LUMBAR SPINE ADJUSTMENTS ALONE, VERSUS COMBINED LUMBAR, THORACIC AND CERVICAL SPINE ADJUSTMENTS FOR THE TREATMENT OF MECHANICAL LOW BACK PAIN

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By

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I, David Burns Russell, do hereby declare
that this work is my own, both in
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DEDICATION

To Marina, my wonderful supportive wife,
without whose constant encouragement
and devotion this and many other ventures
would not have come to fruition.

For her love and dedication
I'll always be indebted.

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ABSTRACT

Mechanical low back pain is one of the most common and costly conditions confronting health care providers and medical insurers today. Despite the magnitude of the problem no general consensus exists concerning an appropriate treatment for this condition.

The purpose of this study was to investigate and compare the efficacy of two popular treatment approaches adopted by practicing chiropractors. The first approach of adjusting only the lumbar spine for the treatment of mechanical low back pain was compared to adjusting all spinal fixations with the intention of restoring complete spinal mobility.

It was hypothesized that both the lumbar spine adjustments alone and the combined lumbar, thoracic and cervical spine manipulation will be effective in the treatment of mechanical low back pain. It was anticipated that the combined spinal manipulations would be more effective in terms of the subjective and objective clinical findings.

The study was a controlled trial conducted on patients between the ages of 16 and 60 who presented to the Technikon Natal Chiropractic Day Clinic with mechanical low back pain. The patients were randomly divided into two groups (control and research) each consisting of fifteen (15) subjects. The control group received lumbar and sacroiliac adjustments and the research group received combined lumbar, sacroiliac, thoracic and cervical spine adjustments where fixations were identified.

Various diagnostic procedures including exhaustive orthopaedic tests, motion palpation and range of motion analysis, were utilised to determine the areas of spinal fixations. The subjective information was acquired with the use of three questionnaires: the Numerical Pain Rating Scale - 101, the Oswestry Back Disability Index and the McGill Pain Questionnaire. The objective data was collected with the aid of Goniometric and Algometric measurements.

Each patient had a maximum of ten treatments with a one month break before the follow - up treatment. Statistical data was gathered at the first, ninth and follow - up visit.

Statistical analysis at the five percent (5%) level of significance was done using Wilcoxen's paired rank signed test for the intra-group analysis and the Mann-Withney U test for the inter-group analysis. The results were illustrated by means of tables and discussed in detail.

The outcome of the statistical analysis indicated that there was a significant improvement within both treatment groups and that the rate of improvement was comparable for both the subjective and objective data. There was no statistical evidence to indicate that either treatment was more effective than the other for the treatment of mechanical low back pain.

This study supports the use of spinal manipulation in the treatment of mechanical low back pain, and encourages further studies of this nature. It is suggested that larger sample sizes be considered to allow for more accurate statistical data which would aid in identifying the subtle variations in treatment outcomes. This will contribute to the validity of the results and invite changes to the existing treatment protocols used by practising chiropractors.

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ABBREVIATIONS

CG	control group
RG	research group
NSD	No Significant Difference ($P > 0.05$)
SD	Significant Difference ($P < 0.05$)
IC	Initial Consultation
LC	Last Consultation
FU	Follow - up Consultation
SMT	Spinal Manipulative Therapy
NRS-101	Numerical Pain Rating Scale 101 Questionnaire
OBDI	Oswestry Back Disability Index Questionnaire
MPQ	McGill Pain Questionnaire

DEFINITION OF TERMS

Adjustments

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

Compensation

Changes in structural relationships to accommodate foundation disturbances and maintain balance (Haldeman 1992: 622).

Cervical Spine

The cervical spine consists of all the vertebrae making up the bony skeleton from the occiput to the seventh cervical vertebrae including the intervertebral discs, nerve roots and accompanying soft tissues.

Effectiveness

The ability to exert a specific measurable influence (Dorlands 1988: 532).

Facet Syndrome

Pain in the spine not due to organic causes but is associated with phase one degenerative changes in the spine ie. facet joint syndrome, hypomobility and early disc degeneration (Kirkaldy - Willis 1992: 63).

Goniometer

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

Incidence

This refers to the rate at which individuals develop a syndrome or disease over a specific period of time (Dorlands 1988: 826).

Lumbar Spine

All the vertebrae making up the bony skeleton of the low back from the first lumbar vertebrae to the fifth lumbar vertebrae (including the intervertebral discs, nerve roots and all accompanying soft tissues). For research purposes in this paper the lumbar spine will include the sacroiliac joints.

Manipulation

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

Mechanical Low Back Pain

For the purpose of this study it is pain caused by posterior facet syndrome and sacroiliac syndrome.

Pain

Localised sensation of discomfort, distress, agony resulting from the stimulation of specialised nerve endings. (Dorlands 1988: 1212).

Posterior Facet Syndrome

This is pain originating primarily from the posterior facet joints of the lumbar spine (Kirkaldy-Willis 1988: 133 - 135, Plaugher 1993: 216 - 217 and Schafer and Faye1989: 217).

Sacroiliac Syndrome

This refers to low back pain in which the primary lesion is identified to originate in the sacroiliac joint / joints of the pelvis (Kirkaldy-Willis 1988: 135 - 137).

Prevalence

This is a measure of the number of people in a given population who have the syndrome or disease at a particular time (Dorlands 1988: 1353).

Tenderness

Abnormal sensitivity to touch or pressure (Dorlands I1988: 1670).

Thoracic Spine

All the vertebrae making up the bony skeleton from the first thoracic to the twelfth thoracic vertebrae including the intervertebral discs, nerve roots and accompanying soft tissues.

Joint Fixation

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

Subluxation

A motion segment in which alignment, movement integrity, and/or physiologic function are altered although contact between the joint surfaces remains intact (Gatterman 1995: 6).

A state whereby a vertebra or a pelvic bone has become temporarily immobilised in a position which it may normally occupy during any phase of a physiological spinal movement (Sandos 1976).

CHAPTER ONE

INTRODUCTION

1.1 HISTORICAL PERSPECTIVE

Low back pain is a ubiquitous and economically costly problem and it has been estimated that patients with lower back complaints comprise the second largest diagnostic group seeking care from family physicians (Hall 1975: 79). Unfortunately the clinical management of low back pain is not yet well understood. Chiropractic management of low back pain has undergone a transition and is now a more respected and understood alternative to conservative medical care (Manga et al. 1993: 221).

Zylbergold et al. (1981) points out that no universally recognised treatment exists for this common problem and says that this could explain why patients with low back pain not only frequently seek assistance from more than one specialist, but often receive conflicting advice as to the appropriate management of their condition.

The diversity in treatment protocols and the variations in practice suggest that there is uncertainty and confusion in our current system. It is apparent that improved methods of dissemination and implementation need to be developed. Leach (1986: 206) suggests that Chiropractic not only needs broad clinical studies, but also basic research.

1.2 RELATED STUDIES

A study was done by Nansel et al. (1993), to determine whether spinal adjustments, delivered to the upper versus the lower cervical spine, might result in tonic neck reflex-induced alterations in the activity of the lumbar paraspinal musculature. Results showed that lower cervical adjustments induced increases in tissue compliance (decreases in tone) which were highly significant and relatively robust compared to those found following upper cervical adjustments. Furthermore, the greatest effects were observed on either side of the L4 and L5 spinous processes, suggesting influences on the gluteal musculature in particular. (Nansel et al. 1993: 91)

Gatterman (1995: 253) discusses how mechanical neck pain causes reflex neurological activity which may affect muscle tone and posture in the neck, trunk and limbs. Nansel et al. (1993: 91) agree, reporting that cervical spine manipulation can have significant effects on the tone of the lumbopelvic musculature, presumably by facilitating tonic neck reflexes involving intersegmental spinal pathways. These reflexes, as Gatterman (1995: 253) explains, would affect both static and dynamic posture. Shekelle et al. (1992: 592) have however found that chiropractors rarely treat low back pain patients with cervical spine manipulation as a specific treatment for this condition. This study attempts to discover the clinical outcomes of two popular treatment approaches adopted by chiropractors. According to Duke (1995) these approaches are:

a. adjusting all spinal fixations found irrespective of their proximity to the symptomatic region with the aim of restoring mobility to all spinal segments, and

b. adjusting only those segments which are symptomatic with the assumption that they will remain mobile irrespective of other fixations.

This research paper intends to compare the efficacy of these two popular treatment methods, with regard to the management of mechanical low back pain and thereby provide a scientific basis for further maximising the effectiveness of the chiropractic management of this common complaint.

1.3 THE PROBLEM STATEMENT

The aim of this study is to evaluate lumbar spine manipulation and combined lumbar, thoracic and cervical spine manipulation, according to the subjective and objective clinical findings, with the intention of determining the efficacy of each approach in the treatment of mechanical low back pain.

It is anticipated that this study will provide accurate measurements of treatment outcomes, which will enable doctors to make better informed decisions about the risks and benefits of their treatments. Additionally, better practice guide-lines can be developed. As a result, practice pattern variations should be diminished and health care costs conserved.

The primary objective of this research paper is to find a more effective manipulative regime for the treatment of mechanical low back pain and in so doing help alleviate the great diversity in practice and to improve patient recovery.

CHAPTER TWO

REVIEW OF THE RELATED LITERATURE

2.1. INTRODUCTION

In reviewing the literature it is intended that an overview of low back pain, the biomechanics of the development of low back pain and the fundamental issues surrounding its treatment are highlighted.

Despite the frequent occurrence of back pain and the substantial morbidity that it causes, the objective data evaluating its treatment are scarce (Jayson et al. 1981: 409).

No universal consensus exists concerning the most effective treatment for low back pain (Meade et al. 1990: 1431). Gatterman (1990), states that compared with other forms of conservative treatment, spinal manipulative therapy affords faster relief of pain and improves spinal function. (Gatterman 1990:399).

2.2. INCIDENCE AND PREVALENCE OF MECHANICAL LOW BACK PAIN

Low back pain, according to Manga et al. (1993: 221) afflicts at least 80% of the population at some time during their lives. At any given time, at least 6.8% of the United States adult population has been found to have back pain. The prevalence of low back pain rises after the age of 25 to peak in the 55 to 64 year old range. This will decrease again after age 65 and it is generally found that men and women are affected similarly (Cox 1990: 339).

A study by Waalen and Waalen (1993) found that significant and clinically relevant gender-related differences existed in patients with respect to the region and the duration of their chief complaint. Men had more frequent lumbar complaints, compared to the women who suffered more with cervical complaints. Women, irrespective of the area of complaint, did not seek treatment as promptly as males and subsequently required more treatments than males. (Waalen and Waalen 1993: 145)

2.3. ANATOMY AND BIOMECHANICS OF THE SPINE

The vertebral column provides a partly rigid and partly flexible axis for the body and a pivot for the head. The vertebral column plays an important role in posture, in the support of body weight, in locomotion, and in the protection of the spinal cord and spinal nerve roots (Moore 1985: 565).

The upright adult spine exhibits a balanced posture which is determined by its physiological curves. Four anteroposterior curvatures are visible in the adult human spine. They provide increased axial flexibility with stability and augmented shock absorbing capacity (White and Panjabi 1990: 116). The thoracic and sacral curvatures (primary curvatures) are concave anteriorly and the cervical and lumbar curvatures (secondary curvatures) are concave posteriorly. The lumbar curve is slightly more accentuated in women. (White and Punjabi 1990: 116) Human posture is the product of moment-by-moment modification of neural circuits that are responsible for response patterns (Gatterman 1990: 260). The postural reflex patterns result in a co-ordination of many joint movements and muscle actions and reactions. Loss of the postural curves is often a result of muscle spasm and /or acute spinal injury (Gatterman 1990: 260).

