisted of 30 subjects, which complied with the governing criteria of the study, and were randomly divided into two groups :

- i) control group of 15 patients (C-group)
- ii) experimental group of 15 patients (E-group)

The control group was treated using cervical spine manipulation only. The experimental group was treated using combined cervical and thoracic spine manipulation.

3.4.3 Standards of Acceptance of Patients

All patients had to meet the criteria of the study which were the following:

1. Each patient had to undergo an full case history (addendum F) and physical examination (addendum G),
2. the subjects had to undergo a cervical orthopaedic examination and must have been diagnosed as having mechanical neck pain (addendum H),
3. the subjects were not to exhibit any contra-indications to spinal manipulative therapy (eg. inflammation, infection, advanced degeneration, congenital malformations, trauma and cerebrovascular anomalies),
4. where required, subjects had to undergo x-rays to exclude pathology of the cervical spine,
5. all chosen subjects had to give informed consent before they were treated (addendum I), and
6. all subjects had to be over or including the age of 16 years.

3.4.4 Interventions

At the initial consultation the patient was required to complete the McGill Short-Form Pain Questionnaire, the Numerical Pain Rating Scale and the CMCC Neck Disability Index. The cervical spine ranges of motion and algometer readings were also taken on the initial visit.

Each patient was treated twice weekly for a period of 3 weeks, and if the condition persisted, the treatment was continued twice weekly for a maximum of 6 weeks.

Treatment consisted of a chiropractic adjustment(s) to the segment(s) of joint dysfunction identified on examination. The biomechanically based "Diversified" adjusting technique was used. Adjustments were given in the form of cervical breaks (rotary and lateral), combination movements, crossed bilateral transverse pisiform and anterior thoracic techniques (States 1985: 45).

The manipulative techniques are described as follows (States 1985: 56):

- 1. Cervical Break** - this technique is indicated for all cervical fixations, whether rotatory or lateral fixations. The patient lies supine with the headpiece level and the head rotated 45 degrees to the contralateral side. The doctor stands on the ipsilateral side of the patient. An index contact is taken with the caudad hand on the anterior aspect of the articular pillar of the involved segment. The indifferent hand cups the contralateral cheek and ear of the patient. Skin slack is taken up in a posterior to anterior direction. A break technique is used, applying the thrust straight across, and adjusting the segment in the direction of restricted movement. Slight ulnar deviation of the contact hand is required during the thrust when a rotatory adjustment is delivered.

2. Combination Movement - this technique is indicated for rotatory fixations of thoracic levels T1 - T4. The patient lies prone with the headpiece slightly lowered. The doctor stands in a "Fencer" stance on the ipsilateral side facing cephalad. A pisiform contact is taken on the involved transverse process with the caudad hand. The indifferent hand cups the ipsilateral side of the patient's cheek. Skin slack is taken out medial to lateral. The forearm is at right angles to the contact hand. The thrust, a straight arm body drop, is applied in an antero-superior direction.

3. Crossed Bilateral Transverse Pisiform - this adjustment is indicated for anterior thoracic fixations and is the technique of choice for rotatory fixations of the thoracic spine. The patient lies prone with the headpiece level or slightly flexed. The doctor stands in a "Fencer" stance on the contralateral side of the involved segment. A pisiform contact is taken on the transverse process of the involved segment contralateral to the doctor. The indifferent hand takes a pisiform contact on the transverse process of the segment below the involved level and slides in under the contact hand. Skin slack is removed from medial to lateral. The thrust is delivered using a straight arm body drop with slight torque (ulnar deviation of the contact hand) of both hands. The line of drive is antero-superior, with the torque in the direction of restricted movement.

4. Anterior Thoracic Technique - this technique is indicated for anterior thoracic fixations (T1 - T12). The patient is supine

with the headpiece raised and the arms crossed across the chest. The doctor stands in the "Fencer" stance facing cephalad at the level of the patients waist. The doctor reaches over and around the patients chest to place the caudad contact hand on the segment directly inferior to the involved level. The contact is made with flexed interphalangeal joints, with the spinous processes placed between the flexed fingers and the thenar eminence. The indifferent hand grasps the patients crossed arms and the doctor leans onto his/her own forearm. The indifferent contact tractions the patients crossed arms caudad and posteriorly, so to induce slight passive flexion of the thoracic spine. During the patients exhalation a quick body drop is delivered in a posterior and slightly superior direction, towards the contact hand.

Soft tissue therapy (effleurage) was used, as required, as pre-adjustment procedure.

3.4.5 Solving for the Subproblems

Statistical analysis was conducted on the subjective and objective data collected, each of which is contained in the three subproblems. The results obtained from the data was then used to solve each of the subproblems.

The null (H_0) and alternative (H_a) hypothesis for each of the subproblems was as follows:

1. The First Subproblem

The first subproblem was to evaluate cervical spine manipulation, in terms of subjective and objective clinical findings, in order to determine the efficacy of this approach in the treatment of mechanical neck pain.

The hypotheses for the experimental and control groups were:

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

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

2. The Second Subproblem

The second subproblem was to evaluate combined cervical and thoracic spine manipulation, in terms of subjective and objective clinical findings, in order to determine the efficacy of this approach in the treatment of mechanical neck pain.

The hypotheses for the experimental and control groups were:

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

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

3. The Third Subproblem

The third subproblem was to interpret the data obtained during this study, in terms of the subjective and objective data collected, in order to determine which of the treatment methods were more appropriate and/ or effective in the treatment of mechanical neck pain.

Comparing the experimental group to the control group the hypotheses were:

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

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

3.5 STATISTICAL ANALYSIS

3.5.1 TREATMENT OF THE DATA

3.5.1.1 Treatment of the Subjective Data:

To solve the subjective component the data was treated as follows:

- (i) The questionnaires, after completion by the patients, were screened to determine if they were correctly completed.

- (ii) The units obtained from the three questionnaires were converted to percentages, and these percentages were recorded separately for the experimental and control groups.
- (iii) The data was then statistically analyzed.

3.5.1.2 Treatment of the Objective Data:

To have solved the objective component the data was treated as follows:

- (i) The readings obtained with the algometer were recorded separately for the experimental and control groups.
- (ii) The cervical spine ranges of motion, measured with the goniometer, were recorded in degrees of flexion, extension, left/right lateral flexion, and left/right rotation. This was done separately for the experimental and control groups.
- (iii) The average difference between the pre-treatment and post-treatment goniometric readings were recorded for each plane of movement.
- (iv) The data then underwent statistical analysis.

3.5.2 STATISTICAL ANALYSIS OF THE DATA

The statistical analysis was conducted at a 90% confidence level based on the advise given by the Technikon Natal statistician for the following reasons:

- (i) The project consisted of a small sample size (30 subjects),
and
- (ii) the statistical testing was of a non-parametric nature.

3.5.2.1 Non-Parametric Paired Hypothesis Tests

The Subjective Data:

The subjective results, for each of the questionnaires, were derived after statistical analysis using the Wilcoxon Signed Rank Test, for both the treatment groups. The units (in percentages) compared were taken from:

- (i) the initial consultation (IC) and the final consultation (FC),
- (ii) the initial consultation (IC) and the fourth consultation (4C), and
- (iii) the fourth consultation (4C) and the final consultation (FC).

i.e. E-Group

C-Group

IC <--> FC

IC <--> FC

IC <--> 4C

IC <--> 4C

4C <--> FC

4C <--> FC

The figures were compared to determine the level of significance.

The Objective Data:

The cervical spine range of motion measurements were statistically analysed by means of the Wilcoxon Signed Rank Test,

for the experimental and control groups.

The units (in degrees) compared, for each plane of movement, were taken from:

- (i) the initial consultation (IC) and the final consultation (FC),
- (ii) the initial consultation (IC) and the fourth consultation (4C), and
- (iii) the fourth consultation (4C) and the final consultation (FC).

i.e. E-Group

C-Group

IC <--> FC

IC <--> FC

IC <--> 4C

IC <--> 4C

4C <--> FC

4C <--> FC

The figures were compared to determine the level of significance.

The patients' pressure tolerance, measured with the algometer at the level of joint dysfunction, were analyzed by means of the Wilcoxon Signed Rank Test, for each of the control and experimental groups.

The units (in kilograms per square centimetre) compared were taken from:

- (i) the initial consultation (IC) and the final consultation (FC),
- (ii) the initial consultation (IC) and the fourth consultation (4C), and
- (iii) the fourth consultation (4C) and the final consultation (FC).

i.e. <u>E-Group</u>	<u>C-Group</u>
IC <--> FC	IC <--> FC
IC <--> 4C	IC <--> 4C
4C <--> FC	4C <--> FC

These figures were compared to determine the level of significance.

The differences between pre-treatment and post-treatment goniometric measurements, for each plane of cervical spine movement, were tabulated. This was done for both the experimental and control groups. The units (in degrees) compared were taken from the initial consultation (IC) and the final consultation (FC).

i.e. <u>E-Group</u>	<u>C-Group</u>
IC <--> FC	IC <--> FC

These figures were compared to determine the level of significance.

The Wilcoxon Signed Rank Test was chosen, under the advise of the Technikon Natal statistician, because of its less restrictive assumptions and near equivalence in sensitivity to the parametric t-test (Siegel 1956 : 312).

3.5.2.2 Non-Parametric Unpaired Hypothesis Tests

The Subjective Data:

The measurements, taken separately for each questionnaire, were analysed by means of the Mann-Whitney U-Test, comparing the

median units of the experimental and control groups.

The median units (in percentages) compared were:

- (i) the initial consultations (IC) of the experimental and control groups,
- (ii) the fourth consultations (4C) of the experimental and control groups, and
- (iii) the final consultations (FC) of the experimental and control groups.

i.e. E-Group C-Group

IC <-----> IC

4C <-----> 4C

FC <-----> FC

These figures were compared to determine the level of significance.

The Objective Data:

The readings of the cervical spine ranges of motion were analyzed by means of the Mann-Whitney U-Test, comparing the median units of the experimental and control groups.

The median units (in degrees) compared were:

- (i) the initial consultations (IC) of the experimental and control groups,
- (ii) the fourth consultations (4C) of the experimental and control groups, and
- (iii) the final consultations (FC) of the experimental and control groups.

i.e. E-Group C-Group

IC <-----> IC

4C <-----> 4C

FC <-----> FC

These figures were compared to determine the level of significance.

The patients' pressure tolerance, measured with the algometer at the level of joint dysfunction, were analyzed by means of the Mann-Whitney U-Test, comparing the median units of the control and experimental groups.

The median units (in kilograms per square centimetre) compared were:

- (i) the initial consultations (IC) of the experimental and control groups,
- (ii) the fourth consultations (4C) of the experimental and control groups, and
- (iii) the final consultations (FC) of the experimental and control groups.

i.e. E-Group C-Group

IC <-----> IC

4C <-----> 4C

FC <-----> FC

These figures were compared to determine the level of significance.

The difference between pre-treatment and post-treatment goniometric measurements, for each plane of cervical spine movement, were tabulated and graphically represented. This was done for both the experimental and control groups. The average result, for each plane of movement, was represented on a bar graph for visual interpretation.

The median units of the difference in goniometric measurements were compared in the following manner:

- (i) the initial consultations (IC) of the experimental and control groups,
- (ii) the final consultations (FC) of the experimental and control groups.

i.e. E-Group C-Group

IC <-----> IC

FC <-----> FC

These figures were compared to determine the level of significance.

The Mann-Whitney U-Test was chosen, under the advise of the Technikon Natal statistician, because of its less restrictive assumptions and near equivalence in sensitivity to the t-test (Siegel 1956 : 312).

All statistical analyses were performed on the "Statgraphics Plus" Version 6, supplied by Manugistics Inc.. Statistical quality control was conducted using the "Computerized Business Statistics" software package by Owen P. Hall, Jnr. This dissertation was typed on the "Word Perfect" version 5.1 software package by WordPerfect Corporation.

CHAPTER FOUR

THE RESULTS

4.1 INTRODUCTION

This chapter states the results obtained in terms of the subjective and objective data, for both the control and experimental groups.

The first set of results show the average figures obtained for the experimental and control groups, giving an impression of the results. These figures were also used as a comparison to other results shown in past research.

The second set of results are the statistically analyzed figures which compared the intra-treatment and the inter-treatment data, so to determine the efficacy of each treatment regime. The null and alternative hypotheses were either accepted or rejected based on the positive results found for each measurement parameter.

4.2 CRITERIA GOVERNING THE ADMISSIBILITY OF THE DATA

- Only the data obtained from the selected patients that met the criteria of the study and that complied with all the researcher's instructions were used.
- Only the questionnaires completed under the supervision of the researcher, or the supervising clinician, were used.

- Only the range of motion measurements and algometer measurements taken by the researcher, or the supervising clinician, were used.
- Only the data collected using the questionnaires and measuring devices stated in this study were used.

4.3 TABULATED RESULTS

4.3.1 The Subjective Data

TABLE 4.1 The average subjective results as perceived by the patients:

	Contr	Exp
Numerical Pain Rating Scale	26.29%	23.09%
CMCC Neck Disability Index	10.54%	10.19%
McGill Short Form Questionnaire	7.92%	9.49%

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

4.3.2 The Objective Data

TABLE 4.2 The average algometer readings:

	Contr	Exp
Algometer	4.56 kg/cm	3.56 kg/cm

The higher the unit the less pain perceived by the patients, thus the higher the pain tolerance level.

TABLE 4.3 The average range of motion readings taken for each of the planes of movement:

ROM	Control	Exp
Flexion	68.16'	72.73'
Extension	68.40'	74.33'
Rotation L	60.25'	68.58'
Rotation R	64.55'	68.87'
Lateral Flexion L	38.50'	41.31'
Lateral Flexion R	41.33'	45.07'

TABLE 4.4 The average differences between before and after treatment range of motion measurements:

ROM	Control	Exp
Flexion	3.04'	2.84'
Extension	3.03'	3.36'
Rotation L	3.13'	3.5'
Rotation R	2.56'	3.82'
Lateral Flexion L	2.72'	4.22'
Lateral Flexion R	3.20'	4.49'

4.3.3 Improvement of the Patients

TABLE 4.5 The tabulated results of the subjective improvement of the patents:

Improvement	Contr	Exp
Tx 1 - Tx final	54.12%	71.26%
Tx 1 - Tx 4	39.30%	35.73%
Tx 4 - Tx final	14.82%	35.53%

TABLE 4.6 Comparison of the subjective responses of the first and final treatments:

	No Improvement	1-33% Impr (Mild)	34-66% Impr (Moderate)	67-100% Impr (Marked)
Contr	2	2	3	8
Exp	0	0	6	9

4.4 THE ANALYZED DATA

4.4.1 Abbreviations

test stat = large sample test statistic

P = two-tailed probability of equalling or exceeding P

(sig) = significance

ns = no significant difference in the medians

s = significant difference in the medians

tx1 = first treatment

txF = final consultation

tx4 = fourth consultation

contr = control group

exp = experimental group

If $P = < 0.1$ = significant difference (10% level of significance).