Movement of the entire spine can be viewed in terms of the sum of all the movements between each individual vertebra because the spine is composed of multiple segments. Movement between adjacent vertebra takes place at the intervertebral disc and at the paired zygapophysial joints, and these joints are known as the three joint complex (White and Punjabi 1990:45).

Movement between individual vertebral motion segments is slight, but together they can produce a wide range of spinal movements. While the absence of motion at a single facet joint does not significantly affect overall flexibilty, it does have far-reaching reflexogenic effects influencing muscle tone and the excitabilty of stretch reflexes in all the striated muscles (Gatterman 1990: 48).

There are greater amounts of movement in the lumbar and cervical regions than in the thoracic region owing to the thinner intervertebral discs and the fact that the thoracic region has rib attachments which provides considerable stability (Schafer and Faye 1990: 200). As a result of this, the lumbar and cervical regions incur a greater percentage of the injuries (Moore 1985: 565). The three main articulating regions of the spine, (cervical, thoracic and lumbar regions), function summarily, nevertheless the cervical spine sacrifices stability for mobility, the thoracic spine sacrifices mobility for stability while the lumbar spine remains stable, yet mobile.

2.3.1 FUNCTIONAL SPINAL UNIT

The functional spinal unit (FSU) is the smallest segment of the spine that exhibits biomechanical characteristics similar to those of the entire spine. Because the spine may be considered a structure composed of multiple FSUs connected in series, its total behaviour may be approximated as a composite of the behaviours of the individual FSUs constituting the spine (White and Panjabi 1990: 45). For this reason, when one FSU does not display its normal / appropriate function it has full spinal repercussions.

2.3.2. THE SUBLUXATION COMPLEX

Gatterman (1990: 415) describes the subluxation complex as:

1. The partial or incomplete dislocation of a facet joint,
2. the restriction of motion of a joint in a position exceeding normal physiologic motion, although the anatomical limits have not been exceeded, and
3. the unnatural relationship between two adjacent articulations which may have functional or pathological consequences, thus causing alterations in the biomechanical and/or neurophysiological reflexes of the joint, the structures around the joint and/or the body systems affected by them.

Gatterman (1990:39) further categorises the subluxation into two parts:

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.

Whenever an articulation is deprived of carrying out its normal function (motion), at least one other articulation is forced to take upon itself the burden of compensatory excessive motion, which may include eccentric and/or out-of-plane movement. This additional role within the counterpart joint in the kinematic chain leads to irritation and ultimately to inflammation of that joint.

(Schafer and Faye 1990: 4) These authors argue that patients do not always present with symptoms at a site of hypomobility (fixation), but rather at the site of compensatory hypermobility. Greenman (1996: 18) agrees adding that these sites of relative hypermobility are not uncommon and that they are self correcting once the areas of hypomobility are adequately treated. Sites of hypermobility are contraindicated for manipulation and therefore would only be aggravated if adjusted.

2.3.3 SPINAL FIXATION COMPLEXES

Mechanical stress at one area of the spine often produces distortions at vertebral motion segments distal to that segment. Descending compensatory effects of the spine in response to upper cervical fixations also recur.

Schafer and Faye (1990: 293) describe spinal fixation complexes as series of fixations that consistently appear to be specifically complementary to each other. They explain that a single spinal fixation is often found in acute conditions , and that in more chronic conditions one or a multiple of series of fixations are found. Each series has within it a causative spinal fixation (primary fixations) to which others have become associated (secondary fixations). They illustrate that where clinical attention is restricted to one area of the spine, the corrected fixation will only sometimes be the primary fixation. When they are, the results will be excellent. However, when these fixations are secondary fixations, with the primary fixation being remote to the area being treated, then the results will only be of a temporary nature. Primary fixations, they argue, when corrected, will only necessitate one adjustment, whereas when correcting secondary fixations, numerous adjustments will be needed to achieve the same results.

Bourdillon et al. (1989) are not entirely convinced that a structural diagnosis made after the first treatment is definitive. They argue that it is common to find the first treatment has only peeled off the outer skin of the onion and under it are many dysfunctions which may not have been found at the first examination. An example of this is the patient who has had previous trouble in a different segment of the spine and who presents with symptoms following a fresh injury. Treatment of the recently injured level may make the patient much better, but if the old dysfunctions are not dealt with, the recent dysfunction is likely to recur. This is not unexpected because an old unresolved dysfunction will leave asymmetrical tension that will not only predispose the spine to dysfunstions at other levels, but will tend to make such dysfunctions recur precisely because of the asymmetry. It has been inferred but not explicitly stated that most patients will be found to have multiple dysfunctions. This is true and it will often be an old and no longer symptomatic joint that is the basic cause of recurrences. (Bourdillon et al. 1989: 138.)

2.3.4. CHAIN LINK SYSTEM

The biomechanics of the spine is a chain reaction (Gatterman 1990:399) and without an understanding of the interaction of the locomotor system, many biomechanical lesions of the spine go unrecognised and untreated.

In 1875 Reuleaux introduced the term "kinematic chain " in reference to a mechanical system of links. A kinematic chain consists of an open and a closed kinematic chain. In an open kinematic chain, the distal segment terminates in free space, and as such, the cervical spine qualifies as an open kinematic chain. In a closed kinematic chain, the end segments are united to form a ring or closed circuit, with the motion of one link having determinate relations with every link in the system. The pelvic girdle is considered a closed kinematic chain, that is made up of three bony segments, united at two sacroiliac joints and the symphysis pubis. A sacroiliac fixation at one joint in this closed chain can affect the mechanics of the entire chain, with hypermobility usually being exhibited in the contralateral articulation. (Gatterman 1990: 32)

Compensatory hypermobility is also a common finding with fixations of the spine. This may take the form of eccentric mobility on the hypermobile side of a vertebra when the contralateral posterior joint is fixated, or it may be found in joints adjacent to locked vertebral motion segments. This chain - like concept of spinal dynamics is of utmost importance to the chiroprator who seeks to treat the area of hypomobility or joint fixation while avoiding areas of compensatory hypermobility (Gatterman 1990: 33).

Geiringer et al. (1988) reports that several authors believe that if induced motion of a vertebra does not reproduce a symptom the vertebra should not be manipulated. Others claim that in a many bodied linkage system such as the spine, restricted motion in one area of the system might cause discomfort in a distant vertebra that has to compensate for this loss of motion. They conclude that there is supporting evidence either way.

The treatment of vertebral motion restrictions in asymptomatic patients is conducted for several reasons:

1. Future stress in the form of mechanical use, systemic illness, psychogenic problems, or the loss of compensatory motion in an aging

mechanical system will eventually cause problems in the restricted area,

2. structural normality lessons metabolic demands,
3. there may be visceral effects, and
4. restrictions become fixed by fibrosis or a type of neurological set if left untreated. (Geiringer 1988)

2.3.5 COUPLING

According to Moore, (1985: 570) the main movements of the vertebral column are flexion, extension, lateral bending and rotation. Each of the physiological motions of the spine are inherently connected. This phenomenon, called coupling, is due to the geometry of the individual vertebra and the connecting disc and ligaments, as well as the curvature of the spine. For example, when the lumbar spine motion segment is axially rotated, it bends in the frontal and sagittal planes, and when bent laterally, it simultaneously bends in the sagittal planes and rotates axially. However, bending in the sagittal plane does not produce any rotations. (White and Panjabi 1990: 53.)

The coupling pattern of the cervical and thoracic spine is inherently different to that seen in the lumbar spine. In the cervical and upper thoracic regions, with lateral bending, the spinous processes move toward the convexity of the curve. Whereas, in the lumbar and lumbosacral region, the spinous processes move toward the concavity of the curve. (White and Panjabi 1990: 118)

These associated movements become important when chiropractors are confronted with spinal degeneration, joint dysfunction and aberrant spinal motion (Plaugher 1993: 34). According to Plaugher (1993: 15) disturbed kinematics of the functional spinal unit (FSU) will lead to unequal movements of the facet joints and therefore will alter the normal coupling patterns of the spine.

2.4. AETIOLOGY OF MECHANICAL LOW BACK PAIN

There are numerous factors which contribute to the development of low back pain. In a review of the literature, Pustaver (1993) found that smoking, occupational hazards such as high degrees of vibration and drivers of heavy vehicles, obesity, and sedentary occupations were among the higher risk groups. It has also been shown that 85% of whiplash patients develop low back pain within 1 year of the cervical injury (Neel et al. 1988: 86-88).

Schafer and Faye (1990:195) describes three common types of low back pain:

1. lumbar facet syndrome
2. sacroiliac syndrome
3. lumbar radicular syndrome (discogenic or mechanical in origin)

The cause of these syndromes may be due to:

1. Sprain/strain,
2. overuse,
3. poor posture,
4. disuse,
5. joint dysfunction (fixation / hypermobility),
6. developmental abnormalities,
7. degenerative changes, and
8. combination of any of the above (Schafer and Faye 1990:195).

2.5. PATHOGENESIS OF MECHANICAL LOW BACK PAIN

According to Kirkaldy-Willis (1988: 49 - 55) three aspects must be considered when determining the pathophysiology of low back pain. These include:

1. Emotional Factors - (tension, stress, anxiety, fear, resentment, and depression.)
2. Changes in muscle - (vasoconstriction, impaired local circulation, sustained muscle contraction, structural muscle changes, abnormal contraction)
3. Changes in the three joint complex - (disc degeneration, facet joint synovitis, strains, degeneration)

Paramount to the understanding of the pathology and pathogenesis of mechanical low back pain is the concept of the three joint complex (Gatterman 1990: 137). If an alteration to any one structure of this complex occurs, it inherently leads to disturbed kinematics and pain of the other two structures. (Cox 1990: 38 and Swezey 1983)

A classic facet syndrome can predispose a patient to a disc herniation as the three joint complex degenerates, and other underlying pathology can mimic back pain of biomechanical origin (Gatterman 1990: 399). Whatever the cause of low back pain, the production of pain is as a result of the irritation of nociceptors (Wyke 1985).

Adams and Dolan (1994) report that mechanical loading plays a central role in low back disorders even when there is no history of trauma. Furthermore they state that mechanical deformation of sensitive tissues and abnormalities in muscle function can also be important in the production of pain. (Adams and Dolan 1994: 3 - 19)

From the extensive literature reviewed it can be concluded that mechanical low back pain has no singular cause but is rather the result of long term degeneration and tissue failure. This however does not include cases in which severe trauma has taken place where the cause of back pain is obvious.

2.6. CLINICAL PRESENTATION OF LOW BACK PAIN

Low back pain syndromes are numerous and they affect individuals differently. Unfortunately, back pain is subjective and can only be determined by the patient's report of the quality and intensity of the pain. The verbalizations of these painful experiences are very limited (Goel and Weinstein 1990: 38). The signs and symptoms of mechanical low back pain are extremely diverse according to the severity, chronicity and stage of degeneration.

2.6.1. Symptoms of mechanical low back pain

Common symptoms of mechanical low back pain mainly comprise pain (local, or referred to the groin, greater trochanter region and posterior thigh), weakness, catching on movement , restriction of motion , low back stiffness , and subjective numbness (Kirkaldy-Willis 1988: 118 -131).

2.6.2. Signs of mechanical low back pain

The objective assessment of low back pain produces more consistent findings and among these are tenderness, muscle hypertonicity, lumbar spine hypomobility, altered range of motion and altered motion of the individual functional spinal unit (Kirkaldy-Willis 1988: 118 - 131).

The above characteristics cannot be defined or measured with a high degree of accuracy and objectivity and not every patient with low back pain will have all of these characteristics but a combination of them.

2.7. DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS OF MECHANICAL LOW BACK PAIN

The differential diagnosis of low back pain continues to be a dilemma for the examining physician, with 60 - 80 % of cases still being classified as idiopathic (Greenman 1996: 279).

A definitive diagnosis by the Chiropractor involves two parts:

a. the pathological diagnosis - this reflects the tissue damage incurred and allows for an accurate prognosis, and
b. the biomechanical diagnosis, which facilitates an accurate treatment plan. (Gatterman 1990:137).

Particular syndromes which fall into the realm of this research paper include dysfunctions of mechanical origin. It must be remembered that one specific lesion may not always present on its own but in combination with other lesions which may in themselves be at different stages of degeneration. The following syndromes are commonly associated with the signs and symptoms listed above:

1. Posterior facet syndrome
2. Sacroiliac syndrome
3. Maigne's syndrome
4. Myofascial syndrome
5. Herniated nucleus palposus
6. Combined degenerative changes in the disc and facet joints
7. Lateral stenosis
8. Central canal stenosis
9. Spondylolisthesis (Kirkaldy-Willis 1988: 133)

According to Kirkaldy-Willis (1988: 230) the following comprise important and often missed causes of low back pain:

Vascular:	Abdominal aortic aneurysm	
	Peripheral vascular disease	
Neurogenic:	Nerve root tumours :	Neurofibroma
		Neurilemmoma
	Spinal cord tumours	
	Diabetic neuropathy	
Spondylogenic:	Multiple myeloma	
	Secondary malignancy	
	Osteiod osteoma	
	Pathologic fracture (osteoporosis)	
	Vertebral osteomyelitis	
	Ankylosing spondylitis	

Gatterman (1990: 75) emphasised that motion palpation introduced by Gillet and Faye was one of the greatest contributions to the chiropractic profession.

2.8. CONTRA-INDICATIONS OF MANIPULATION

The benefits of spinal manipulation far outweigh the risks of complication. Complications can be avoided by careful diagnostic procedures and by employing skilled and precise manipulative techniques (Gatterman 1990: 55). The most common contra-indications for spinal manipulative therapy include:

1. **Vascular complications** -vertebral - basilar insufficiency, atherosclerosis, aneurism.
2. **Tumours** - lung, thyroid, prostate, breast, bone.
3. **Bone infections** - tuberculosis, osteomyelitis.
4. **Traumatic injuries** - fractures, joint hypermobility, severe sprains/strains, unstable spondylolisthesis.
5. **Arthritis** - reumatoid arthritis, ankylosing spondylitis, psoriatic arthritis, osteoarthritis, uncoarthrosis.
6. **Psychological conditions** - malingering, hysteria, hypochondriasis, pain intolerance.
7. **Metabolic disorders** - blood clotting disorders, osteopaenia.
8. **Neurologic complications** - disc protrusions, sacral nerve root involvement, space occupying lesions.
9. **Congenital** (Gatterman 1990: 67)

Manipulation that forces further movement on an already hypermobile articulation may increase nerve and other soft tissue irritation and is contraindicated (Gatterman 1990:13) as it will be harmful to the patient.

2.9. ETHICAL CONSIDERATIONS

Francis (1974: 156 - 166) states that 95% of all back pain cases can be relieved by manipulation. The clinical evidence is corroborated by meta-analysis, case-control studies and highly-respected clinical guide-line panels. There are no clinical or case-control studies that demonstrate or even imply that chiropractic spinal manipulation is unsafe in the treatment of low back pain. Chiropractic manipulation is as safe and many times safer than medical management of low back pain (Manga et al. 1993 :227).

With enough force any joint can be gapped and a release be obtained, but the more forceful the thrust, the greater the likelihood of creating iatrogenic hypermobility through ligamentous strain (Gatterman 1990: 51).

While patients tend to have recurring episodes of facet joint locking requiring occasional manipulation, maintenance care consisting of repeated manipulation is not recommended (Gatterman 1990: 399). Most of the complications of spinal manipulative therapy can be avoided by careful evaluation of each patient based on a good working knowledge of the relevant anatomy and physiology. If prolonged therapy becomes necessary, re-evaluation after six to eight treatments is indicated, since laxity of ligaments may result from repeated stretching of joints. (Grieve 1989)

Certain ethical considerations must be considered when adjusting fixated segments, which are not painful. Some chiropractors only adjust segments of the spine which are fixated and painful, while segments which are fixated, but not painful, are left alone. The motivation for this approach is that the adjustments of non-painful segments may predispose to hypermobility and consequently, pain at that joint. Chiropractors in the United States hesitate to adjust segments which are fixated and not painful, due to potential legal action if that segment later becomes symptomatic (Brantingham 1996).

An absolute contraindication for manipulative therapy in one area of the spine may not apply to another area of the spine, which is unaffected by the condition. Healing may be enhanced in areas of hypermobility if normal mobility is restored and maintained in another area of the spine that exhibits hypomobility (Gatterman 1990: 399).

2.10 SPINAL MANIPULATION

Low back pain is the most common complaint for which manipulation is recommended (Haldeman 1992: 420). Chiropractic care is the treatment of choice in most cases of mechanical low back pain syndromes. The basis of this statement is backed by numerous scientific trials. Unfortunately some authors, such as Deyo (1983) criticise these trials because they do not meet all rigorous criteria for validity and applicability. Nevertheless the following section gives a brief synopsis of some of the studies concerned with this topic.

The primary indication for spinal manipulation is a reversable mechanical derangement of the intervertebral joint which produces a barrier to normal motion. This movement restriction has been referred to as joint fixation, and it is determined clinically by motion palpation and orthopaedic tests. Motion palpation is used to detect relative movement between palpable bony landmarks. Increased resistance to joint movement can also be determined by springing or tractioning the joint (Gatterman 1990: 50).

Spinal manipulation is directed towards removal of reversable fixations of the zygapophyseal articulations. These spinal joints are not merely the juncture of bones, but are essential to motor function, and are richly inervated by both proprioceptive and nociceptive fibres that provide essential kinesthetic and postural information as well as being the source of much pain (Wyke 1985). Greenman (1996:5) states that the goal of manipulation is to restore maximal, pain-free movement to the musculoskeletal system to optimise postural balance.

The effects that the treatment forces of spinal manipulation have on the spinal column are, according to Hertzog (1994), not well understood. He hypothesizes that the following effects occur:

1. Absolute and relative movements of the vertebral bodies in the vicinity of the force applied,
2. cavitation of the facet joints, and
3. reflex responses of the muscles in the vicinity of the spinal manipulative therapy application. (Hertzog 1994)

Unfortunately, far more is speculated about the mechanisms and effects of a manipulation or adjustment than is scientifically proven. Clinicians often have the same clinical objectives but frequently choose different adjustive techniques or clinical models to achieve these objectives (Haldeman 1992).

Greenland et al. (1980) evaluated six randomised clinical trials conducted on back pain sufferers in which spinal manipulation was compared to other forms of therapy. Their findings were that in all the trials, manipulation was superior to the other forms of therapy, although they concluded that no long term benefits have been proven.

Shekelle et al. (1992) conducted a literature review of all studies reporting the use and complications of spinal manipulation and of all controlled trials on the efficacy of spinal manipulation. They concluded that spinal manipulation hastens the recovery of acute uncomplicated low back pain, but its long term effect, either in preventing the development of chronic low back pain or in preventing recurrence of acute low back pain is unknown. They also state that the data to either support or refute the use of spinal manipulation for the treatment of chronic low back pain is insufficient. Borenstein et al. (1995) take it one step further, stating that spinal manipulation is only associated with transient relief, lasting hours.

Jayson et al. (1981) compared mobilization and manipulation with placebo physiotherapy in patients with nonspecific low back pain. They conducted their study on 94 patients seen in general practice and 94 patients referred to hospital rheumatology and orthopaedic clinics. Three assessments were performed; the first, immediately after the treatment course, the second, two months later, and the third, at one year. There were improvements in both groups, however there was a definite advantage in favour of those receiving mobilization and manipulation immediately after the treatment course. They deduced that in a condition which was likely to improve anyway, the improvement was hastened by mobilization and manipulation.

In a randomised controlled trial Meade et al. (1990) and Meade et al. (1995) compared chiropractic and hospital outpatient treatment of mechanical low back pain. They assessed the long term effectiveness (over a three year period) of chiropractic and hospital outpatient management of low back pain.

The 741 men and women between the ages of 18 and 64 were randomly allocated to chiropractic and hospital outpatient care. The results of the study led the authors to conclude that for patients with mechanical low back pain in whom manipulation is not contraindicated, chiropractic treatment almost certainly offers worthwhile, long term benefit in comparison with hospital outpatient management. These findings prompted the authors to suggest that chiropractic be introduced into the British national health service practice.

Borenstein et al. (1995) reported on the same study done by Meade et al. and they conclude that the groups were not comparable because the number of treatments were not equal. They also report that chiropractors in general tend to spend more time with their patients offering them emotional support. They attempt to substantiate their finding by stating that the essential beneficial factor of manipulation may not be the thrust but rather the conversation before and after the manipulation.

There has however been more objective criticism that not all research has shown favourable results supporting manipulative therapy. Brunarski (1984: 243) states that much of the research done on spinal manipulation has been criticised due to poor methodology and design. Complications after manipulation of the lumbar spine are not as frequent as those of the cervical spine. Most often, forceful long-lever rotational manipulation leads to complications. (Haldeman 1992: 552)

Sims-Williams et al. (1979) conducted a study on 94 patients, 48 of whom were allocated to a group that received mobilization and manipulations, and a 46 who received a placebo treatment. Both forms of treatment were carried out by pysiotherapists. The patients were assessed one month and three months after the treatment. Both groups considered their treatments beneficial and reported that their symptoms had improved and that they were better able to perform physical activity. They concluded that mobilization and manipulation made no difference to the outcome when compared to the placebo treatment (microwave at the lowest possible setting).

Waagen et al. (1986) offer a reason why the efficacy of chiropractic therapy can only be inferred by some authors. They explain that from the studies of manipulative therapy, for the treatment of low back pain, which have been performed, the types of manipulations utalised have been light mobilization or non-specific long lever rotational type manipulations. These procedures have usually been performed by medical, osteopathic, or physiotherapy-trained practitioners of manipulation. They conclude by explaining that chiropractors specialise in the delivery of small-amplitude, short lever, high velocity and very specific spinal adjustments which can be termed Spinal Adjustive Therapy, a sub-classification of Spinal Manipulative Therapy. Chiropractors also receive a longer formal training in the use of this therapy and commonly utalise different manipulative techniques. The results extrapolated from Sims-Williams' study can therefore not directly be associated to chiropractic.