If $P = > 0.1$ = no significance (10% level of significance)

4.4.2 Non-Parametric Paired Hypothesis Tests

4.4.2.1 Range of Motion

Flexion:

TABLE 4.7 One sample analysis of flexion comparing the 1st, 4th and final treatments of the control group:

	tx1 - tx4	tx4 - txF	tx1 - txF
Test Statistic	0.288675	-0.288675	1.28692
P value (sig)	0.38641 (ns)	0.38641 (ns)	0.09906 (s)

TABLE 4.8 One sample analysis of flexion comparing the 1st, 4th and final treatments of the experimental group:

	tx1 - tx4	tx4 - txF	tx1 - txF
Test Statistic	0.5547	1.6641	0.384371
P value (sig)	0.28954 (ns)	0.048046 (s)	0.012689 (s)

The null hypothesis is rejected for both the experimental and control groups as there was a statistically significant difference between the first and final treatments, indicating an improvement as a result of the treatment.

Extension:

TABLE 4.9 One sample analysis of extension comparing the 1st, 4th and final treatments of the control group:

	tx1 - tx4	tx4 - txF	tx1 - txF
Test Statistic	-0.267261	0.0	0.439435
P value (sig)	0.39463 (ns)	0.5 (ns)	0.33017 (ns)

TABLE 4.10 One sample analysis of extension comparing the 1st, 4th and final treatments of the experimental group:

	tx1 - tx4	tx4 - txF	tx1 - txf
Test Statistic	0.0	0.603023	0.384371
P value (sig)	0.5 (ns)	0.27324 (ns)	0.35035 (ns)

The null hypothesis is accepted for both the experimental and control groups as there was no statistically significant difference between the first and final treatments, indicating that there was no improvement as a result of the treatment.

Lateral Flexion (R):

TABLE 4.11 One sample analysis of lateral flexion (R) comparing the 1st, 4th and final treatments of the control group:

	tx1 - tx4	tx4 - txf	tx1 - txF
Test Statistic	0.0	2.0	1.76505
P value (sig)	0.5 (ns)	0.02275 (s)	0.03877 (s)

TABLE 4.12 One sample analysis of lateral flexion (R) comparing the 1st, 4th and final treatments of the experimental group:

	tx1 - tx4	tx4 - txF	tx1 - txF
Test Statistic	0.0	0.866025	1.7122
P value (sig)	0.5 (ns)	0.19321 (ns)	0.043429 (s)

The null hypothesis is rejected for both the experimental and control groups as there was a statistically significant difference between the first and final treatments, indicating that there was an improvement as a result of the treatment.

Lateral Flexion (L):

TABLE 4.13 One sample analysis of lateral flexion (L) comparing the 1st, 4th and final treatments of the control group:

	tx1 - tx4	tx4 - txF	tx1 - txF
Test Statistic	0.0	0.603023	0.564988
P value (sig)	0.5 (ns)	0.27324 (ns)	0.28603 (ns)

TABLE 4.14 One sample analysis of lateral flexion (L) comparing the 1st, 4th and final treatments of the experimental group:

	tx1 - tx4	tx4 - txF	tx1 - txF
Test Statistic	-0.288675	0.0	0.862991
P value (sig)	0.38641 (ns)	0.5 (ns)	0.19409 (ns)

The null hypothesis is accepted for both the experimental and control groups as there was no statistically significant difference between the first and final treatments, indicating that there was no improvement as a result of the treatment.

Rotation (R):

TABLE 4.15 One sample analysis of rotation (R) comparing
the 1st, 4th and final treatments of the control
group:

	tx1 - tx4	tx4 - txF	tx1 - txF
Test Statistic	2.41209	0.316228	2.47697
P value (sig)	0.00793 (s)	0.37591 (ns)	0.00657 (ns)

TABLE 4.16 One sample analysis of rotation (R) comparing
the 1st, 4th and final treatments of the
experimental group:

	tx1 - tx4	tx4 - txF	tx1 - txF
Test Statistic	0.603023	2.02073	2.34117
P value (sig)	0.27324 (ns)	0.02165 (s)	0.00961 (s)

The null hypothesis is accepted for the control group as there was no significant difference between the first and final treatment, indicating that there was no improvement as a result of the treatment. The null hypothesis is rejected for the experimental group as there was a statistically significant difference between the first and final treatments, indicating that there was an improvement as a result of the treatment.

Rotation (L):

TABLE 4.17 One sample analysis of rotation (L) comparing
the 1st, 4th and final treatments of the control
group:

	tx1 - tx4	tx4 - txF	tx1 - txF
Test Statistic	0.603023	0.948683	2.39262
P value (sig)	0.27324 (ns)	0.17139 (ns)	0.00836 (s)

TABLE 4.18 One sample analysis of rotation (L) comparing
the 1st, 4th and final treatments of the
experimental group:

	tx1 - tx4	tx4 - txF	tx1 - txF
Test Statistic	2.41209	0.0	2.16646
P value (sig)	0.00793 (s)	0.5 (ns)	0.01513 (s)

The null hypothesis is rejected for both the experimental and control groups as there was a statistically significant difference between the first and final treatments, indicating that there was an improvement as a result of the treatment.

4.4.2.2 Difference in pre-treatment and post-treatment goniometric measurements.

TABLE 4.19 One sample analysis of pre-treatment and post-treatment goniometric measurements for the control group:

Tx1 - TxF	Test Statistic	P Value (sig)
Flexion	0.564988	0.286039 (ns)
Extension	0.470679	0.318933 (ns)
Lateral Flexion (L)	0.470769	0.318933 (ns)
Lateral Flexion (R)	0.8664	0.193134 (ns)
Rotation (L)	2.23572	0.012684 (s)
Rotation (R)	0.353009	0.362039 (ns)

The null hypothesis is accepted for the control group as 83.4% of the measurements did not show a statistically significant difference between the first and final treatments, indicating that there was no improvement as a result of the treatment.

TABLE 4.20 One sample analysis of pre-treatment and post-treatment goniometric measurements for the experimental group:

Tx1 - TxF	Test Statistic	P Value (sig)
Flexion	1.42701	0.076788 (s)
Extension	1.47798	0.069707 (s)
Lateral Flexion (L)	1.50254	0.066478 (s)
Lateral Flexion (R)	2.40059	0.008184 (s)
Rotation (L)	0.662541	0.253811 (ns)
Rotation (R)	0.509902	0.305058 (ns)

The null hypothesis is rejected for the experimental group as the results indicated a statistically significant difference between the first and final treatments, demonstrating an improvement as a result of the treatment.

4.4.2.3 Algometer

TABLE 4.21 One sample analysis of algometer readings for the control group:

	tx1 - tx4	tx4 - txF	tx1 - txF
Test Statistic	2.93987	2.21359	3.32715
P value (sig)	<u>0.00164</u> (s)	<u>0.01342</u> (s)	<u>0.00043</u> (s)

TABLE 4.22 One sample analysis of algometer readings for the experimental group:

	tx1 - tx4	tx4 - txF	tx1 - txF
Test Statistic	2.93987	2.7735	3.43617
P value (sig)	<u>0.001641</u> (s)	<u>0.002772</u> (s)	<u>0.00029</u> (s)

The null hypothesis is rejected for both the experimental and control groups as there was a statistically significant difference between the first and final treatments, indicating that there was an improvement as a result of the treatment.

4.4.2.3 CMCC Pain Disability Index

TABLE 4.23 One sample analysis of CMCC Neck Disability Index for the control group:

	tx1 - tx4	tx4 - txF	tx1 - txF
Test Statistic	2.4535	0.66666	2.72622
P value (sig)	<u>0.008078</u> (s)	0.252491 (ns)	<u>0.0080784</u> (s)

TABLE 4.24 One sample analysis of CMCC Neck Disability Index for the experimental group:

	tx1 - tx4	tx4 - txF	tx1 - txF
Test Statistic	1.87083	2.66667	3.43617
P value (sig)	0.030684 (s)	<u>0.00383</u> (s)	<u>0.000295</u> (s)

The null hypothesis is rejected for both the experimental and control groups as there was a statistically significant difference between the first and final treatments, indicating that there was an improvement as a result of the treatment.

4.4.2.4 McGill Short-Form Pain Questionnaire

TABLE 4.25 One sample analysis of McGill Short-Form Pain Questionnaire Index for the control group:

	tx1 - tx4	tx4 - txF	tx1 - txF
Test Statistic	1.87083	2.84605	3.02898
P value (sig)	0.030684 (s)	0.002213 (s)	0.000666 (s)

TABLE 4.26 One sample analysis of McGill Short-Form Pain Questionnaire Index for the experimental group:

	tx1 - tx4	tx4 - txF	tx1 - txF
Test Statistic	1.87083	2.84605	3.43617
P value (sig)	0.030684 (s)	0.002213 (s)	0.000295 (s)

The null hypothesis is rejected for both the experimental and control groups as there was a statistically significant difference between the first and final treatments, indicating that there was an improvement as a result of the treatment.

4.4.2.5 Numerical Pain Rating Scale

TABLE 4.27 One sample analysis of Numerical Pain Rating Scale
for the control group:

	tx1 - tx4	tx4 - txF	tx1 - txF
Test Statistic	1.6614	1.58114	2.69939
P value (sig)	0.048046 (s)	0.056923 (s)	<u>0.0034733 (s)</u>

TABLE 4.28 One sample analysis of Numerical Pain Rating Scale
for the experimental group:

	tx1 - tx4	tx4 - txF	tx1 - txF
Test Statistic	1.87083	3.17453	3.43617
P value (sig)	0.030684 (s)	<u>0.000748 (s)</u>	<u>0.000295 (s)</u>

The null hypothesis is rejected for both the experimental and control groups as there was a statistically significant difference between the first and final treatments, indicating that there was an improvement as a result of the treatment.

4.4.3 Non-Parametric Unpaired Hypothesis Tests

4.4.3.1 Range of Motion

Flexion:

TABLE 4.29 Two sample analysis of flexion measurements comparing the experimental group and control group:

	tx1 contr - tx1 exp	tx4 contr - tx4 exp	txF contr - txF exp
Test Statistic	1.81831	2.12291	2.02411
P value (sig)	0.03451 (s)	0.016880 (s)	0.021479 (s)

Extension:

TABLE 4.30 Two sample analysis of extension measurements comparing the experimental group and control group:

	tx1 contr - tx1 exp	tx4 contr - tx4 exp	txF contr - txF exp
Test Statistic	0.500135	1.13366	0.438604
P value (sig)	0.30848 (ns)	0.128468 (ns)	0.330472 (ns)

Lateral Flexion (R):

TABLE 4.31 Two sample analysis of lateral flexion (R)
measurements comparing the experimental group and
control group:

	tx1 contr - tx1 exp	tx4 contr - tx4 exp	txF contr - txF exp
Test Statistic	0.795822	0.786838	0.881294
P value (sig)	0.21306 (ns)	0.215687 (ns)	0.189078 (ns)

Lateral Flexion (L):

TABLE 4.32 Two sample analysis of lateral flexion (L)
measurements comparing the experimental group and
control group:

	tx1 contr - tx1 exp	tx4 contr - tx4 exp	txF contr - txF exp
Test Statistic	0.229126	0.0231423	0.23206
P value (sig)	0.40938 (ns)	0.49076 (ns)	0.408243 (ns)

Rotation (R):

TABLE 4.33 Two sample analysis of rotation (R) measurements
comparing the experimental group and control group:

	tx1 contr - tx1 exp	tx4 contr - tx4 exp	txF contr - txF exp
Test Statistic	1.04347	0.392006	1.14653
P value (sig)	0.14836 (ns)	0.34752 (ns)	0.12578 (ns)

Rotation (L):

TABLE 4.34 Two sample analysis of rotation (L) measurements
comparing the experimental group and control group:

	tx1 contr - tx1 exp	tx4 contr - tx4 exp	txF contr - txF exp
Test Statistic	1.00966	2.58665	1.48247
P value (sig)	0.15632 (ns)	0.004847 (s)	0.069108 (s)

The null hypothesis is accepted as it was shown that 66.67% of the measurements did not indicate a statistically significant difference between final treatments of the experimental and control groups, indicating that there was no difference in the efficacy of the treatments.

4.4.3.2 Difference in pre and post goniometric measurements

TABLE 4.35 Two sample analysis of pre-treatment and post-treatment **flexion** goniometric measurements comparing the experimental group and control group:

	tx1 contr - tx1 exp	txF contr - txF exp
Test Statistic	0.9735	-0.176581
P value (sig)	0.18843 (ns)	0.43027 (ns)

TABLE 4.36 Two sample analysis of pre-treatment and post-treatment **extension** goniometric measurements comparing the experimental group and control group:

	tx1 contr - tx1 exp	txF contr - txF exp
Test Statistic	0.974329	-0.611511
P value (sig)	0.19432 (ns)	0.27042 (ns)

TABLE 4.37 Two sample analysis of pre-treatment and post-treatment lateral flexion (L) goniometric measurements comparing the experimental group and control group:

	tx1 contr - tx1 exp	txF contr - txF exp
Test Statistic	0.98661	0.578459
P value (sig)	0.19270 (ns)	0.28147 (ns)

TABLE 4.38 Two sample analysis of pre-treatment and post-treatment lateral flexion (R) goniometric measurements comparing the experimental group and control group:

	tx1 contr - tx1 exp	txF contr - txF exp
Test Statistic	1.633495	1.06456
P value (sig)	0.10065 (ns)	0.14353 (ns)

TABLE 4.39 Two sample analysis of pre-treatment and post-treatment rotation (L) goniometric measurements comparing the experimental group and control group:

	tx1 contr - tx1 exp	txF contr - txF exp
Test Statistic	1.4491305	0.984356
P value (sig)	0.13324 (ns)	0.16246 (ns)

TABLE 4.40 Two sample analysis of pre-treatment and post-treatment rotation (R) goniometric measurements comparing the experimental group and control group:

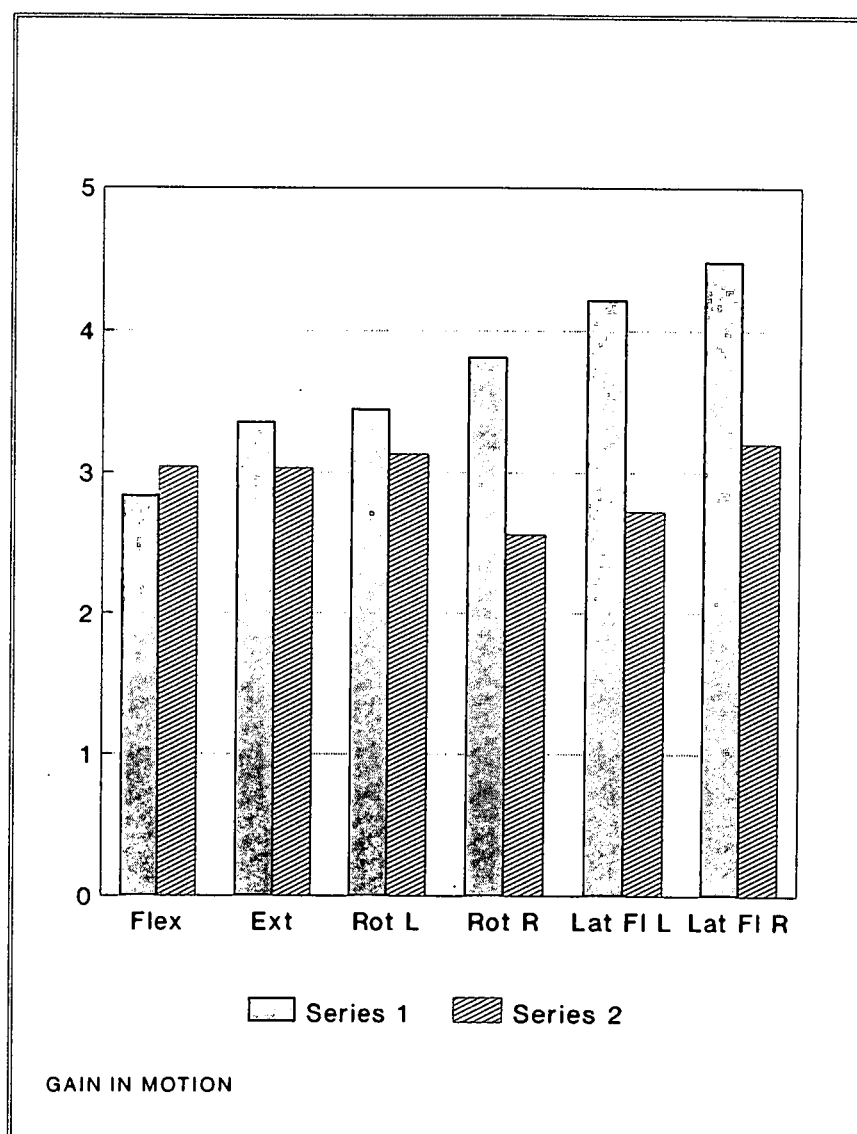
	tx1 contr - tx1 exp	txF contr - txF exp
Test Statistic	0.431455	1.17086
P value (sig)	0.33354 (ns)	0.12082 (ns)

The null hypothesis is accepted as it was shown that the data did not indicate a statistically significant difference between final treatments of the experimental and control groups, indicating that there was no difference in the efficacy of the treatments.