Hoehler et al. (1981) conducted a randomised clinical trial on 95 patients with low back pain to determine the relative efficacy between manipulation therapy and soft tissue massage. Comparison of the two groups indicated that patients who received manipulative therapy were much more likely to report immediate relief after the first treatment but at the time of discharging the patients there was no significant difference between the two groups because both groups demonstrated a substantial improvement. They concluded that although manipulation facilitated recovery, there was no evidence to demonstrate that it affects the long-term prognosis.

Read (1995) states that spinal manipulation is most effective in the treatment of facet problems, but can also help in small disc lesions and sacroiliac joint problems. He emphasises that manipulation is not the correct treatment for all back problems. Casidy and Kirkaldy-Willis (1988) agree, stating that for certain kinds of back pain, spinal manipulation can be demonstrably beneficial.

Of the 28 randomised clinical trials that Manga et al. (1993) reviewed, more than two thirds concluded that manual manipulation had significant beneficial outcomes in the treatment and management of low back pain and that more importantly the studies gave greater credibility to the effectiveness of chiropractic manipulation of low back pain.

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

2.11. CONCLUSION

To understand back pain there must be a framework from which to work. The main aim should be to understand the mechanisms, the nature of back pain, and the rationale for treatment. Only then can one begin to institute rational treatment with predictable results. The very nature of back pain and its impact on industrialised countries imposes such a sense of urgency, that if one method of treatment fails, another must be sought (Weinstein 1990: 83)

Examination of the objectives and the models of clinical practice facilitates a better understanding of the similarities and differences in chiropractic (Haldeman 1992:).

From the available literature it appears that there is sufficient evidence to support the rationale for full spinal manipulative therapy in the treatment of mechanical low back pain. It is therefore proposed that fixations in the cervical spine and thoracic spine may cause compensatory fixations in the lumbar spine due to the biomechanical association and vertebral coupling principle. (Schafer and Faye 1989: 4)

While the restoration and normalization of joint motion is the mechanism of chiropractic therapy, the ultimate goal is to promote homoeostasis of the human body (Gatterman 1990: 52).

Biomechanically based chiropractic techniques utilise in this study are expected to highlight the efficacy of full spinal manipulative therapy for the treatment of mechanical low back pain.

CHAPTER THREE:

MATERIALS AND METHODS

3.1 INTRODUCTION

In this chapter complete details of the trial are given. This includes the study design, the subjects and the details relating to them, the interventions used, the measurements and the methods of obtaining them and finally the statistical procedure utilised.

3.2 THE DATA

This study consists of primary and secondary data collected at different intervals :

3.2.1 The Primary Data skipped

a. Case History (Appendix A)
b. Physical Examination (Appendix B)
c. Orthopaedic Regional Low Back Examination (Appendix C)
d. Orthopaedic Regional Thoracic Spine Examination (Appendix D)
e. Orthopaedic Regional Cervical Spine Examination (Appendix E)
f. Lumbar Spine Range of Motion (Appendix F and L)
g. Algometric values of the entire spine (Appendix G)
h. McGill Short-Form Pain Questionnaire (Appendix H)
i. Oswestry Back Disability Index (Appendix I)
j. Numerical Pain Rating Scale 101 Form (Appendix J)
k. Patient Informed Consent Form (Appendix K)

3.2.2 The Secondary Data

The secondary data comprised the following:
An overview of the criteria necessary for the diagnosis of mechanical low back pain as detailed by Kirkaldy-Willis (1988: 134) and the literature applicable to this topic obtainable in chapter two.

3.3 METHOD OF MEASUREMENT

3.3.1 Subjective Measurement

3.3.1.1 Oswestry Back Disability Index (Appendix H)

This questionnaire is designed to enable the researcher to accurately quantify the subjective functional disability (Haas and Nyiendo 1992) or the extent of the patient's **ability to cope** with everyday life. It comprises a battery of commonly asked questions each of which is scored out of a maximum of five points and a minimum of zero. The result obtained is represented as a percentage and is calculated by scoring the questionnaire out of fifty points.

In the event that one section was not completed the highest possible score was then calculated out of 45 before being converted to the percentage. Likewise, if more than one section was not answered the total score was divided by 5 less points per un-answered section before the percentage was calculated.

The ease with which this test is administered and scored makes it an increasingly popular instrument in research conducted on low back pain patients (Meade et al. 1990).

Haas and Nyiendo (1992) found that the combined use of the McGill Pain Questionnaire and the Oswestry Back Disability Index had the most acceptable predictive power to discern between different clinical disorders.

3.3.1.2 **McGill Short - Form Pain Questionnaire** (Appendix I)

This questionnaire is designed to determine the subjective **sensory interpretation** of the subject's pain (Melzack and Katz 1992: 162). The questionnaire comprises fifteen adjectives to describe the quality of the patients pain. These adjectives were selected on the basis of their frequency of usage by patients and each word is ranked on an intensity scale:

0 = none

1 = mild

2 = moderate

3 = sever (Melzack and Katz 1992: 162)

Melzak (1975: 277) states that the McGill Pain Questionnaire was a major development in the assessment of pain and that it is one of the most used measurement tests for the evaluation of pain because it is sensitive to clinical therapies. Later Melzak and Katz (1992: 163) mention that the questionnaire was effective in the measurement of chronic pain and the sensory dimensions thereof. The sensory interpretation of acute and chronic pain must be assumed to be identical in this instance.

3.3.1.3 **Numerical Pain Rating Scale** (Appendix J)

This questionnaire is designed to ascertain the **pain intensity** that the subjects experience. Each subject is required to indicate by means of a percentage the intensity of the pain they experience when the pain is at its worst and when it is at its least. An accurate assessment of the pain intensity is then obtained by taking the average of the two scores.

Jensen et al. (1986: 125) conducted a study in which six different methods of judging pain intensity were compared. They determined that the Numerical Pain Rating scale - 101 had practical advantages over the other methods because:

1. It was simple and easy 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
   (Jensen et al. 1986: 125).

Jensen et al. (1986: 125) suggests that the Numerical Pain Rating Scale is a reliable method of measurement and should be used as a questionnaire of choice.

3.3.2 Objective Measurement

3.3.2.1 **Lumbar Spine Range of Motion** (Appendix F and L)

The ranges of motion of the lumbar spine were objectively measured using the BROM II (Back Range Of Motion) Goniometer, a product of Performance

Attainment Associates. The BROM II provides readings which, according to the manufacturers, are easily reproduced by a second examiner.

Haldeman (1992: 328, 536) states that goniometers have been in common usage, but stresses the point that the technique used, measures a compound motion that does not specifically reflect the true motion of the spine.

Bolton (1994) agrees that spinal flexion is among the commonly used objective measures used to evaluate treatment outcomes for low back pain. He does caution though, that the inclinometers and goniometers used generally only have a moderate reliability.

The following ranges of motion were measured:

1. Forward flexion,
2. extension,
3. bilateral rotation, and
4. bilateral lateral flexion

3.3.2.2 **Algometer** (Appendix G)

Spinal tenderness was assessed using the Force Dial algometer. The higher the reading, the less tenderness was felt by the patient, therefore indicating a higher tolerance to pain. The measurements were taken on each spinous process from the first cervical vertebra to the last lumbar vertebra (including L6, where appropriate) and over bilateral sacroiliac joints. The force readings were measured in kilograms per square centimetre (kg/cm) and then the average for each section of the spine was calculated.

The use of the Algometer to measure sensitivity is widespread (Fischer 1986). He also states that the algometers ability to measure pressure sensitivity and to identify aberrant tender areas provides a means of quantifying treatment, including manipulation, so as to identify patient improvement (Fischer 1986: 837).

3.4 THE LOCATION OF DATA

All the patient consultations were conducted at the Technikon Natal Chiropractic Day Clinic. The primary data was obtained at the commencement of the first, last and follow-up consultations, and consisted of the following:

1. Oswestry Back Disability Index questionnaire
2. McGill Short Form Pain questionnaire
3. Numerical Pain Rating Scale
4. Lumbar Spine Range of Motion
5. Algometric Readings

The secondary data was collected from text books, current journals and the CD - Rom at the Technikon Natal Library and personal communication with respected local Chiropractors. When literature was unavailable locally, interlibrary loans were made use of.

3.5 STUDY DESIGN AND PROTOCOL

3.5.1 OBJECT OF THE STUDY

The primary objective of this study was to determine the efficacy of each treatment in terms of objective and subjective measurements. The study endeavoured to identify whether the combination of full spinal manipulation was more effective than lumbar spine manipulation alone for the treatment of mechanical low back pain. Once having determined that, it was anticipated that the cost of treating this common ailment would be minimised and that a more standardised approach could be adopted by practising chiropractors and other manipulators alike, in order to eliminate the existing diversity in practice. It was with this considerable variability of treatment in mind, that this controlled study was undertaken.

3.5.2 SUBJECTS

Only subjects having mechanical low back pain ie. posterior facet syndrome and sacroiliac syndrome, were considered for this clinical trial. All subjects had to present with mechanical low back pain and have cervical and/or thoracic spinal fixations, but had to be asymptomatic with regards to pain in these latter regions.

Subjects selected to participate in this trial were randomly divided into two groups using the probability sampling method. The sample size incorporated thirty subjects, all of whom had to comply to certain governing criteria regulating the study. There was no gender or racial discrimination. Each group consisted of fifteen subjects:

a. Research group of 15 subjects (**R - group**)

b. Control group of 15 subjects (**C - group**)

3.5.2.1 ACCEPTANCE OF SUBJECTS

Subjects were specifically selected to minimise variations caused by subject characteristics. Patients selected for this study had to fulfil the following criteria:

1. All subjects had to be between and including the ages of 16 to 60 years of age,
2. all subjects selected had to sign an informed consent form (Appendix N) prior to any treatment given,
3. all subjects had to be free from any contraindicating factors to spinal manipulative therapy,
4. where necessary, subjects had to agree to undergo an X-ray evaluation to exclude any pathology,
5. each patient had to undergo a complete case history (Appendix A) and physical examination (Appendix B),
6. each patient had to undergo a comprehensive Lumbar Spine Orthopaedic examination (Appendix C) and be diagnosed as suffering from mechanical low back pain, and
7. each patient had to undergo a comprehensive Cervical and Thoracic Spine Orthopaedic examination (Appendix D).

3.6 INTERVENTIONS

Once accepted into the research programme, each subject was required to complete the following prior to any treatment received:

1. McGill Short - Form Pain questionnaire
2. Oswestry Back Disability Index questionnaire
3. Numerical Pain Rating Scale.

The lumbar spine ranges of motion were then measured using the goniometer and spinal tenderness was assessed using the algometer. Each subject was treated twice weekly for five weeks and on their last visit the questionnaires and measurements were reassessed. Thereafter the patients returned after a four week period of no treatment to complete the same questionnaire and be remeasured in a follow -up consultation.

The **R group** receive adjustments to all fixated segments of the spine, including the occiput and sacroiliac joints where indicated. The **C group**, irrespective of fixations elsewhere, only received adjustments to the lumbar spine and the sacroiliac joints where indicated.

The "Diversified " adjusting technique was used on all subjects and they comprised the following:

3.6.1 Cervical Spine:

3.6.1.1 Cervical break

This technique is indicated for all cervical fixations, whether rotary or lateral fixations. The subject lies supine with the headpiece of the table level and the head rotated 45 degrees to the contralateral side. The doctor stands on the ipsilateral side of the subject.

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 the ear of the subject. 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 the restricted movement. Slight ulnar deviation of the contact hand is required during the thrust when a rotary adjustment is delivered. (States 1985: 56)

3.6.1.2 Combination movement

This technique is indicated for rotary fixations of the thoracic spinal levels T1 - T4. The subject 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 subject's cheek. Skin slack is taken out from 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. (States 1985: 56)

3.6.1.3 Thumb move / bench TM

This technique is indicated for rotary type fixations (C6 - T3). The subject lies prone with the head piece below horizontal. Doctor takes up the "Fencer" stance on the side of the lesion and faces cephalad.

The contact is taken with the doctor's thumb on the ipsilateral side of the lesion with the wrist straight, fingers loose and the web of the hand resting on the subject's trapezius. The contact is made against the spinous-lamina junction while the arm of the contact hand maintains a horizontal position. The indifferent hand is cupped against the rim of the subject's occiput with the fingers pointing cephalad and resting against the temporal bone. The indifferent hand provides occiput and cervical rotation and traction.

The subject's face is rotated away from the lesion side with the indifferent hand until sufficient rotation is felt under the contact hand. Joint slack is taken up with the contact hand in a rotary plane using the spinous process as a lever. Line of drive is in a transverse plane, straight across. The thrust is a high velocity impulse performed under traction. (Szaraz 1990: 4.1)

3.6.1.4 Combination move

The combination move is indicated for rotary type fixations of the upper thoracic spine (T1 - T4). The subject lies prone with the headpiece below horizontal. The doctor takes up the "Fencer" stance at the head of the subject, facing cephalad and on the side as the lesion.

A high chiropractic arch is formed with the inferior hand and a padded pisiform contact is slid onto the ipsilateral transverse process of the involved vertebra. The cupped hand is secured around a mass of trapezius muscle with the fingers spread and free from the table and subject's neck. The indifferent hand is cupped with the web of the hand secured against the rim of the subject's occiput. The occiput is rotated towards the doctor until rotation is sensed under the contact hand. While cephalad traction and rotation is maintained with the indifferent hand joint slack is removed with the contact hand by transferring the body weight onto the stiffened contact arm.

The line of drive is anterior and slightly cephalad. The thrust is a single, high velocity, and moderate amplitude body drop. (Szaraz 1990: 4.2)

3.6.2 Thoracic Spine:

3.6.2.1 Crossed Bilateral Transverse Pisiform

This technique is indicated for rotary type fixations of T4 - T12. The subject lies prone with the doctor in a "Fencer" stance on the side of the lesion, facing cephalad. Skin slack is removed with the middle finger of the indifferent hand in a cephalad direction.

A stiff chiropractic arch is formed with the contact hand and slid onto the transverse process of the involved vertebra, providing a padded pisiform contact. The fingers of the contact hand are comfortably spread with the little finger parallel to the vertebral column.

The indifferent hand (superior hand) is crossed over the contact hand and placed on the contralateral tranverse process. Joint and soft tissue slack are taken up in a cephalad direction with the contact hand and the line of drive is cephalad with torque, if required. A combination of an impulse and a body drop type of thrust are utilised. (Szaraz 1990: 6.4.)

3.6.2.2 Anterior Thoracic Technique

This technique is indicated for anterior thoracic fixations (T1-T12). The subject is supine with the headpiece raised and the arms crossed tightly across the chest. The doctor stands in the "Fencer" stance facing the cephalad at the level of the patient's waist.

The doctor reaches over and around the subject's chest to place the caudad contact hand on the segment directly inferior to the involved segment. 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 subject's crossed arms and the doctor leans onto his/her own forearms. The indifferent contact tractions the subject's crossed arms caudally and posteriorly, so as to induce slight passive flexion of the thoracic spine.

During the subject's exhalation a quick but gentle body drop is delivered in a posterior and slightly superior direction, towards the contact hard. (States 1985: 56)

3.6.2.3 Bilateral Hypothenar - Carver Bridge

The Carver Bridge technique is indicated for general mobilisation in flexion of T4 - T12. The subject lies prone while the doctor takes up the "Fencer" stance, facing cephalad on either side of the patient.

The fingers of both clutched hands are interwoven and the hypothenar eminences takes up skin slack in a cephalad direction. The padded pisiforms slide onto the involved tranverse processes of the involved vertebra, bilaterally. The doctor leans forward on the contact hands to remove skin and joint slack. Radial deviation of both wrists together with a combined impulse and body lean thrust, directs the vertebra into flexion. The line of drive is in a cephalad direction with a scooping motion of the wrists. (Szaraz 1990: 6.3)

3.6.3 Lumbar Spine:

3.6.3.1 Lumbar Roll (Pisiform - Mamillary)

This technique is indicated for rotary type fixations of the lumbar spine (L1 - L5). The subject lies in the side posture position with the headpiece elevated for comfort. The subject's lower arm is pulled laterally and folded over the shoulder of the opposite arm and stabilised with the indifferent hand, while cephalad traction is provided. The subject's lower leg is slightly bent at the knee while the upper leg is flexed at the hip and the knee with the foot placed into the popliteal space of the lower leg.

The doctor takes up the "Fencer" stance and places the subject's upper bent knee between his/her thighs. The doctor's pelvis should be at the level of the lesion. The subject's upper leg is flexed while the doctor monitors the interspinous movement of the segments above and below the lesion. The pelvis and thigh are stabilised at the point of the start of any movement of the involved spinous process by downward transfer of the doctor's weight. The doctor's forward leg carries the majority of his/her body weight.

Skin slack is removed by cephalad traction of the indifferent hand while a pisiform contact is made with the caudad hand on the mamillary process of the superior segment. The fingers should be spread, facing cephalad and with fifth digit parallel to the spinal column. The cephalad hand is placed on the subject's upper shoulder and used to stabilise the torso and prevent excessive torque.

The thrust is a body drop with a sudden impulse and small amplitude. (Szaraz 1990: 9.1)

3.6.3.2 Spinous Hook / Pull

This technique is indicated for rotary type fixations involving superior fibers of sacro-spinalis, with the lesion side down (T10 - L5). The subject and doctor position are as for the lumbar roll technique.
The contact is taken with the caudad hand's index or middle finger tip on the contralateral side of the involved spinous process. A cup is made with the contact hand by extending the wrist and flexing the proximal interphalangeal joints. The contact is made with the index or middle finger tip and reinforced by the adjacent fingers. The doctor's hand and forearm rest on the subject's flank and superior ilium while avoiding the sciatic nerve. The doctor's elbow is kept close to his/her torso.

The indifferent hand is placed on the superior shoulder of the subject as in the lumbar roll technique. Skin slack is removed by cephalad traction of the indifferent hand and rotating the upper torso to the point of pivot under the contact. Gently stress the segments inferior to the lesion by anterior rotation of the pelvis through forearm of contact hand. Care should be taken to prevent excessive upper torso torque.

The line of drive is directed through the wrist and forearm and the thrust is a pull with the fingers and forearm combined with a sudden impulse. The thrust should be sudden, fast and shallow. (Szaraz 1990: 9.12)

3.6.3.3 Spinous Push

This technique is indicated for rotation type fixations of L1 - L5, lesion side up. Subject lies in a side posture position with no torso rotation (spine and pelvis should be maintained perpendicular to the table). The legs are in the same position as for the lumbar roll. The doctor takes up a "Fencer" stance as for the lumbar roll.

The middle finger tip of the contact hand is placed on the ipsilateral side of the spinous process. An arch is formed with the hand and the fingers are reinforced, the wrist is fully flexed and ulnar deviated. The forearm of the contact hand rests on the superior ilium, avoiding the sciatic notch and the body weight is transferred through the forearm caudally and medially. Stabilise the spinous process and rotate the lower segments including the ilium, anteriorly.

The indifferent hand is placed on the upper shoulder and only used to stabilise the torso. Remove skin slack by cephalad traction with the indifferent hand and caudal traction and anterior rotation of the contact arm by transferring body weight onto that arm through the pelvis. The line of drive is a continuation of taking up skin slack and the thrust is a body drop with sudden impulse. (Szaraz 1990: 9.11)

3.6.3.4 Upper Sacro - iliac Joint

This technique is indicated for upper sacro-iliac joint fixations. The subject lies in the side posture portion with the headpiece elevated for comfort. The subject's lower arm is pulled laterally and folded over the shoulder of the opposite arm and stabilised with the indifferent hand, while cephalad traction is provided. The subject's lower leg is slightly bent at the knee while the upper leg is flexed at the hip and the knee with the foot placed into the popliteal space of the lower leg.

The doctor takes up the "Fencer" stance facing approximately 45 degrees cephalad and places the subject's upper bent knee between his/her thighs. The doctor raises his/her center of gravity to take contact. The inferior hand forms a stiff chiropractic arch with the heel of the contact hand placed over the upper posterior superior iliac spine. The subject's inominate is rotated anteriorly and gently pushed into extension while the upper torso is stabilised by the indifferent hand. Doctor's body weight is progressively lowered against subject's upper thigh through doctor's inferior leg, positioning the sternal notch over the contact point.

The line of drive is anterior and inferior, down subject's superior thigh. The thrust is a single, high velocity, short amplitude impulse which may be combined with a body drop. (Szaraz 1990: 9.2)

3.6.3.5 Lower Sacro - iliac Joint

This technique is indicated for lower sacro-iliac fixations. the subject is side lying with minimal torso rotation. The upper leg is flexed at the hip joint and the upper thigh remains parallel to the table top. The doctor takes up a low "Fencer" stance with torso behind the contact point, while standing in front of the subject and facing cephalad.

The doctor's inferior thigh supports the subject's upper flexed thigh preventing it from dropping off the side of the table. A stiff chiropractic arch is formed with the inferior hand (contact hand) and the heel of the hand is placed over the ischial tuberosity. The indifferent hand supports the subject's torso.

Joint and skin slack is taken up by inducing inominate flexion. Line of drive is anterior and cephalad creating inominate flexion. The thrust is a single high velocity, short amplitude impulse. (Szaraz 1990: 9.3)

3.6.4 Soft Tissue Therapy

Soft tissue treatment in the form of effleurage was administered to each patient before every spinal manipulation. Soft tissue therapy is a non-specific application, that will not influence the outcome of this study, because it is applied to both groups, and because it is generally used on patients during treatment at chiropractic practices (Haldeman 1992: 519).

3.7 SOLVING FOR THE SUBPROBLEMS

Statistical analysis was conducted on both the subjective and objective data, each of which is contained in three subproblems. The results procured from the data were then used to address the three subproblems.

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3.8 TREATMENT OF THE DATA

3.8.1 TREATMENT OF THE SUBJECTIVE DATA

The subjective data was managed as follows:

1. Each questionnaire was screened to determine whether they had been completed correctly and completely,
2. the three questionnaires were expressed as percentages and recorded, and
3. the data was then statistically analysed.

3.8.2 TREATMENT OF THE OBJECTIVE DATA

The objective data was managed as follows:

1. The lumbar spine ranges of motion were measured and recorded in degrees, and
2. the data was then statistically analysed.