FIGURE 4.1 Gain in cervical range of motion after manipulation:

Key: Series 1 - Experimental group

Series 2 - Control group



4.4.3.3 Algometer

TABLE 4.41 Two sample analysis of algometer measurements
comparing the experimental group and control group:

	tx1 contr - tx1 exp	tx4 contr - tx4 exp	txF contr - txF exp
Test Statistic	-0.851438	-1.05897	-1.04066
P value (sig)	0.19726 (ns)	0.144805 (ns)	0.29803 (ns)

The null hypothesis is accepted as it was shown that the algometer readings did not indicate a statistically significant difference between final treatments of the experimental and control groups, indicating that there was no difference in the efficacy of the treatments.

4.4.3.3 CMCC Neck Disability Index

TABLE 4.42 Two sample analysis of CMCC Neck Disability Index
measurements comparing the experimental group and
control group:

	tx1 contr - tx1 exp	tx4 contr - tx4 exp	txF contr - txF exp
Test Statistic	-0.604783	0.395013	-0.869569
P value (sig)	0.27263 (ns)	0.34641 (ns)	0.19226 (ns)

The null hypothesis is accepted as it was shown that the CMCC Neck Disability Index data did not indicate a statistically significant difference between the experimental and control groups, indicating that there was no difference in the efficacy of the treatments.

4.4.3.4 McGill Short-Form Pain Questionnaire

TABLE 4.43 Two sample analysis of McGill Short-Form Pain Questionnaire Index measurements comparing the experimental group and control group:

	tx1 contr - tx1 exp	tx4 contr - tx4 exp	txF contr - txF exp
Test Statistic	0.580887	1.24417	-0.232623
P value (sig)	0.28065 (ns)	0.106718 (ns)	0.408024 (ns)

The null hypothesis is accepted as it was shown that the McGill Short Form Pain Questionnaire data did not indicate a statistically significant difference between the experimental and control groups, indicating that there was no difference in the efficacy of the treatments.

4.4.3.5 Numerical Pain Rating Scale

TABLE 4.44 Two sample analysis of Numerical Pain Rating Scale measurements comparing the experimental group and control group:

	tx1 contr - tx1 exp	tx4 contr - tx4 exp	txF contr - txF exp
Test Statistic	-0.769918	0.207105	-0.459801
P value (sig)	0.22067 (ns)	0.417961 (ns)	0.39463 (ns)

The null hypothesis is accepted as it was shown that the Numerical Pain Rating Scale data did not indicate a statistically significant difference between the experimental and control groups, indicating that there was no difference in the efficacy of the treatments.

4.4.4 Age and gender of patients

TABLE 4.45 The average age and gender distribution of the patients:

Average age of patients	35.37 yrs
Number of male and female patients	M: 19 F: 11

FIGURE 4.2 Age distribution of patients:

Key: Series 1 - Control group

Series 2 - Experimental group

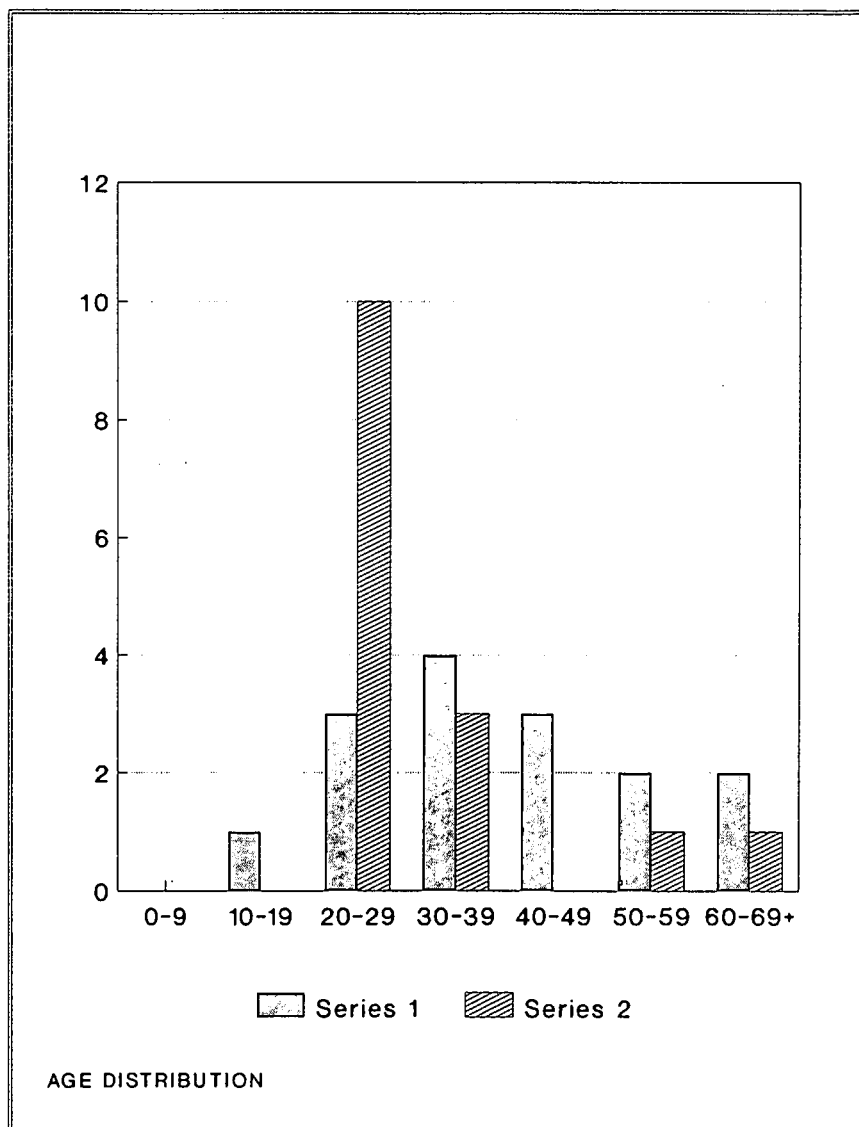
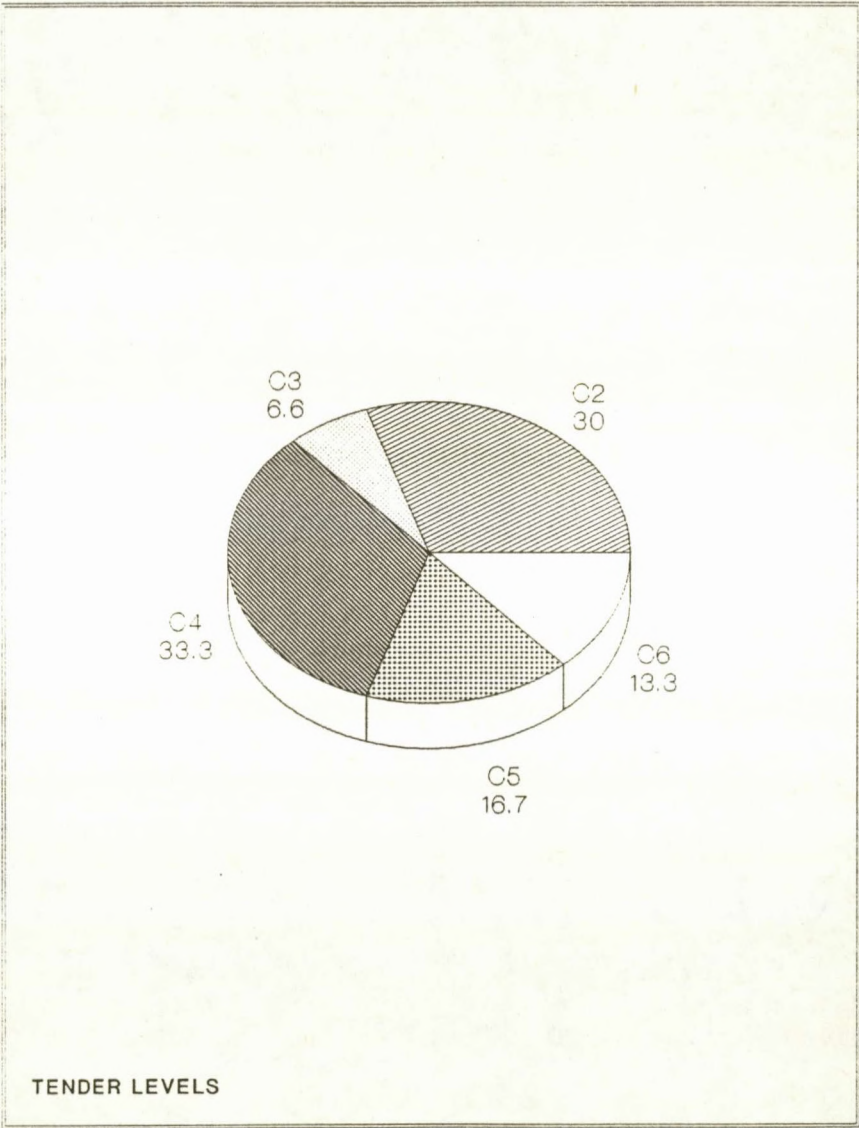


FIGURE 4.3 Most frequent levels of joint dysfunction:



4.5 STATISTICAL QUALITY CONTROL

Statistical quality control was conducted on the results using X-bar-chart and R-chart at an error tolerance level (α) of 3. The paired and unpaired statistical processes were assessed, with each group consisting of 2 samples. Each sample size consisted of 16 units.

It was found that the statistical processes were within acceptable limits, indicating that they were of sufficient statistical quality.

Below are the results of the quality control tests:

Results

Upper Control Limit (X-Chart):	0.2663
Calculated Process Average (X-Chart)	0.1122
Lower Control Limit (X-Chart):	0
Upper Control Limit (R-Chart):	0.2681
Calculated Process Average (R-Chart)	0.0820
Lower Control Limit (R-Chart):	0

Upper Control Limit (X-Chart):	0.3701
Calculated Process Average (X-Chart)	0.2227
Lower Control Limit (X-Chart):	0.0754
Upper Control Limit (R-Chart):	0.2563
Calculated Process Average (R-Chart)	0.0784
Lower Control Limit (R-Chart):	0

FIGURE 4.4 The X-bar-chart and R-chart of the paired results:

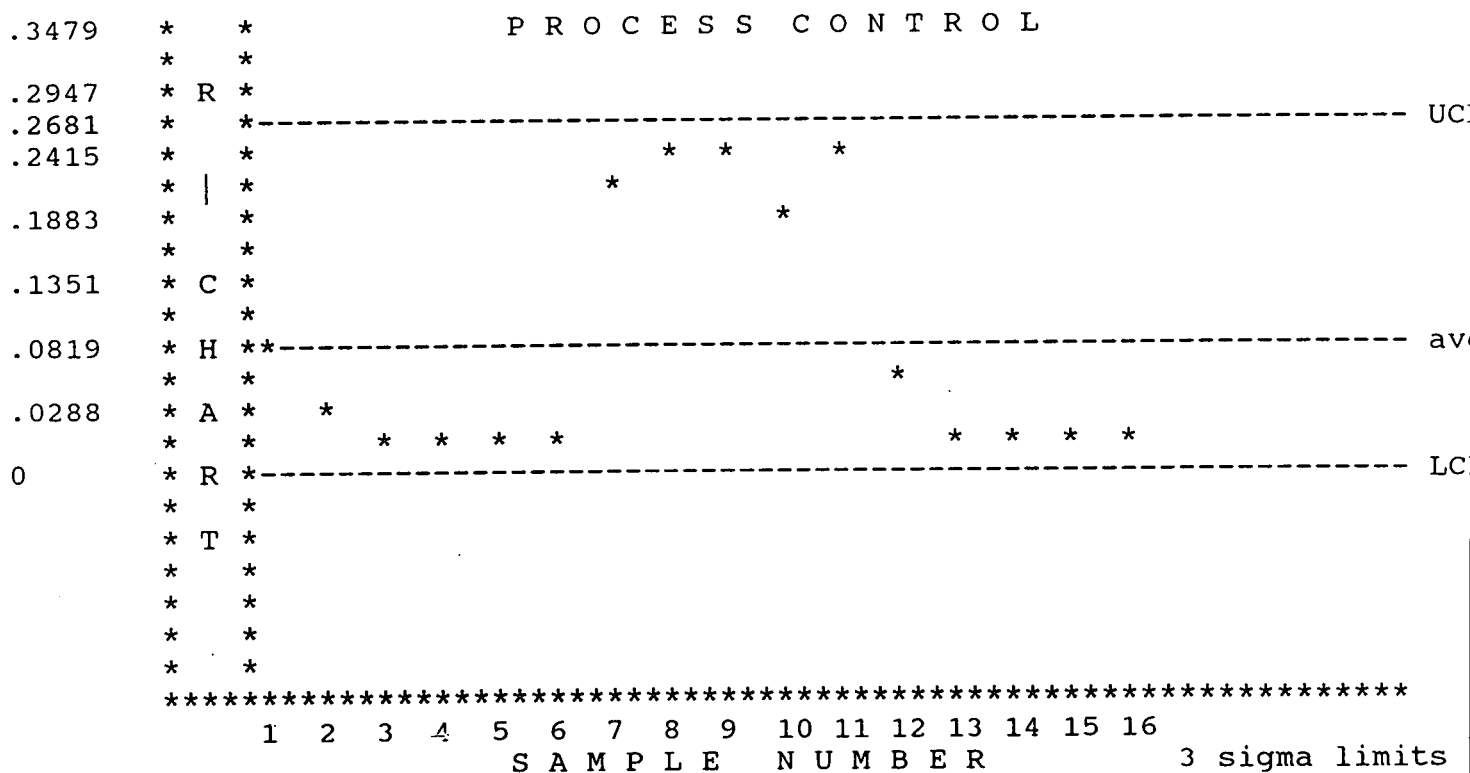
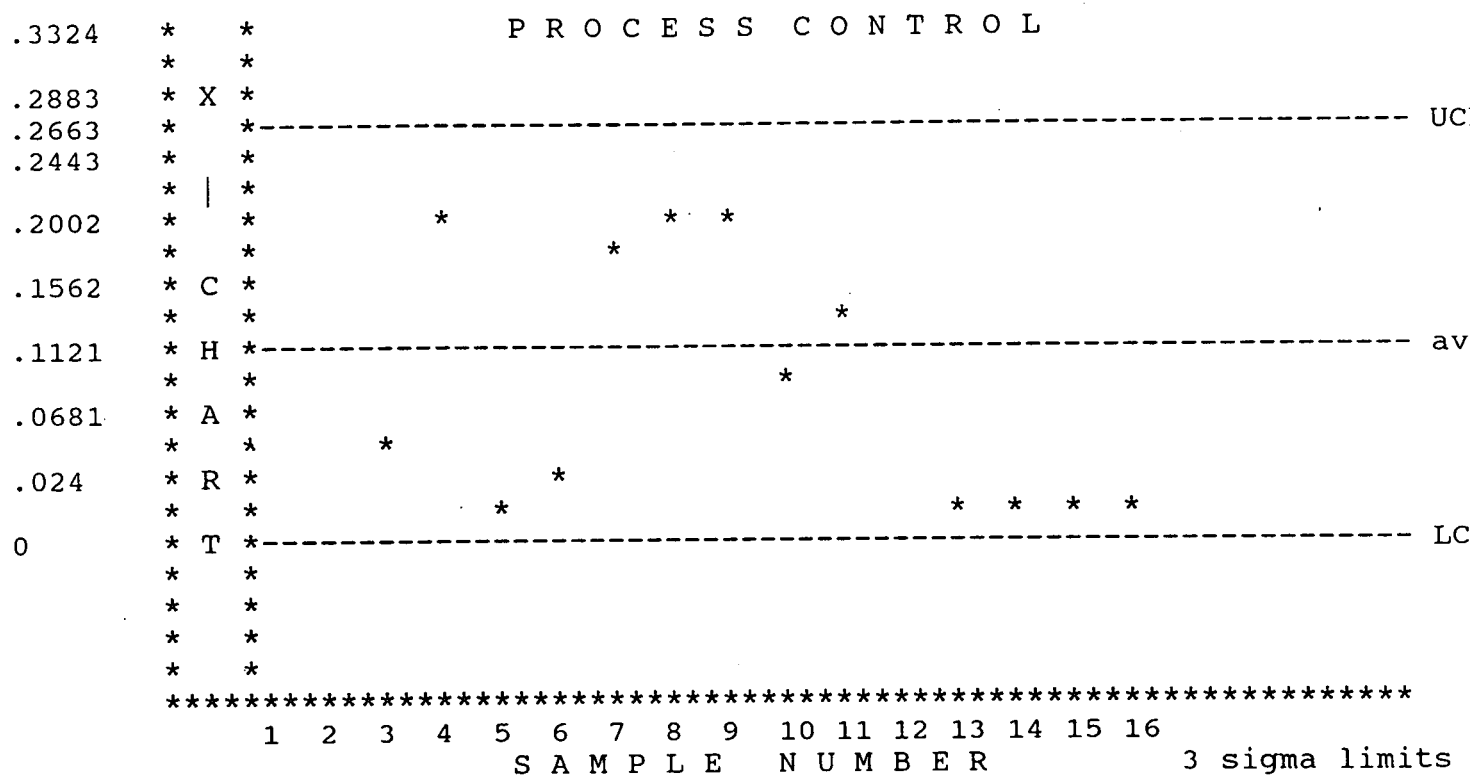
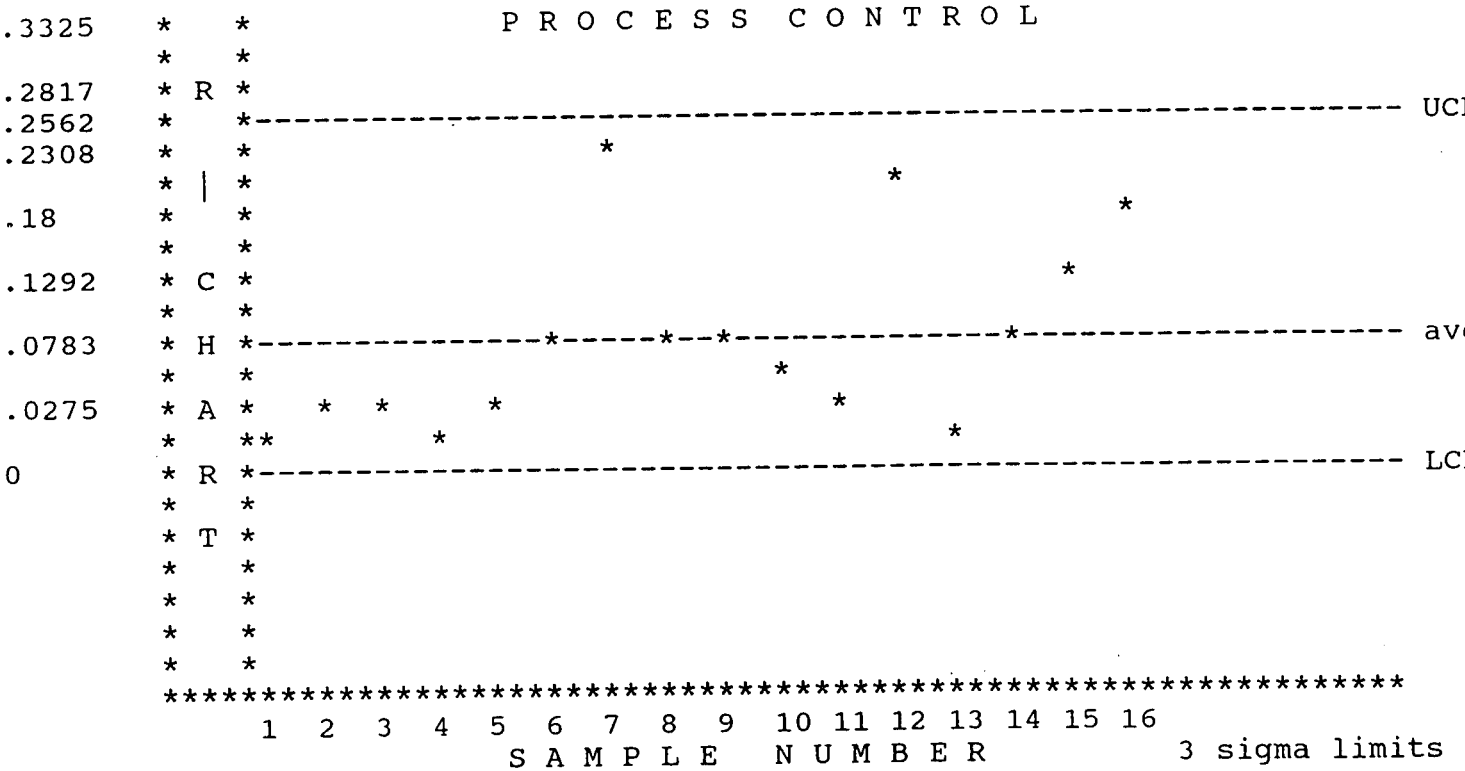
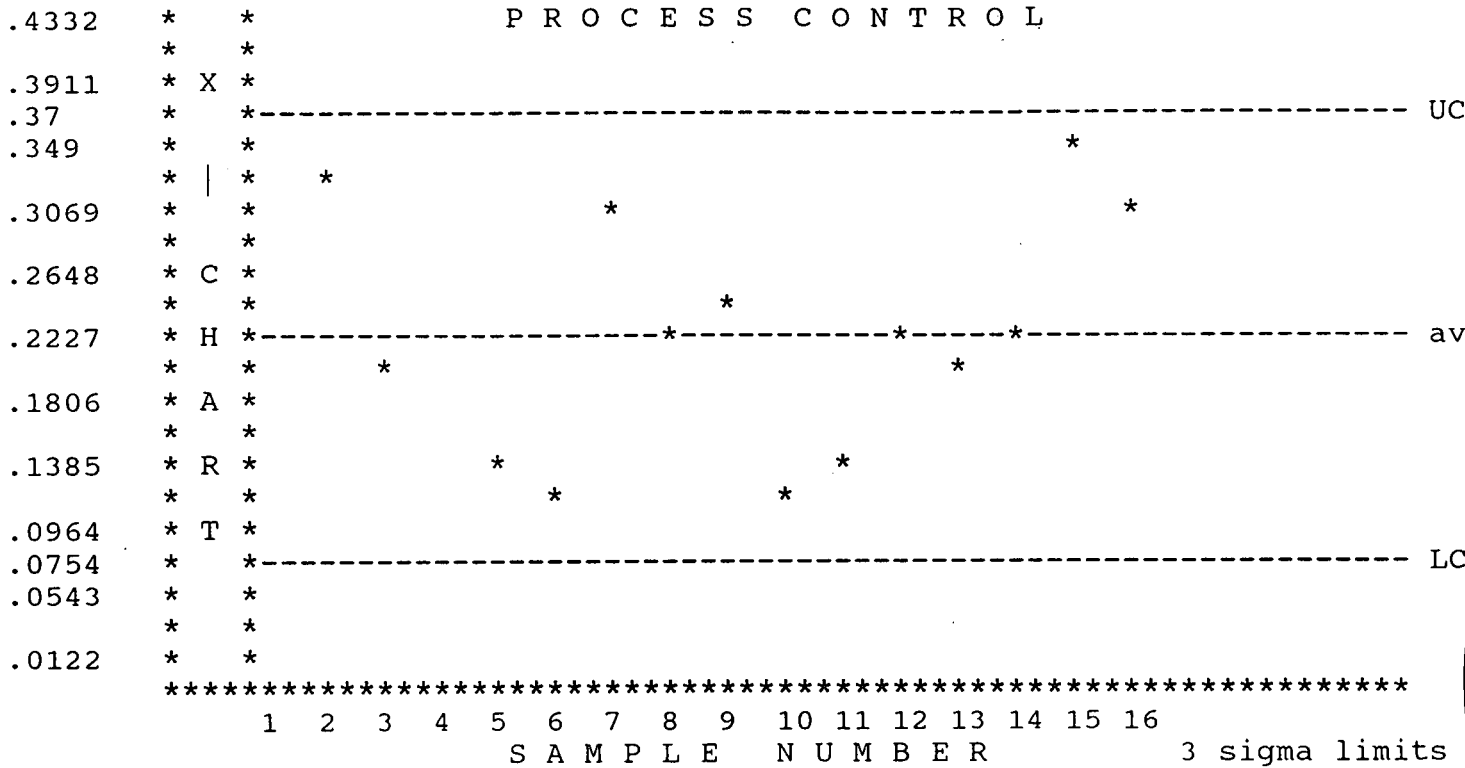


FIGURE 4.5 The X-bar-chart and R-chart of the unpaired results:



CHAPTER FIVE

DISCUSSION

5.1 INTRODUCTION

This chapter involves the discussion of the results obtained from the questionnaires, goniometer and algometer.

The results are discussed in two sections: (1) the subjective results, and (2) the objective results. Each of the measurement parameters is discussed separately and comprises of both the intra-treatment and inter-treatment statistical evaluation.

The evaluation of the intra-treatment results of the first and final treatments give an indication of the efficacy of the treatment regime. The comparison of: (1) the first and fourth treatments, and (2) the fourth and final treatments are also evaluated in order to determine during which treatment interval the most favourable response to the treatment was shown.

The inter-treatment evaluation, assessing the first treatment measurements, exhibits any difference in the subjective and objective findings between the two patient groups, in terms of their original signs and symptoms.

Comparison of the fourth treatment measurements demonstrates the rate of improvement. The inter-treatment evaluation of the final treatment measurements indicate which treatment method is more effective.

5.2 THE SUBJECTIVE DATA

5.2.1 The CMCC Neck Disability Index

5.2.1.1 Intra-treatment Comparison

The paired analysis of the median measurements of the CMCC Neck Disability Index revealed that there was a significant improvement in both the control and experimental groups, in terms of a reduction in disability.

A comparison of (1) the first and fourth treatments, and (2) the fourth and final treatments demonstrated that both the control and experimental groups had improved in the first treatment interval.

However, it was shown that only the experimental group showed a significant change in the second treatment interval.

This suggests that the patients in the control group showed most improvement in the first treatment interval, whereas the patients in the experimental group showed improvement throughout the treatment period.

5.2.1.2 Inter-treatment Comparison

The comparison of the median measurements of the initial consultations indicated that there was no difference in the original degree of disability caused by the neck pain. This indicates that both treatment groups were similar in nature in terms of disability.

Analysis of the median measurements of the: (1) last treatment, and (2) the fourth treatment of the treatment groups indicated that both treatments were equally effective over the same treatment period and that the patient recovery rate was similar.

The average perceived disability (Table 4.1) also demonstrates the similarity between the two treatment groups (10.54% - control and 10.19% - experimental).

5.2.2 The McGill Short-Form Pain Questionnaire

5.2.2.1 Intra-treatment Comparison

The statistical evaluation of the median measurements of the McGill Short-Form Pain Questionnaire illustrated a significant improvement in both the control and experimental groups, in terms of the reduction in patients' perception of pain.

Comparing the median measurements of: (1) the first and fourth treatments, and (2) the fourth and final treatments confirmed

that both the control and experimental groups had shown improvement during both stages of the treatment.

5.2.2.2 Inter-treatment Comparison

The statistical evaluation of the medial measurements of the initial consultations indicated a resemblance in the original degree of pain intensity caused by the neck pain, suggesting that both treatment groups were similar in nature.

Further comparison of the: (1) last treatments, and (2) the fourth treatments of the control and experimental groups indicated that both treatments were equally effective over the same treatment period and that the patient recovery rate was similar.

The average pain perception (Table 4.1) was also comparable (7.92% - control and 9.47% - experimental), indicating a similarity in the improvement.

5.2.3 The Numerical Pain Rating Scale

5.2.3.1 Intra-treatment Comparison

The median measurements of the Numerical Pain Rating Scale were evaluated and it was revealed that there was a significant improvement in both the control and experimental groups, in terms of the reduction in patients' pain intensity.

A comparison of: (1) the first and fourth treatments, and (2) the fourth and final treatments was also conducted, and the results showed that both the control and experimental groups had improved at these stages of the treatment. This confirms that both treatment groups demonstrated an improvement throughout the treatment period.

5.2.3.2 Inter-treatment Comparison

The statistical comparison of the initial consultations, using the median measurements, displayed no difference in the original degree in pain intensity, indicating a similarity in nature in terms of pain intensity.

Further statistical analysis showed that the data was not significantly different when comparing the median measurements of the: (1) last treatments, and (2) the fourth treatments. This suggested that both treatments were equally effective over the same treatment period and that the patient recovery rate was similar.