3.9 STATISTICAL ANALYSIS OF THE DATA

3.9.1 NON - PARAMETRIC PAIRED HYPOTHESIS TESTS

3.9.1.1 The Subjective Data

To analyse the subjective data within each group the **Wilcoxen Signed Rank Test** was applied. This test uses the magnitude of the differences between the observed values. In order to do this, the differences in the values are ranked in order of absolute size. Then the original signs of the differences are allocated to the ranks. The sum of the ranks with negative signs and the sum of the ranks with positive signs are then computed. According to Daniel (1987), the Wilcoxon signed - rank test uses more information than the sign test and is therefore a more powerful test. (Daniel 1987: 31)

The values calculated were selected from the following consultations and compared:

1. The initial consultation (**IC**) and the last consultation (**LC**)
2. the initial consultation (**IC**) and the follow - up consultation (**FU**)
3. the last consultation (**LC**) and the follow - up consultation (**FU**)

3.9.1.2 The Objective Data

Analysis of the objective data within each group was also done using the **Wilcoxen Signed Rank Test**. The ranges of motion, measured in each plane, in degrees, and the algometric readings, measured in kg/cm squared, were compared as follows:

1. The initial consultation (**IC**) and the last consultation (**LC**)
2. the initial consultation (**IC**) and the follow - up consultation (**FU**)
3. the last consultation (**LC**) and the follow - up consultation (**FU**)

All confidence intervals were constructed at the 95% confidence intervals ie. alpha = 0.05.

T - tests of the null hypothesis (ie. that the two groups showed no significant difference) were therefore rejected for any P value less than 0.05, and P<
accepted for any P value greater than 0.05. P>

The Wilcoxon signed-rank test assumes that the sample population is symmetric. With respect to this it is assumed that the population involved in this study was representative of the population in the greater Durban area.

3.9.2 NON - PARAMETRIC UNPAIRED HYPOTHESIS TESTS

3.9.2.1 The Subjective Data

To analyse the data between the groups the **Mann - Whitney U -Test** was utilised. The measurements taken for each questionnaire were collated by taking the median values (as a %) of the research and control groups. The only assumption made with this test is that the data is continuous. The values compared were the following:

1. the IC of the research group and the control groups, initial Concultation
2. the LC of the research group and the control groups, and Last Consutation
3. the FU of the research group and the control groups. follow - up

The level of significance was again set at the 95% confidence interval.

3.9.2.2 Objective Data

The **Mann - Whitney U Test** was also applied to calculate the median values of the lumbar spine ranges of motion and the algometric values between the two groups. The values compared were the following:

1. the IC of the research group and the control groups,
2. the LC of the research group and the control groups, and
3. the FU of the research group and the control groups.

The confidence interval was set at the 95% confidence interval, ie alpha = 0.05.

All the statistical analysis was performed on the **Statgraphics Plus Version 6,** supplied by Manugistics Inc.

3.10 Conclusion

There were thirty six (36) subjects found eligible for this study, of which six were non-compliant. Of the six who proved to be non-compliant four did not return for follow-up treatments and two developed additional pathologies as a result of sporting injuries.

CHAPTER 4

RESULTS

4.1 INTRODUCTION

This chapter deals with the results obtained in terms of the subjective and objective data collected from the respective questionnaires, the goniometric and the algometric readings.

The results secured from the statistical analyses are tabulated to display the z - value and the exceeding probability value (p - value), which is compared to the level of significance which in this study is set at the 95% confidence interval for all the tests.

The control and research **intra - group** data are analysed followed by the **inter - group** data, in order to determine the efficacy of each treatment protocol. The null and alternative hypotheses are then stated and are either accepted or rejected according to the results obtained.

All the questionnaires were completed under the supervision of the researcher and the goniometric and algometric readings were measured by the researcher himself. This was done in order to rule out the possibility of variations in inter examiner reliability.

4.2 HYPOTHESIS TESTING

4.2.1 Null Hypothesis

This is ordinarily the hypothesis that one rejects. In hypothesis testing, the null hypothesis is usually the result that one does not want and it is indicated by **Ho**.

4.2.2 Alternative Hypothesis

This is usually the result that one wishes to accept, ie. the required result and is usually indicated by **Ha**.

4.3 TABULATION OF THE RESULTS

4.3.1 Subproblem One: Control Group (intra - group data)

The first subproblem was to evaluate lumbar spine adjustments, in terms of subjective and objective clinical findings, to establish the efficacy of this approach in the treatment of mechanical low back pain.

Alpha is set at 5% or 0.05. This implies that the level of significance is set at 5%. Additionally this implies that the probability of incorrectly dismissing the so-called null hypothesis is set at 5%.

The hypotheses for the intra-group data in this study were as follows:

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

Ha: there would be a difference in the subjective and objective clinical findings on analysis of the intra - group data, indicating that the treatment was effective in the management of mechanical low back pain.

4.3.1.1 The Subjective Data

The subjective data was obtained from the Numerical Pain Rating Scale 101 (table 1), the Oswestry Back Disability Index (table 2) and the McGill Pain Questionnaire (table 3). The results of the statistical analyses were as follows:

Table 1. **A sample analysis of the NRS-101 comparing the initial consultation, the last consultation and follow-up consultation of the control group:**

	IC - LC	IC - FU	LC - FU
Z VALUE	0.000300669	0.000300669	0.096092
P VALUE	0.000150334	0.000150334	0.048046
SD / NSD	SD	SD	SD

The null hypothesis is rejected for the control group indicating that at the 5% level of significance there was a statistically significant difference between the initial consultation, the last consultation and the follow-up consultation. This confirms that there was an improvement as a result of the treatment. (Table 1)

Table 2. **A sample analysis of the Oswestry Back Disability Index comparing the initial consultation, the last consultation and the follow-up consultation of the control group:**

	IC - LC	IC - FU	LC - FU
Z VALUE	0.00194591	0.00194591	0.34278
P VALUE	0.000972955	0.000972955	0.17139
SD / NSD	SD	SD	NSD

Table 3. **A sample analysis of the McGill Pain Questionnaire comparing the initial consultation, the last consultation and the follow-up consultation of the control group:**

	IC - LC	IC - FU	LC - FU
Z VALUE	0.000300669	0.00194591	0.148914
P VALUE	0.000150334	0.000972955	0.074457
SD / NSD	SD	SD	NSD

At the 5% level of significance there was a statistically significant difference between the initial consultation and the last consultation and between the initial consultation and the follow - up consultation. The null hypotheses are thus rejected for the Oswestry Back Disability Index and the McGill Pain Questionnaire. This confirms that there was an improvement in the back disability and the nature of the pain as a result of the treatment. (Table 2 and 3)

4.3.1.2 Objective Data

The objective data was obtained from readings of the Algometric (table 4 and 5) and the Goniometric evaluations (table 6-12). The results of the statistical analyses are as follows:

Table 4. **A sample analysis of the Algometer Readings comparing the initial consultation, the last consultation and the follow-up consultation of the control group:**

	IC - LC	IC - FU	LC - FU
Z VALUE	0.00194591	0.00982331	0.301698
P VALUE	0.000972955	0.004911655	0.150849
SD / NSD	SD	SD	NSD

There was a statistically significant difference found to exist between the initial consultation and the last consultation and between the initial consultation and the follow-up consultation This indicates that there was an improvement as a result of the treatments given and consequently the null hypothesis is rejected. (Table 4)

Table 5. **The average improvement in the pressure sensitivity readings as measured with the algometer in kilograms per square centimeter between the control and research groups measured:**

	Initial consultation	Last consultation	Follow up consultation	TOTAL IMPROVEMENT
CONTROL	4.35	6.25	7.14	**2.79**
RESEARCH	2.63	4.62	4.74	**2.11**

Very little significant difference was found in the algometer readings between the control and research groups, with the control group only having a 0.68 kilogram per square centimeter greater pressure tolerance. (Table 5)

Table 6. **A sample analysis of the Range of Motion in Forward Flexion comparing the initial consultation, the last consultation and the follow-up consultation of the control group:**

	IC - LC	IC - FU	LC - FU
Z VALUE	0.0265001	0.422676	0.605574
P VALUE	0.01325005	0.211338	0.302787
SD / NSD	SD	NSD	NSD

For forward flexion the control group showed a significant improvement from the initial consultation to the last consultation. Therefore, the null hypothesis is rejected, indicating that at the 5% level of significance there was a statistically significant difference between the initial consultation and the last consultation. That means that there was an improvement as a result of the treatment. (Table 6)

Table 7. **A sample analysis of the Range of Motion in Extension comparing the initial consultation, the last consultation and the follow-up consultation of the control group:**

	IC - LC	IC - FU	LC - FU
Z VALUE	0.267256	0.789264	1
P VALUE	0.133628	0.394632	0.5
SD / NSD	NSD	NSD	NSD

The null hypothesis is accepted for the control group which indicates that at the 5% level of significance there was not a statistically significant difference between the initial consultation, the last consultation and the follow - up consultation. This means that there was no improvement as a result of the treatment. (Table 7)

Table 8. **A sample analysis of the Range of Motion in Left Lateral Flexion comparing the initial consultation, the last consultation and the follow-up consultation of the control group:**

	IC - LC	IC - FU	LC - FU
Z VALUE	0.00554577	0.00194591	0.422676
P VALUE	0.002772885	0.000972955	0.211338
SD / NSD	SD	SD	NSD

Table 9. **A sample analysis of the Range of Motion in Right Lateral Flexion comparing the initial consultation, the last consultation and the follow-up consultation of the control group:**

	IC - LC	IC - FU	LC - FU
Z VALUE	0.00149629	0.0161569	0.772826
P VALUE	0.000748145	0.00807845	0.386413
SD / NSD	SD	SD	NSD

Table 10. **A sample analysis of the Range of Motion in Left Rotation comparing the initial consultation, the last consultation and the follow-up consultation of the control group:**

	IC - LC	IC - FU	LC - FU
Z VALUE	0.096092	0.0161569	0.772826
P VALUE	0.048046	0.00807845	0.386413
SD / NSD	SD	SD	NSD

Table 11. **A sample analysis of the Range of Motion in Right Rotation comparing the initial consultation, the last consultation and the follow-up consultation of the control group:**

	IC - LC	IC - FU	LC - FU
Z VALUE	0.096092	0.00554577	0.386474
P VALUE	0.048046	0.002772885	0.193237
SD / NSD	SD	SD	NSD

At the 5% level of significance there was a statistically significant difference between the initial consultation and the last consultation and the initial consultation and the follow - up consultation. This means that there was an improvement as a result of the treatment and thus the null hypothesis is rejected for the control group. However there was no significant difference between the last consultation and the follow-up consultation indicating that there was no improvement during the lay off period. (Tables 8, 9, 10 and 11)

4.3.2. Subproblem Two: Research Group (intra - group data)

The second subproblem was to evaluate full spinal adjustments, in terms of subjective and objective clinical findings, to establish the efficacy of this approach in the treatment of mechanical low back pain.

Table 12. **A sample analysis of the NRS-101 comparing the initial consultation, the last consultation and the follow-up consultation of the research group:**

	IC - LC	IC - FU	LC - FU
Z VALUE	0.000300669	0.000300669	0.770995
P VALUE	0.000150334	0.000150334	0.03854975
SD / NSD	SD	SD	SD

The null hypothesis is rejected for the research group which indicates that at the 5% level of significance there was a statistically significant difference between the initial consultation and the last consultation, between the initial consultation and the follow - up consultation and between the last consultation and the follow-up consultation. That indicates that there was an improvement as a result of the treatment. (Table 12)

Table 13. **A sample analysis of the Oswestry Back Disability Index comparing the initial consultation, the last consultation and the follow-up consultation of the research group:**

	IC - LC	IC - FU	LC - FU
Z VALUE	0.00328359	0.00149629	0.504983
P VALUE	0.001641795	0.000748145	0.2524915
SD / NSD	SD	SD	NSD

Table 14. **A sample analysis of the McGill Pain Questionnaire comparing the initial consultation, the last consultation and the follow-up consultation of the research group:**

	IC - LC	IC - FU	LC - FU
Z VALUE	0.000300669	0.000512096	1
P VALUE	0.000150334	0.000256048	0.5
SD / NSD	SD	SD	NSD

Table 15. **A sample analysis of the Algometer Readings comparing the initial consultation, the last consultation and the follow-up consultation of the research group:**

	IC - LC	IC - FU	LC - FU
Z VALUE	0.000300669	0.000300669	0.267256
P VALUE	0.000150334	0.000150334	0.133628
SD / NSD	SD	SD	NSD

The null hypothesis is rejected for the control group which indicates that at the 5% level of significance there was a statistically significant difference between the initial consultation and the last consultation and the initial consultation and the follow - up consultation. This means that there was an improvement as a result of the treatment. (Table 13, 14 and 15)

Table 16. **A sample analysis of the Range of Motion in Forward Flexion comparing the initial consultation, the last consultation and the follow-up consultation of the research group:**

	IC - LC	IC - FU	LC - FU
Z VALUE	0.422676	0.301698	1
P VALUE	0.211338	0.150849	0.5
SD / NSD	NSD	NSD	NSD

Table 17. **A sample analysis of the Range of Motion in Extension comparing the initial consultation, the last consultation and the follow-up consultation of the research group:**

	IC - LC	IC - FU	LC - FU
Z VALUE	1	0.267256	0.789264
P VALUE	0.5	0.133628	0.394632
SD / NSD	NSD	NSD	NSD

The null hypothesis is rejected for the control group which indicates that at the 5% level of significance there was a statistically significant difference between the initial consultation and the last consultation and the initial consultation and the follow - up consultation. This means that there was an improvement as a result of the treatment. (Table 16 and 17)

Table 18. **A sample analysis of the Range of Motion in Left Lateral Flexion comparing the initial consultation, the last consultation and the follow-up consultation of the research group:**

	IC - LC	IC - FU	LC - FU
Z VALUE	0.161569	0.00554577	0.7782826
P VALUE	0.00807845	0.002772885	0.386413
SD / NSD	SD	SD	NSD

Table 19. **A sample analysis of the Range of Motion in Right Lateral Flexion comparing the initial consultation, the last consultation and the follow-up consultation of the research group:**

	IC - LC	IC - FU	LC - FU
Z VALUE	0.00194591	0.0433079	0.301698
P VALUE	0.000972955	0.02165395	0.150849
SD / NSD	SD	SD	NSD

Table 20. **A sample analysis of the Range of Motion in Left Rotation comparing the initial consultation, the last consultation and the follow-up consultation of the research group:**

	IC - LC	**IC - FU**	**LC - FU**
Z VALUE	0.0613685	0.096092	0.789264
P VALUE	0.03068425	0.048046	0.394632
SD / NSD	SD	SD	NSD

The null hypothesis is rejected for the control group which indicates that at the 5% level of significance there was a statistically significant difference between the initial consultation and the last consultation and the initial consultation and the follow - up consultation. This means that there was an improvement as a result of the treatment. (Table 18, 19 and 20)

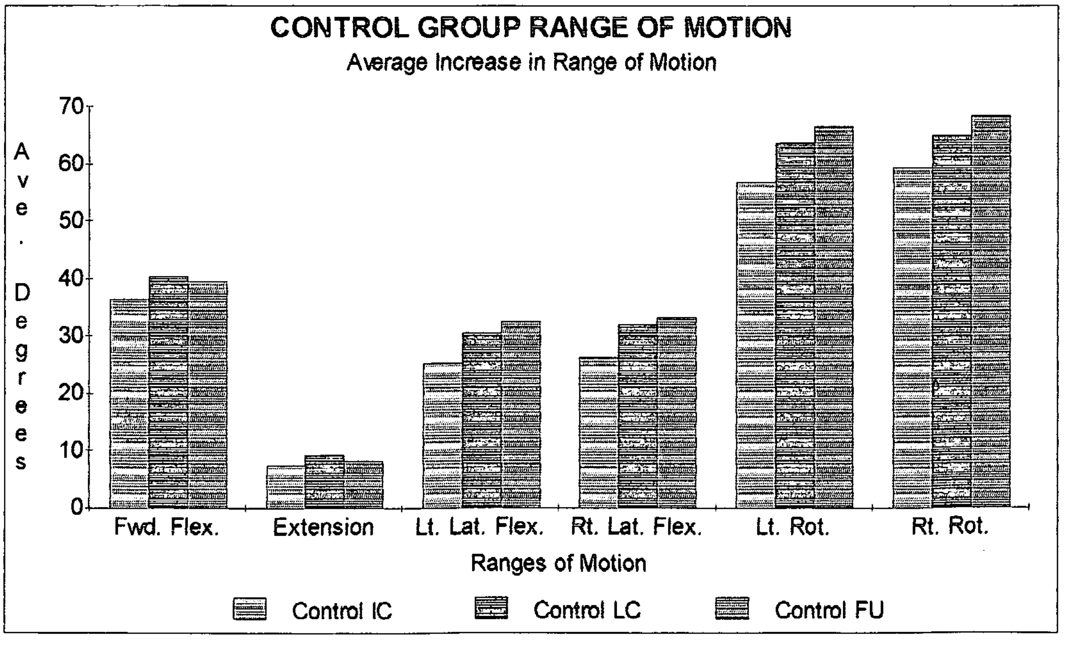
Table 21. **A sample analysis of the Range of Motion in Right Rotation comparing the initial consultation, the last consultation and the follow-up consultation of the research group:**

	IC - LC	IC - FU	LC - FU
Z VALUE	0.181449	0.301698	0.789264
P VALUE	0.0907	0.150849	0.394632
SD / NSD	NSD	NSD	NSD

The null hypothesis is rejected for the control group which indicates that at the 5% level of significance there was a statistically significant difference between the initial consultation and the last consultation and the initial consultation and the follow - up consultation. This means that there was an improvement as a result of the treatment. (Table 21)

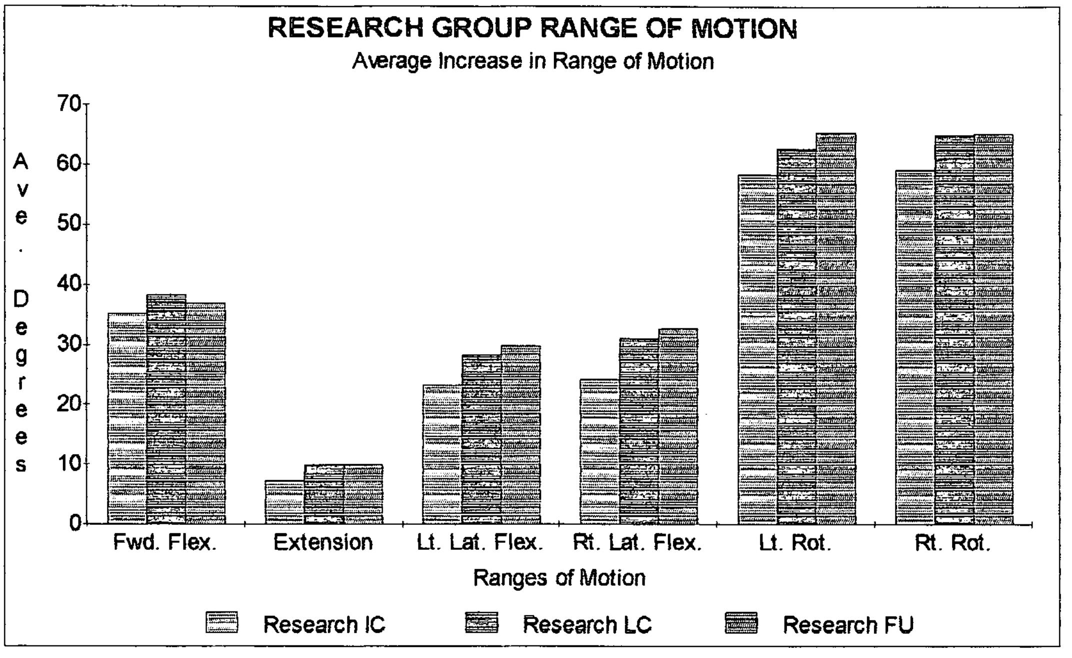
Graph 4.1 **Graph illustrating the average increase in each range of motion as measured in degrees for the control group.**

patients



Graph 4.2 **Graph illustrating the average increase in each range of motion as measured in degrees for the research group.**

for research free of charge



Graphs 4.1 and 4.2 above clearly illustrate how each range of motion improved during the course of each treatment.

4.3.3. SUBPROBLEM THREE: Control and Research Comparison

The third subproblem was to integrate the data indicating the effectiveness of lumbar spine adjustments and full spinal adjustments, in terms of subjective and objective clinical findings, in order to determine the more effective treatment approach in the management of mechanical low back pain.

4.3.3.1 Inter Group Analysis (Unpaired Samples)

This is the analysis of data between the control and research groups and to this end the Mann Whitney - U test was used.

The hypotheses for comparing the control and research group were as follows:

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

Ha: there would be a difference in the subjective and objective clinical findings on analysis of the inter - group data, indicating that the treatments were not equally effective in the management of mechanical low back pain.

Table 22. **A sample analysis of the Numerical Pain Rating Scale -101 comparing the initial consultation, the last consultation and the follow - up consultation of the control and research groups:**

	IC - IC	LC - LC	FU - FU
Z VALUE	0.769722	0.441039	1
P VALUE	0.384861	0.2205195	5
SD / NSD	NSD	NSD	NSD

Graph 4.3 **A comparison of the average subjective scores recorded as a percentage for the Numerical Pain Rating Scale 101 for the control and the research groups.**

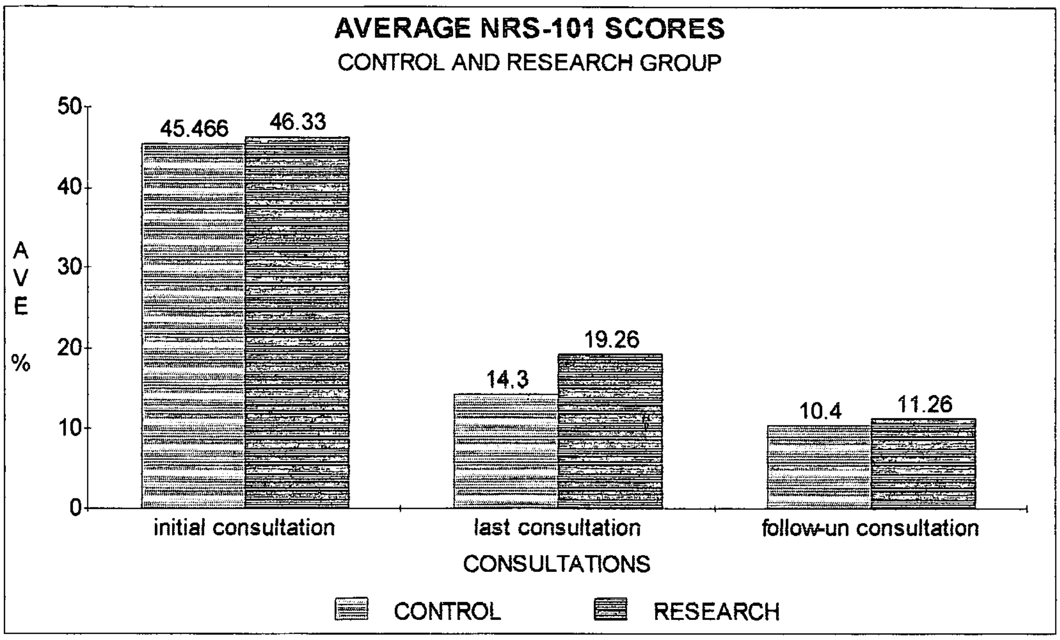


Table 22 and graph 4.3 clearly indicate how the scores of the Numerical Pain Rating Scale for each group significantly improved from the initial consultation through to the follow-up consultation. It also serves in indicate how similar the improvements were between the two groups.