The average pain perception (Table 4.1) between control and experimental group failed to show a significant difference (26.29% and 23.09% respectively), indicating a comparable improvement in pain intensity.

5.2.4 Problems Encountered with Regards to the Subjective Results

It was realised that both treatment protocols were similar in nature and thus the data did not reveal a vast statistical difference. The only difference between the two treatments was the added area of manipulation in the experimental group. The questionnaires may not have been sensitive to subtle changes in pain intensity and disability. A larger sample size may make the recovery rate more apparent.

5.2.5 General Discussion of the Subjective Data

It was hypothesised that both treatment groups would show favourable results in terms of the subjective measurement methods. It was also hypothesised that combined cervical and thoracic manipulation would be more effective than just cervical manipulation in terms of the patients' subjective responses.

The results indicate that both patient groups responded favourably to their respective treatments and that each treatment method acted with equivalent efficacy and that the rate of patient improvement was similar (figure 5.1). The first hypothesis, stating that there would be a similarity in the efficacy of the two treatment groups, is accepted and the second hypothesis, stating that combined cervical and thoracic manipulation would be more effective than just cervical manipulation, is rejected.

However, the overall average subjective responses (in percentages) of the patients revealed that the experimental group experienced a greater improvement in terms of pain and disability (71.26% - experimental and 54.12% - control), but these figures had no statistical relevance.

The data in this project support the findings of Mennel (1990), Howe et.al. (1983), Sloop et.al. (1982) and Cassidy et.al. (1992), where manipulation has shown to be beneficial within a short treatment period. The patient/ doctor approach and education of the patients concerning their condition may have contributed to the favourable results.

5.3 THE OBJECTIVE DATA

5.3.1 Cervical Range of Motion

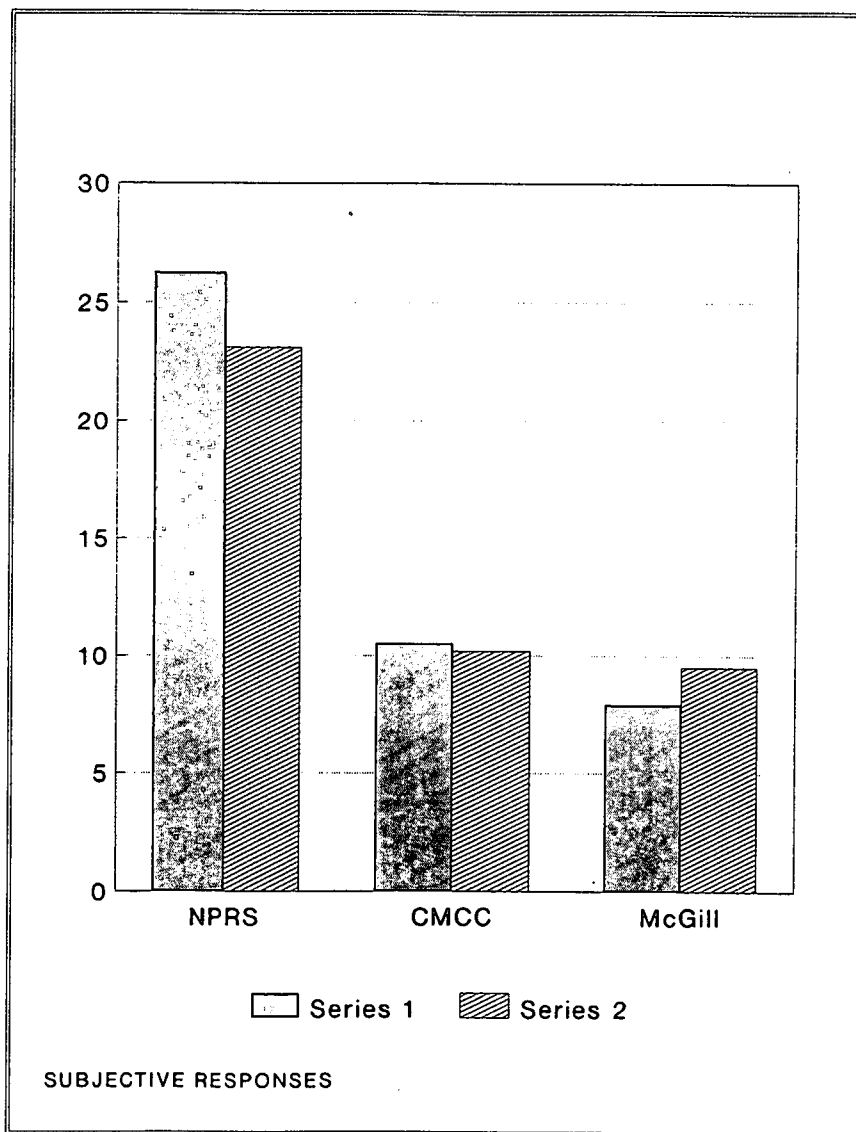
5.3.1.1 Intra-treatment Comparison

The six ranges of motion of the cervical spine were considered, with the first and last treatment measurements being evaluated. It was demonstrated that flexion, right lateral flexion and left rotation were significantly different. The experimental group demonstrated a significant difference in flexion, right lateral flexion, right rotation and left rotation. No significant findings were observed in extension and left lateral flexion. This suggests that there was a clinically significant improvement in the above ranges of motion.

FIGURE 5.1 The subjective data comparing the experimental and control groups:

Key: Series 1 - Control group

Series 2 - Experimental group



A comparison of (1) the first and fourth treatment, and (2) the fourth and final treatment was also conducted. It was demonstrated that the control group showed a significant difference in right lateral flexion (in the second treatment interval), and right rotation (in the first treatment interval). Both treatment intervals did not show any significant improvement in the other ranges of motion.

The experimental group demonstrated significant variations in flexion (in the second treatment interval), right rotation (in the first treatment interval), and left rotation (in the first treatment interval). The other ranges of motion did not indicate significant differences for the two treatment intervals.

The results suggest that there were positive improvements in the ranges of motion mentioned above.

5.3.1.2 Inter-treatment Comparison

The statistical comparison of the median measurements of the initial consultations illustrated the similarity in nature of the two groups in terms of the ranges of motion, except for flexion.

Further statistical analysis of the median measurements comparing: (1) the last treatments, and (2) the fourth treatments showed that the data was not significantly different except for flexion and left rotation. This suggested that both treatments

had a positive influence with respect to the cervical ranges of motion and indicated that they were equally effective over the same treatment period (figure 5.2). The average ranges of motion (in degrees) for the control and experimental groups (table 4.3) also supports this similarity.

5.3.2 Difference between Pre-treatment and Post-treatment Goniometric Measurements

5.3.2.1 Intra-treatment Comparison

The differences between the pre-treatment and post-treatment goniometric measurements for the control group did not reveal any significant findings, except for left rotation, when comparing the median measurements of the first and final treatments.

The experimental group, however, displayed significant findings for flexion, extension, and left and right lateral flexion.

Based on the number of positive findings it is suggested that the experimental group indicated a greater increase in cervical movement after manipulation.

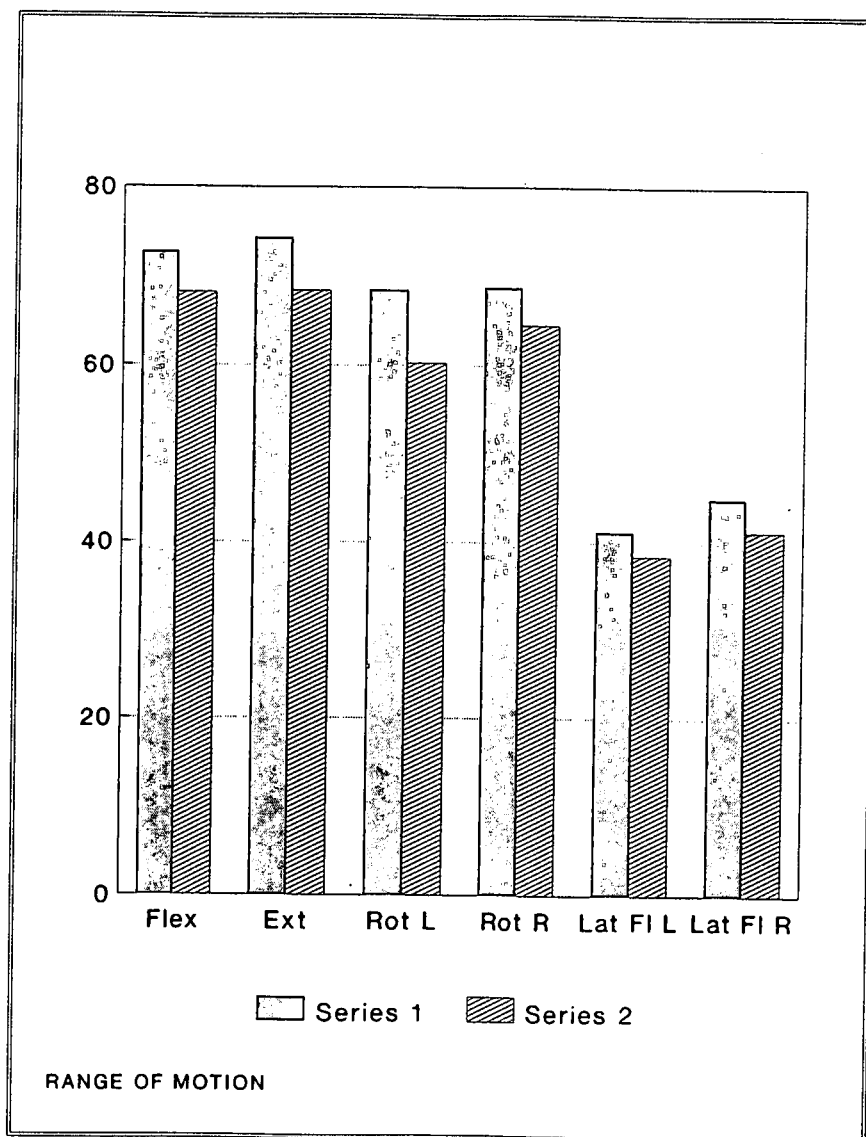
5.3.2.2 Inter-treatment Comparison

The statistical comparison of the initial consultations confirmed that there was no variation in the cervical ranges of motion after manipulation between the two treatment groups.

FIGURE 5.2 Comparison of the experimental group and control
group ranges of motion:

Key: Series 1 - Experimental group

Series 2 - Control group



Statistically it was shown that both treatments were equally effective in increasing all six cervical spine ranges of motion over the treatment period.

Diagrammatically, however, it is suggested that a greater increase in cervical movement after manipulation is observed in the experimental group, but that this was not shown to be statistically significant (figure 4.1).

5.3.3 The Algometer Readings

5.3.3.1 Intra-treatment Comparison

The results indicate that there was an improvement in the pressure/ pain threshold of the patients in both treatment groups and that they improved throughout the course of the treatment period. This was deduced from the positive results observed after paired evaluation using the median measurements of the first, fourth and final treatments.

5.3.3.2 Inter-treatment Comparison

Comparison of the initial treatment algometer readings demonstrated that there was no significant difference, indicating that the original pressure/ pain thresholds of the patients in both treatment groups were similar.

On analysis of the final and fourth treatment measurements it was found that both treatments were equally effective over the same treatment period and that the patient recovery rate was similar (figure 5.3).

The average algometer readings (table 4.2) also supports the favourable results stated above (3.56 kg/cm - experimental and 4.56 kg/cm - control).

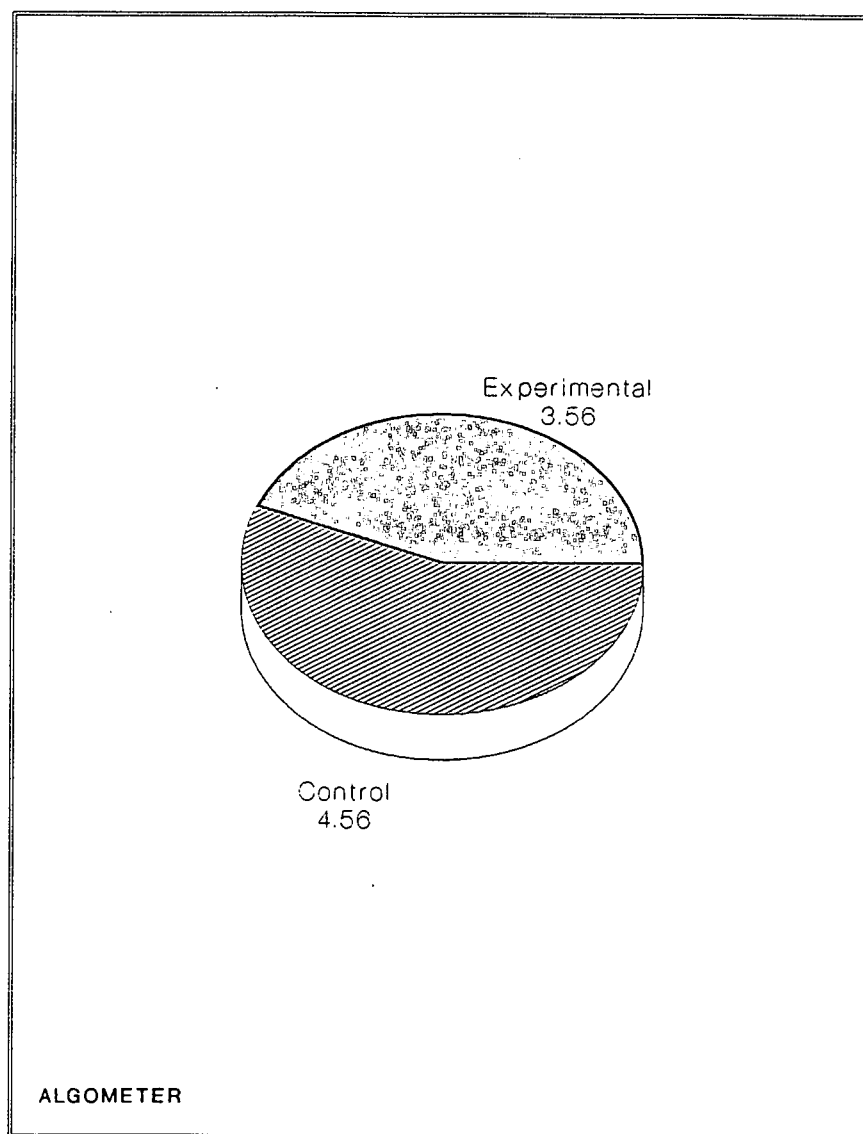
5.3.4. Problems Encountered with Regards to the Objective Measuring Parameters

Considering that the goniometer was calibrated in increments of two degrees, the instrument may not have been sensitive to subtle variations in cervical motion, making the accuracy of the measurements questionable. However, it must be noted that the act of measuring or user's error may also have contributed to variations in readings. With these factors in mind the goniometric readings should be interpreted with discretion.

5.3.5 General Discussion of the Objective Data

The trend of statistically positive results supports the hypothesis that both treatments are effective in the treatment of mechanical neck pain and that they are consistent with that of the subjective findings. The third hypothesis which states that both treatment groups would be equally effective is accepted.

FIGURE 5.3 Comparison of the experimental group and control group algometer readings:



Concerning the average difference between pre-treatment and post-treatment goniometric readings, it was confirmed that manipulation does result in an increase in cervical range of motion and that there were similar findings in both treatment groups.

It is suggested by the author that the experimental group did show a greater gain in range of motion after manipulation than the control group, although the results did not show any statistical relevance.

The data in this project supports the findings of Cassidy et.al. (1992 : 495), where it was stated that there is a correlation between an increase in cervical rotation and a decrease in neck pain, as a result of manipulation.

5.4 COMPARISON OF THE RESULTS WITH PAST RESEARCH

A study conducted by Mennel (1990: 10), using manipulation, revealed that of the 83 patients treated, 30% of the patients improved markedly, 34% showed moderate improvement, and 29% showed mild improvement. The experimental group in this study demonstrated a greater number of patients exhibiting a marked improvement (figure 5.4). However, the measuring criteria of the two studies were different, which makes direct comparison difficult. Interestingly, Mennel (1990: 11) states that age has little bearing on the results, which may also be applicable to this study.

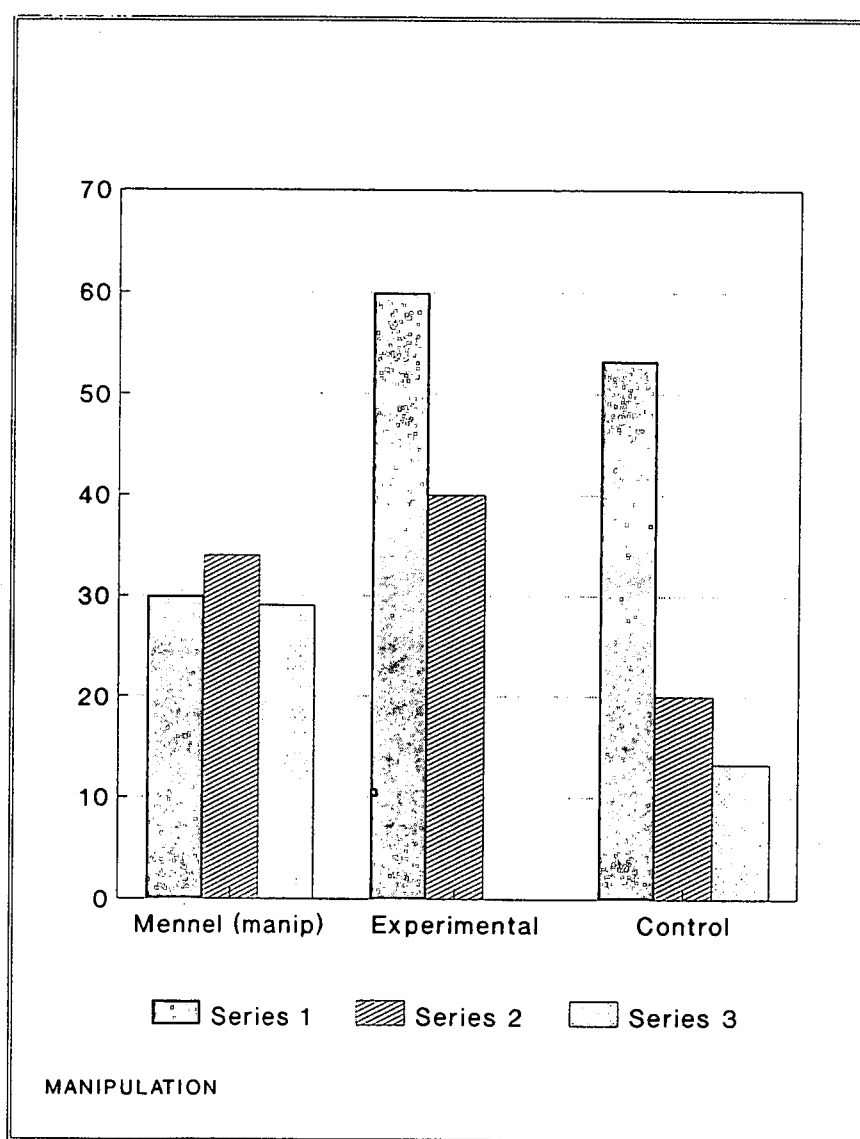
FIGURE 5.4 Comparison of Mennel's (1990: 10) manipulation study
to this study's groups:

Key: Series 1 - marked improvement

Series 2 - moderate improvement

Series 3 - mild improvement

These results are based on the number of patients that showed an improvement.



In a study by Sloop et.al. (1982: 532), the control group was treated with diazepam and the experimental group received diazepam and medical manipulation. The results indicated that 57% of the experimental group and 28% of the control group responded affirmatively. However, this difference was not statistically significant. All the patients remained unimproved 3 weeks after the treatment. This project shows that over a 3 week period only 13.3% of the patients in the control group, and none in the experimental group, showed any regression. This may suggest that chiropractic manipulative treatment brings about superior short-term improvements (figure 5.5).

A comparison of manual therapy (manipulation) and physiotherapy in a study by Koes et.al. (1993: 216) demonstrated that patients who underwent manipulation improved by 48%, whereas patients treated with physiotherapy improved by only 34%. The improvements in this study exceed the results shown by Koes et.al. (1993: 216) (figure 5.6). However, a direct comparison of the findings may be misleading as this study has no follow-up treatment.

It has also been reported by Cassidy et.al. (1993: 495) that there is a reduction in neck pain (figure 5.7) after manipulation and that there is a relationship between a decrease in pain and increase in cervical rotation.

FIGURE 5.5 Comparison of Sloop et.al's. (1982: 532) medical manipulation study to this study's treatment groups:

Key: Series 1 - Manipulation and medication (Sloop et.al.)

Series 2 - Medication only (Sloop et.al.)

Series 3 - Experimental group

Series 4 - Control Group

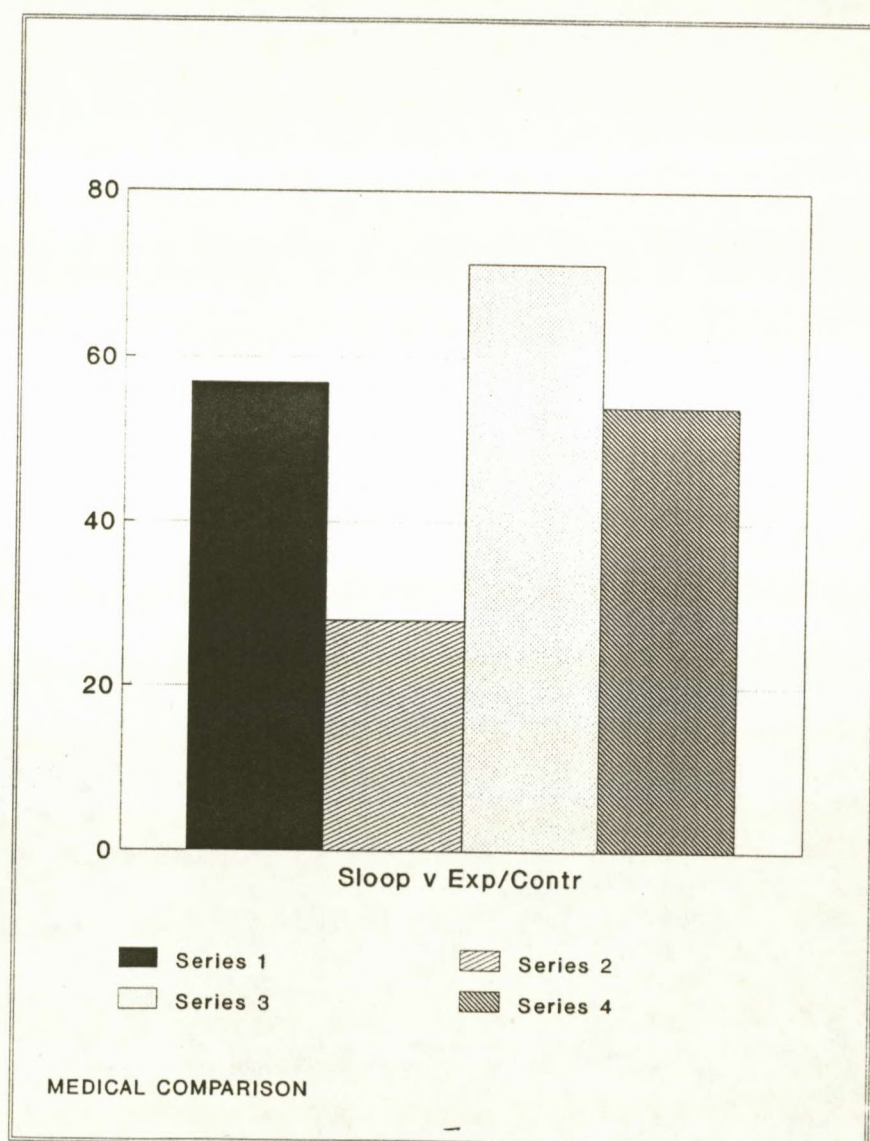
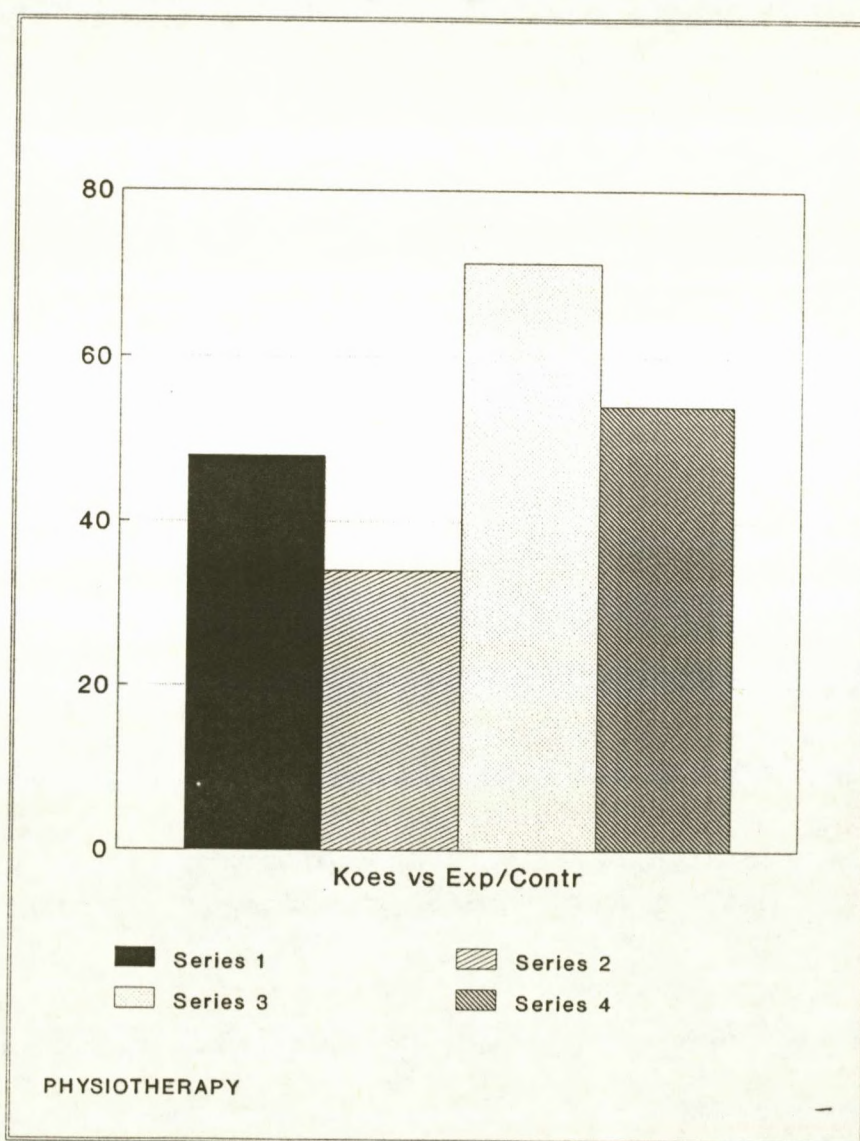


FIGURE 5.6 Comparison of Koes et.al's. (1993: 216) study on
physiotherapy and manipulation to this study's
treatment groups:

Key: Series 1 - Manipulation (Koes et.al.)
Series 2 - Physiotherapy (Koes et.al.)
Series 3 - Experimental group
Series 4 - Control Group



The results produced by Cassidy et.al. (1993: 495) correlate well with the results of this project, especially in terms of the goniometric readings and the increase in cervical movement after manipulation (figure 5.8). This suggests that manipulation does bring about pain relief and increases the range of motion of the cervical spine (figure 5.9).

Note, however, that the study by Cassidy et.al. (1993: 495) was a pilot study and that only a single manipulation was given to each patient. Also, there was no control group which may have diminished the validity of his results. Therefore, direct comparisons with this research is to be conducted with caution.

Much has been written about spinal biomechanics and the joint coupling mechanism. However, little is known about how altered biomechanics of a particular spinal area may influence the kinematic chain of the entire spine. An ulterior motive of this study was to examine if combined cervical and thoracic manipulation would produce superior results, on the assumption that thoracic joint dysfunction was a consequence of cervical joint dysfunction.

It has been shown by Leach (1983: 20) that cervical manipulation can be successful in correcting biomechanical disorders of the spine, deduced from cervical spine x-rays. In research conducted by Leach (1983: 19) it was shown that the experimental group, that received manipulation, was significantly improved when compared to the control group which were not manipulated.

FIGURE 5.7 Comparison of Cassidy et. al's. (1993: 495) study on manipulation (NPRS 101-Scale) to this study's treatment groups:

Key: Series 1 - Experimental group
Series 2 - Control group
Series 3 - Manipulation (Cassidy et.al.)

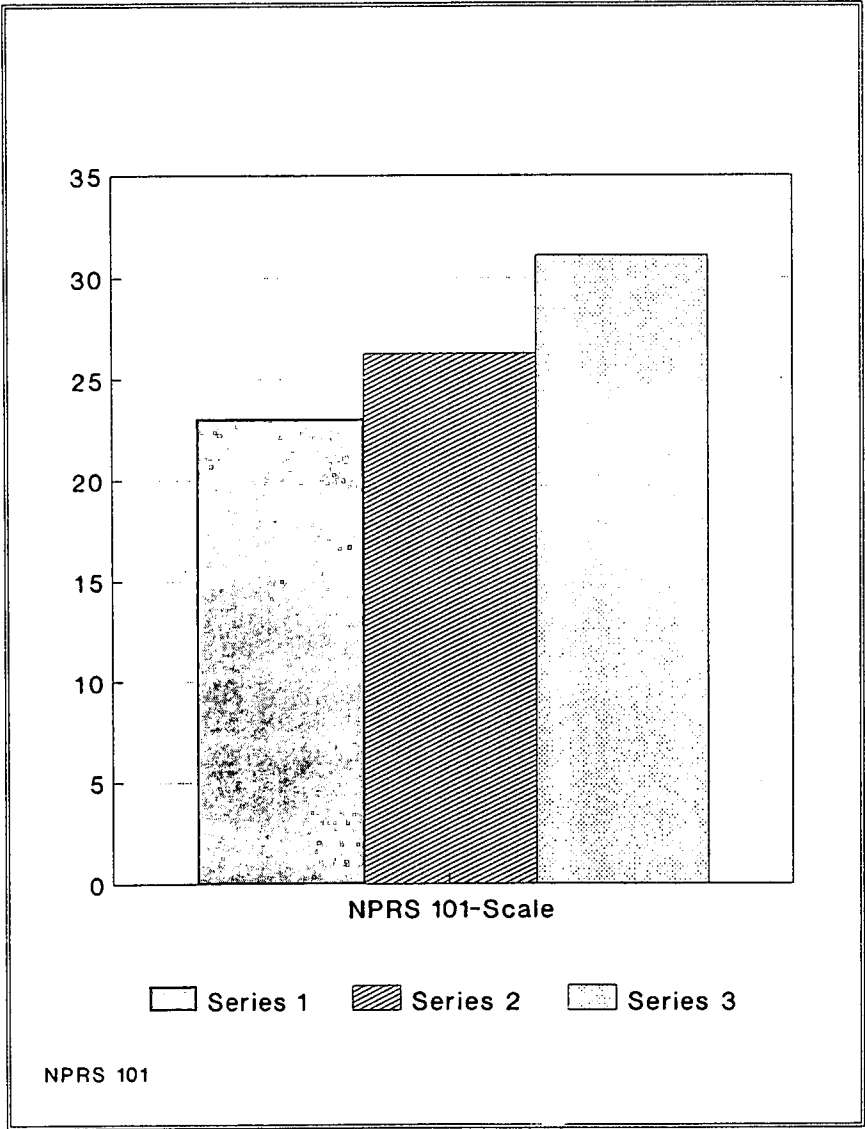


FIGURE 5.8 Comparison of Cassidy et.al's. (1993: 495) study on manipulation (ROM) to this study's treatment groups:

Key: Series 1 - Experimental group
Series 2 - Control group
Series 3 - Manipulation (Cassidy et.al.)

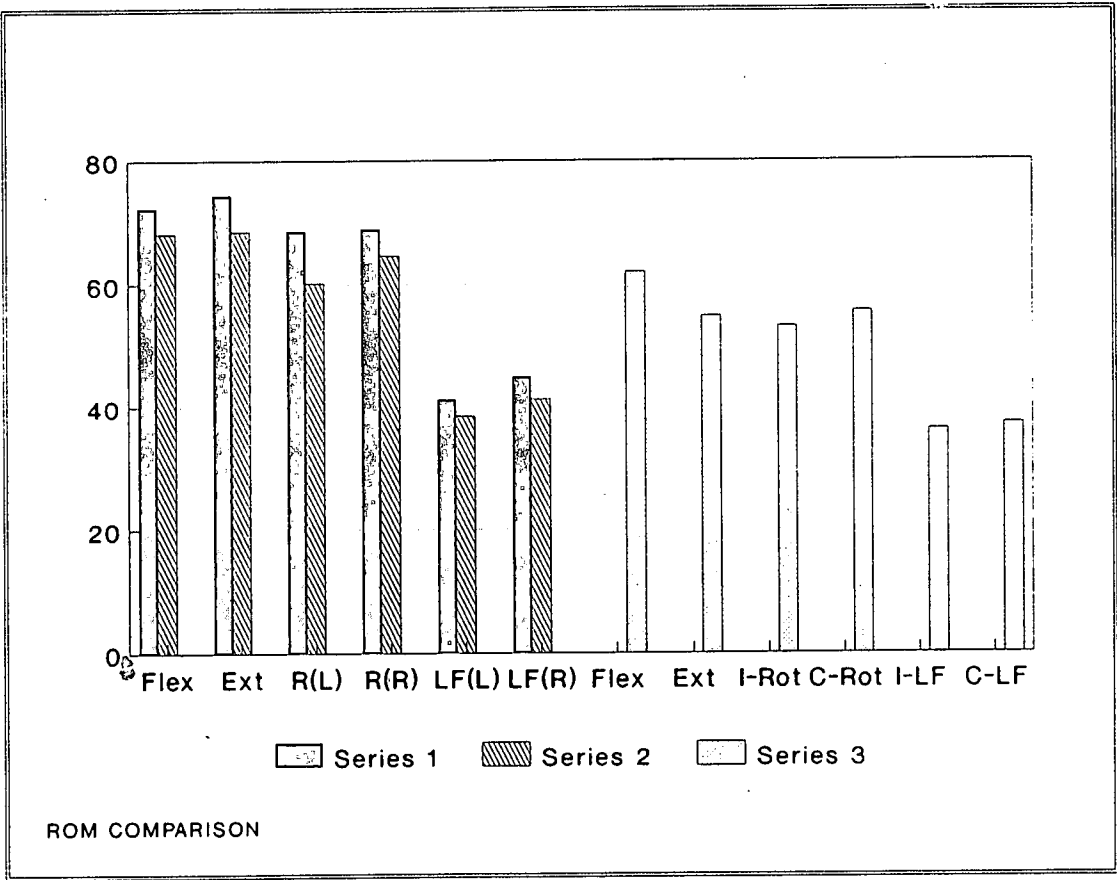
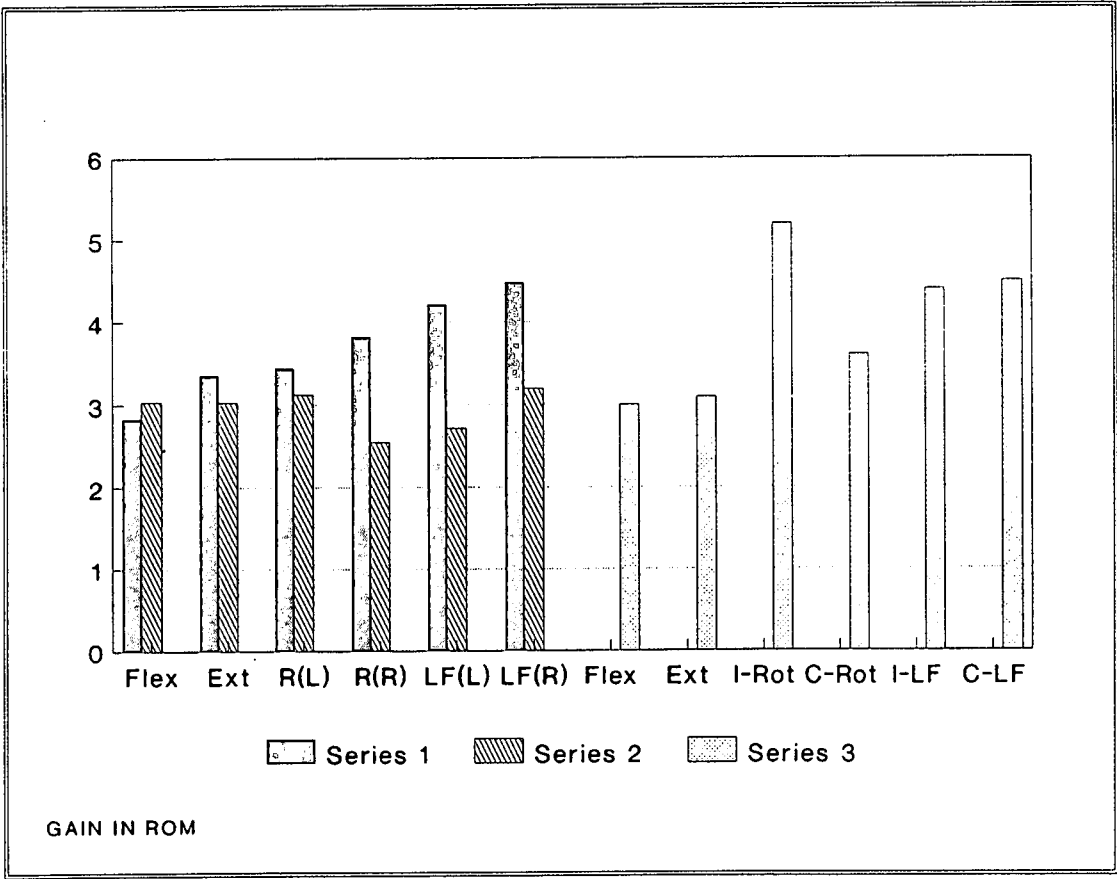


FIGURE 5.9 Comparison of Cassidy et.al's. (1993: 495) study on manipulation (increase in movement after manipulation) to this study's treatment groups:

Key: Series 1 - Experimental group
Series 2 - Control group
Series 3 - Manipulation (Cassidy et.al.)



However, due to the lack of reliability in x-ray positioning and measurement suggest that such data should not be overestimated (Gay 1993: 591).

No conclusions could be drawn with regards to spinal biomechanics or the relationship between the cervical and thoracic spine in this study. This is due to the fact that there is not enough evidence to support such claims as the treatment groups did not show a significant difference in improvement. However, it is suggested by the author that the experimental group did show a greater gain in range of motion after manipulation, based on the graphical representation of the figures (figure 4.1), but that this had no statistical significance.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

This study consisted of 30 patients who were diagnosed with mechanical neck pain (joint dysfunction) after thorough clinical and orthopaedic examination. The patients were divided into control and experimental groups and were subjected to manipulative therapy to relieve them of their symptoms.

The average number of treatments for both the control and experimental groups was 6 per patient.

The results show that there was a significant improvement in both treatment groups and that the rate of improvement was similar for both experimental and control groups. This study illustrates the relationship between increased range of motion and reduction in neck pain, as a result of manipulation. This study also supports the use of manipulation for mechanical neck pain in view of the improvements seen in the treatment groups.

The intervals in which improvements occurred due to the treatment was not successfully demonstrated. It is suggested by the author that a more appropriate statistical method be used in future studies to identify the rate of improvement.

The lack of a follow-up consultation, in the context of this study, did not diminish the validity of the results as it was the intention of the project to assess the short-term improvement shown by each treatment, not to evaluate the long-term efficacy. Also, it is stated by Potash (1993 : 30) that about 70% of those patients who suffer from joint dysfunction become pain free within 6 weeks. This time period was used as a criteria for treatment in this project. Nevertheless, in future projects of this nature, follow-up consultations should be included to determine the long-term efficacy of the treatment.

There is sufficient clinical and statistical evidence to conclude that both treatment groups showed significant improvements within the natural progression of the condition. The favourable results support the use of manipulation as a treatment protocol for mechanical neck pain and show that it is effective within a short treatment period. Unfortunately, this study has not been able to identify a more cost-effective treatment as both treatments revealed similar efficacy.

No conclusions can be drawn with regards to the biomechanical relationship between the cervical and thoracic spine as there is insufficient evidence to support such claims, even though graphically, the experimental group showed a greater gain in range of motion, after manipulation.

6.2 RECOMMENDATIONS

In further studies it would be recommended that the patient characteristics be taken into consideration eg. age, gender, presenting symptoms, level of joint dysfunction and duration of symptoms, in order to make the results more valid.

It is advisable that future studies, dealing with very similar treatment regimes, conduct the project with a larger sample size so that a trend in the results would be more apparent. A larger sample size would also expose subtle changes in cervical range of motion and improvement in pain. A larger sample size would thus provide adequate clinical trial so that sufficient statistical significance could be achieved.

The relationship between the levels of joint dysfunction and the increase in motion at that level after manipulation, in conjunction with the reduction in pain, should receive greater attention in further studies. The accumulation of controlled results from past studies may aid in this task.

Cassidy et al (1992 : 499) comments that statistical analysis of the data should be of utmost importance as weak and inappropriate analysis has been common in the past. This study shows that the use appropriate statistical methods is vital, with reference to the method used to assess patient improvement during certain treatment intervals, as the results were not adequate to draw firm conclusions.

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ADDENDUM A:

MEASUREMENT OF PAIN

SHORT-FORM MCGILL PAIN QUESTIONNAIRE

Ronald Melzack

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

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

The descriptors 1-11 represent the sensory dimension of pain experience and 12-15 represent the affective dimension. Each descriptor is ranked on an intensity scale of 0 = none, 1 = mild, 2 = moderate, 3 = severe. Copyright 1984 Ronald Melzack.

ADDENDUM B:

NUMERICAL PAIN RATING SCALE - 101 QUESTIONNAIRE

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

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

.....

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

.....

ADDENDUM C:

CMCC NECK DISABILITY INDEX

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

This questionnaire has been designed to give the doctor information as to how your neck pain has affected you every day life. Please answer every section and mark in each section only ONE box which applies to you. Please choose the box most closely describes your problem.

Section 1 - Pain Intensity

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

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

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

Section 3 - Lifting

- ☐ I can lift heavy weights without extra pain.
- ☐ I can lift weights but it give extra pain.
- ☐ Pain prevents me from lifting weights off the floor, but I can manage them if they are conveniently placed.
- ☐ Pain prevents me from lifting heavy weights, but I can manage them if they are conveniently placed.
- ☐ I can lift very light weights.
- ☐ I cannot lift or carry anything at all.

Section 4 - Reading

- ☐ I can read as much as I like without pain in my neck.
- ☐ I can read as much as I like with only slight pain.
- ☐ I can read as much as I want with moderate pain.
- ☐ I can't read as much as I want due to moderate pain.
- ☐ I can hardly read due to severe pain in my neck.
- ☐ I cannot read at all.

Section 5 - Headaches

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

Section 6 - Concentration

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

Section 7 - Work

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

Section 8 - Driving

- ☐ I can drive my car as long as I want with any neck pain.
- ☐ I can drive my car as long as I want with slight pain in my neck.
- ☐ I can drive my car as long as I want with moderate pain in my neck.
- ☐ I can't drive my car as long as I want due to moderate neck pain.
- ☐ I can hardly drive at all due to severe neck pain.
- ☐ I can't drive my car at all.

Section 9 - Sleeping

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

Section 10 - Recreation

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

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

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

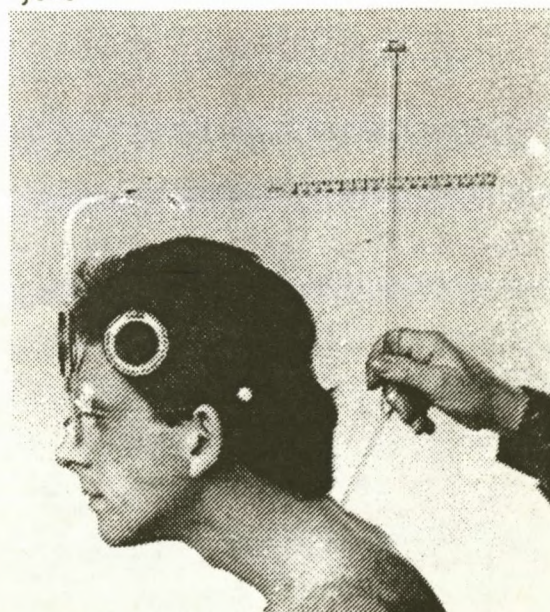


Figure 2: CROM with forward head arm and vertebra locator

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.

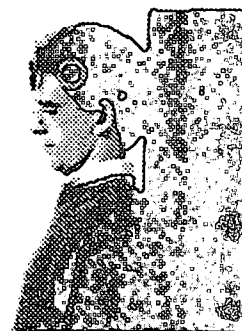


Figure 4: Flexion

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.

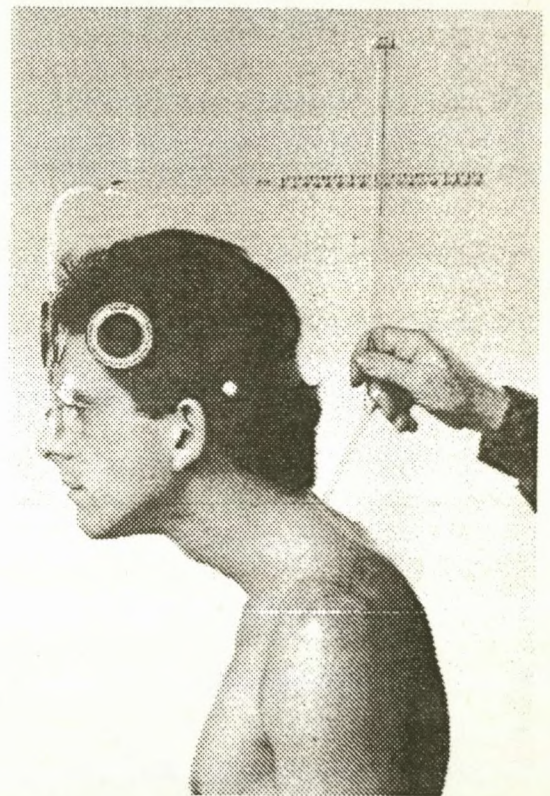


Figure 13: CROM with forward head arm and vertebra locator

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:

FORCE DIAL
(PUSH - PULL FORCE GAGE)
and
RECORDING SHEET

FORCE DIAL

CERTIFICATE OF CALIBRATION

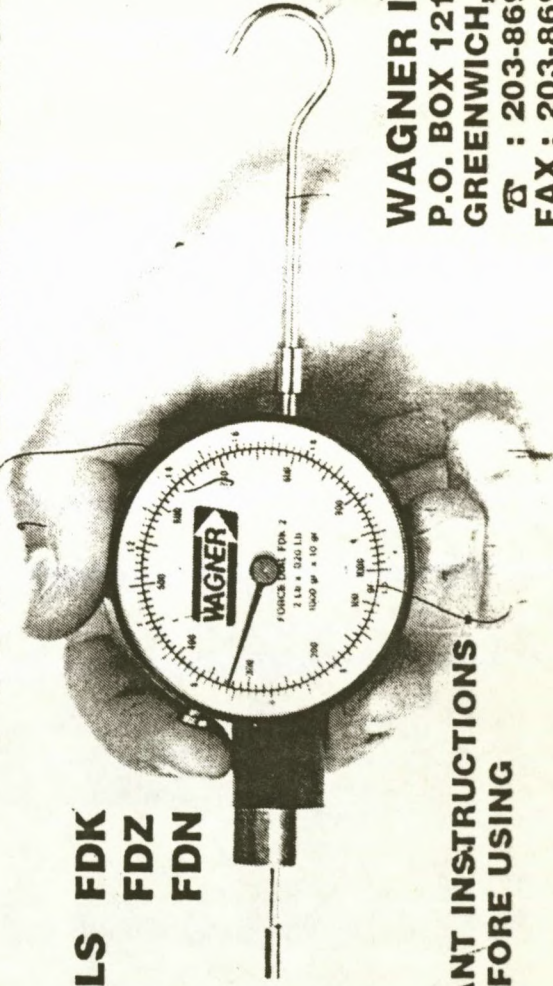
WAGNER INSTRUMENTS certifies that all **FORCE DIALS** are calibrated at the factory to meet the specified accuracy of $\pm 1\%$ of full scale, advertised in our current catalog.

QUALITY CONTROL DIRECTOR

FORCE DIALTM

PUSH - PULL FORCE GAGE

**MODELS FDK
FDZ
FDN**



**IMPORTANT INSTRUCTIONS
READ BEFORE USING**

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

GENERAL

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

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

Lubrication of the FORCE DIAL is not recommended.

IMPORTANT

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

CALIBRATION

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

IMPLEMENT WEIGHT ADJUSTMENT

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

WEIGHT OF IMPLEMENTS:

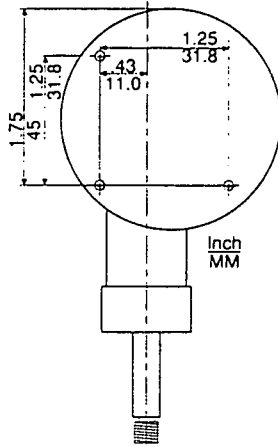
- Plunger: .015 LB/ 1/4 OZ/ 7 G
- Flat Tip: .004 LB/ 1/16 OZ/ 2 G
- Long Rod: .009 LB/ 5/32 OZ/ 4 G
- Pull Hook: .013 LB/ 7/32 OZ/ 6 G

ADJUSTMENT:

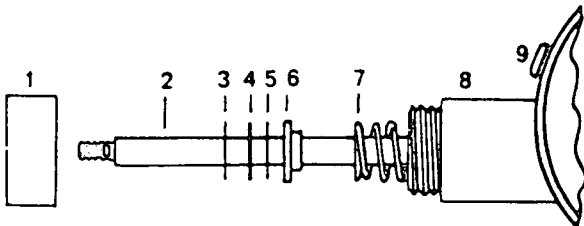
<u>USE</u>	<u>WITH</u>	<u>+/-</u>
Pushing Down	Plunger/Flat Tip	+9 G
Pushing Down	Plunger/Long Rod	+11 G
Pulling Down	Plunger/Flat Tip/Hook	+15 G
Pushing Up	Plunger/Flat Tip	-9 G
Pushing Up	Plunger/Long Rod	-11 G
Pulling Up	Plunger/Flat Tip/Hook	-15 G

MOUNTING

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



PARTS



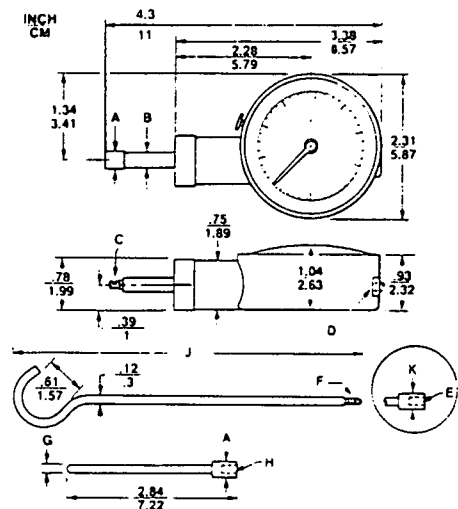
- | | | |
|--------------|-------------------------|-----------------|
| (1) Retainer | (5) Calibration Washers | (8) Case |
| (2) Plunger | (6) Plate | (9) Push Button |
| (3) Disc | (7) Spring | (10) Crystal * |
| (4) Clip | | (11) Pointer * |

ACCESSORIES: *

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

* Not shown in diagram.

DIMENSIONS



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

All dimensions are approximate.

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

Complete list of available FORCE DIALS

FDK

DECIMAL POUND / GRAM GRADUATIONS

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

OUNCE / GRAM GRADUATIONS

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

FDN

NEWTON / GRAM GRADUATIONS

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

PATIENT PAIN THRESHOLD (ALGOMETER READINGS)

PATIENT NAME:

FILE NUMBER:

INTERN:

DATE:

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

AVERAGE OF ALL ALGOMETER READINGS:

OTHER INFORMATION:

.....

ADDENDUM F:

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

CASE HISTORY

Patient: _____ Date: _____

Age: _____ Sex: _____ Occupation: _____

Intern/Clinician: _____ Signature: _____

Case History:

1. Source of History:

2. Chief Complaint:

3. Present Illness:

Location
Onset
Duration
Frequency
Pain (character)
Progression
Aggravating factors
Relieving factors
Associated signs & symptoms
Previous occurrences
Past treatment and outcome

4. Other complaints:

5. Past History:

General health status
Childhood illnesses
Adult illnesses
Psychiatric illnesses
Accidents/ injuries
Surgery
Hospitalization

6. Current health status and life-style:

Allergies
Screening tests
Environmental hazards
Safety measures

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

7. Family history:

Immediate family:

Age
Health
Cause of Death
Diabetes
TB
Stroke
CA
Anemia
Thyroid
Mental illness
Drug addiction

Heart disease
HBP
Kidney disease
Arthritis
Headaches
Epilepsy
Alcoholism
Other

8. Psychosocial history:

Home situation
Daily Life
Important experiences
Religious beliefs

9. Review of the systems:

General
Skin
Head
Neck
Breasts
Respiratory
Cardiac
Gastro-intestinal
Urinary
Genital
Vascular
Musculoskeletal
Neurologic
Haematologic
Endocrine
Psychiatric

ADDENDUM G:

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

Patient: _____ Date: _____

Intern/Clinician: _____ Signature: _____

VITAL SIGNS:

Height: _____ Weight: _____ Temp: _____

Rates: Heart: _____ Pulse: _____ Respiration: _____

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

Legs: L ____ / ____ R ____ / ____

General appearance:

STANDING EXAMINATION:

Minor's sign

Skin changes

Posture

erect

Adam's

Ranges of motion:

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

ROM Diagram:

Flex

L. Rot

R. Rot

L.Lat F.

L.Lat F.

Ext

/ = pain-free limitation // = painful limitation

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

Half Squat
Muscle tone
Pronator drift

Gait:

rhythm
on heels
tandem

pendulousness
on toes

Shoulder:

skin
symmetry
ROM: glenohumoral
scapulo-thoracic
acromioclavicular
elbow
wrist

Chest measurement:

inspiration

expiration

Visual acuity

Breast examination:

Inspection:

skin
contour
arm overhead
leaning forward

size
nipples
hands on hips

Palpation:

axillary lymph nodes
supraclavicular

SEATED EXAMINATION:

Spinal posture

Head:

scalp
face

skull
skin

Eyes:

conjunctiva
eyebrows
lacrimal glands
alignment

sclera
eyelids
nasolacrimal duct
corneal reflex

ocular movement:

	L	R
	III IV VI	III IV VI
visual fields		accommodation
iris		pupils
red reflex		optic disc
vessels		general background
vitreous		macula
lens		

Ears:

auricle	ear canal
drum	auditory acuity
Weber test	Rinne test

Nose:

external
internal
 septum
 turbinates
 olfaction

Sinuses (frontal and maxillary):

tenderness
transillumination

Mouth and Pharynx:

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

Neck:

posture	size
swelling	scars
discolouration	hair line
ROM:	

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

ROM Diagram:.

		Flex		
		L. Rot	R. Rot	
		L.Lat F.		L.Lat F.
		Ext		
/ = pain-free limitation		// = painful limitation		
lymph nodes			trachea	
thyroid			carotid arteries	
CN V			CN VII	
CN VIII			CN IX	
CN XI				

Temporomandibular Joint:

Inspection:	
ROM	deviation
Palpation:	
crepitus	tenderness

Neurological Examination:

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

Thorax:

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

Percussion:	
lungs	kidney punch
diaphragmatic excursion	
Auscultation:	
breath sounds:	
vesicular	bronchial
adventitious sounds:	
crackles	wheezes
voice sounds:	
bronchophony	egophony
whispered pectoriloquy	
Cardiovascular:	
inspection:	
auscultation:	
aortic	mitral
pulmonary	tricuspid
general	carotids
rear chest	
Allen's test	

SUPINE EXAMINATION

JVP
PMI

Cardiovascular:

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

Abdomen:

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

Palpation:

reflexes
light
deep
spleen
aorta
shifting dullness

cough

rebound tenderness
liver
kidneys
intra-/retro-abdominal mass
fluid wave

Acute Abdomen:

original site of pain
tenderness
rebound tenderness
psoas sig
cutaneous hyperaesthesia
PR

cough

guarding
Rovsing's sign
obturator sign

Murphy's sign

Male Genitals:

Inspection:

skin
glans
nits/ lice
inguinal bulge

prepuce

meatus
scrotum
femoral bulge

Palpation:

penis
epididymis
femoral canal

testes

inguinal canal
cremasteric reflex

Auscultation:

scrotal mass

Peripheral Vasculature:

Inspection:

skin
pigmentation

nail bed
hair loss

Palpation:

pulses:

radial
femoral
post. tibial

brachial
popliteal
dorsalis pedis

lymph nodes:

epitrochlear

femoral (horizontal &
vertical)

temperature (feet & legs)

Manual compression test

Retrograde filling (Trendelenburg) test

Arterial insufficiency test

Musculoskeletal:

ROM:

Hip:

-

Flex: 90/120'

Ext: 15'

Abd: 45'

Add: 30'

Int Rot: 40' -

Ext rot: 45'

Knee: Flex: 130' Ext: 0/15'
Ankle: Plant Flex: 45' Dorsiflex: 20'
Inversion: 30' Eversion: 20'
Leg length:
actual L: _____ R: _____
apparent L: _____ R: _____

Neurological examination:

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

Rectal examination (PR):

Inspection:
sacroccygeal and perianal areas
faeces after palpation
fistulas
Palpation:
sphincter tone tenderness
induration nodules
prostate seminal vesicles

Mental Status:

Appearance and behaviour:
level of consciousness
posture and motor behaviour
dress, grooming, personal hygiene
facial expression, affect
Speech and language:
quantity rate
volume fluency
rate (prn)
Mood
Thought processes
Memory and orientation:
orientation (time, place, person)
recent & remote memory
new learning ability
Higher cognitive functions:
information and vocabulary
abstract thinking

ADDENDUM H:

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

CERVICAL SPINE REGIONAL EXAMINATION

Patient: _____ Date: _____

Intern/ Clinician: _____ Signature: _____

OBSERVATION:

Posture
Scars
Hair-line
Bony/ soft tissue

Swellings
Discolouration
Muscle spasm
Expression (face)

RANGE OF MOTION:

Flex: 45'
L/R Rot: 70'

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

Flex

L. Rot

R. Rot

L. Lat Flex

R. Lat Flex

Ext

KEY: / = painless limitation // = painful limitation

PALPATION:

Lymph nodes
Thyroid Gland
AC joint

Trachea
Clavicle
Scapula

ORTHOPAEDIC EXAMINATION:

Tenderness

Active Myofascial Trigger Points:

SCM
Scalenii
Posterior Cervical

Trapezius
Levator Scapulae
Supraspinatus

Doorbell sign
Kemp's test
Cervical distraction
Halstead's test
Hyperabduction test
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 test
O'Donoghue's test

Remarks: _____

NEUROLOGICAL EXAMINATION:

Dermatomes:

C2 L: _____ R: _____
C4 L: _____ R: _____
C6 L: _____ R: _____
C8 L: _____ R: _____

C3 L: _____ R: _____
C5 L: _____ R: _____
C7 L: _____ R: _____
T1 L: _____ R: _____

Myotomes:

C1 L: _____ R: _____
C3 L: _____ R: _____
C5 L: _____ R: _____
C7 L: _____ R: _____
T1 L: _____ R: _____

C2 L: _____ R: _____
C4 L: _____ R: _____
C6 L: _____ R: _____
C8 L: _____ R: _____

Reflexes:

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

VASCULAR EXAMINATION:

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

Carotids:

auscultation

palpation

Subclavians:

auscultation

palpation

WALLENBERG'S TEST L: _____ R: _____

Comments: _____

MOTION PALPATION:

C0
C2
C4
C6
T1
T3

C1
C3
C5
C7
T2
T4

ADDENDUM I:

PATIENT CONSENT FORM

Patient: _____

Intern/Clinician: _____ Signature: _____

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

Signature: _____

Date: _____