Table 23. **A sample analysis of the Oswestry Pain Disability Index comparing the initial consultation, the last consultation and the follow - up consultation of the control and research groups:**

	IC - IC	LC - LC	FU - FU
Z VALUE	0.4916	0.458312	0.239915
P VALUE	0.2458	0.229156	0.1199575
SD / NSD	NSD	NSD	NSD

Graph 4.4 **An illustration depicting the relative average scores of the Oswestry Back Disability Index questionnaire which are expressed as a percentage.**

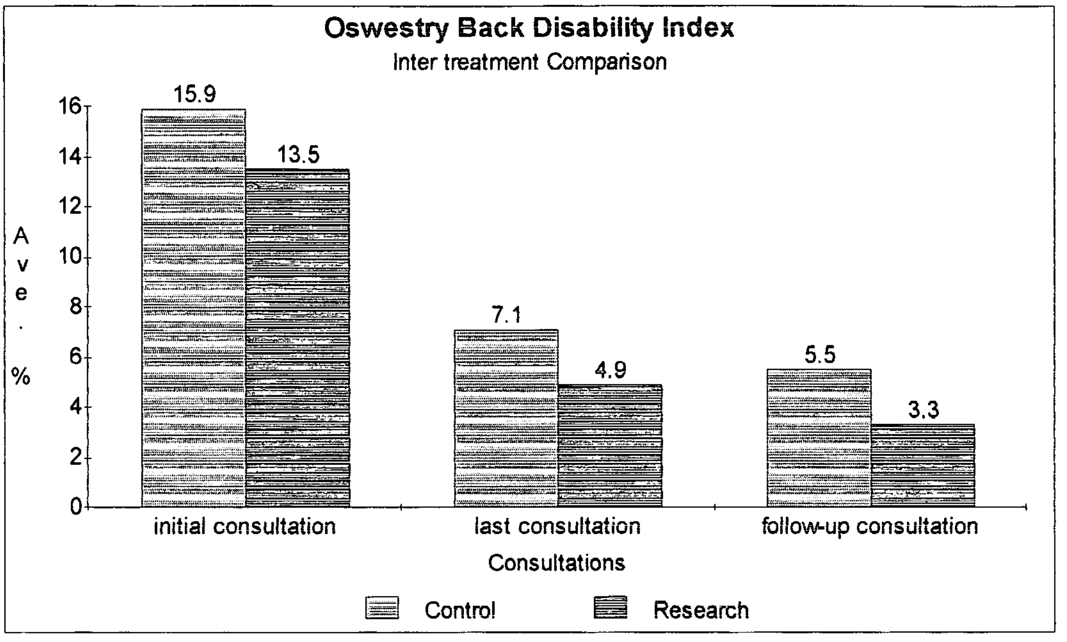


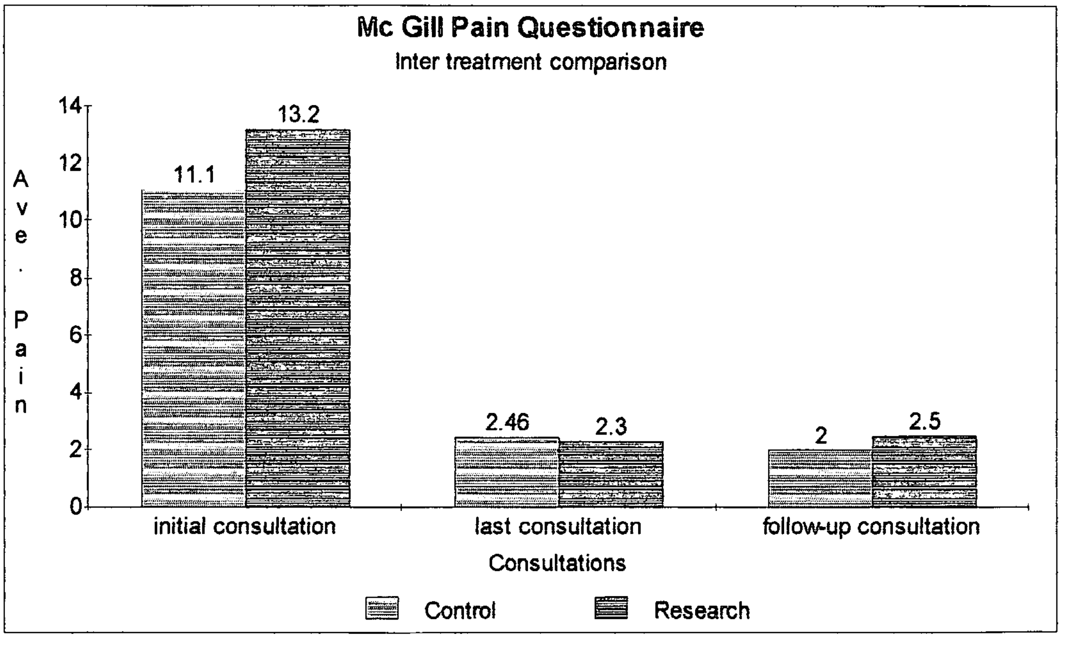
Table 23 and graph 4.4 effectively illustrates the consistent decrease in the subjective back disability experienced by the subjects in both the control and the research groups.

Table 24. **A sample analysis of the McGill Pain Questionnaire comparing the initial consultation, the last consultation and the follow - up consultation of the control and research groups:**

	IC - IC	LC - LC	FU - FU
Z VALUE	0.47975	0.849212	0.829453
P VALUE	0.239875	0.4246095	0.4147265
SD / NSD	NSD	NSD	NSD

Neither the control group nor the research group showed a statistically significant difference in treatment outcomes between the initial consultation, the last consultation and the follow-up consultation at the 5% level of significance. Therefore the null hypothesis is accepted indicating that neither group improved more than the other. (Table 24)

Graph 4.5 **Graphic illustration of the pain scores obtained from the McGill Pain Questionnaire for the control and research groups measured as a percentage.**



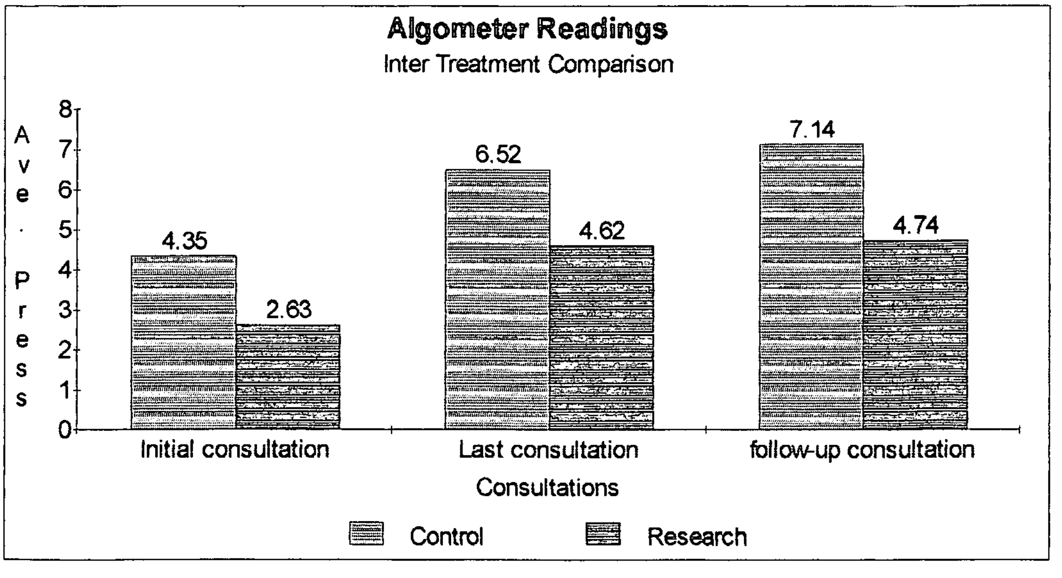
Graph 4.5 demonstrates that in both treatment groups there was a significant improvement in the pain experienced by the subjects as a result of the treatments administered.

Table 25. **A sample analysis of the Algometer Readings comparing the initial consultation, the last consultation and the follow - up consultation of the control and research groups:**

	IC - IC	LC - LC	FU - FU
Z VALUE	0.000421926	0.00618992	0.00229117
P VALUE	0.000210963	0.00309496	0.001145589
SD / NSD	SD	SD	SD

Both the control group and the research group showed a statistically significant difference in treatment outcomes between the initial consultation, the last consultation and the follow - up consultation at the 5% level of significance. Therefore the null hypothesis is rejected indicating that both groups improved equally, as a result of their respective treatments. (Table 25)

Graph 4.6 **Visual representation of the Algometer readings (pressure tolerance) measured in kilograms per square centimeter between the control and research groups.**



The graph above serves to illustrate the increase in pressure tolerance by the subjects in both the control and research groups over the course of the treatment period. (Graph 4.6)

Table 26. **A sample analysis of the Ranges of Motion in Forward Flexion comparing the initial consultation, the last consultation and the follow - up consultation of the control and research groups:**

	IC - IC	LC - LC	FU - FU
Z VALUE	0.933726	0.966846	0.506344
P VALUE	0.466863	0.483423	0.253172
SD / NSD	NSD	NSD	NSD

Table 27. **A sample analysis of the Ranges of Motion in Extension comparing the initial consultation, the last consultation and the follow - up consultation of the control and research groups:**

	IC - IC	LC - LC	FU - FU
Z VALUE	0.661017	0.617687	0.32742
P VALUE	0.3305085	0.3088435	0.16371
SD / NSD	NSD	NSD	NSD

Table 28. **A sample analysis of the Ranges of Motion in Left Lateral Flexion comparing the initial consultation, the last consultation and the follow - up consultation of the control and research groups:**

	IC - IC	LC - LC	FU - FU
Z VALUE	0.66237	0.519302	0.370265
P VALUE	0.331185	0.259651	0.1851325
SD / NSD	NSD	NSD	NSD

Table 29. **A sample analysis of the Ranges of Motion in Right Lateral Flexion comparing the initial consultation, the last consultation and the follow - up consultation of the control and research groups:**

	IC - IC	LC - LC	FU - FU
Z VALUE	0.617056	0.835248	0.755098
P VALUE	0.308528	0.417624	0.377549
SD / NSD	NSD	NSD	NSD

Table 30. **A sample analysis of the Ranges of Motion in Left Rotation comparing the initial consultation, the last consultation and the follow - up consultation of the control and research groups:**

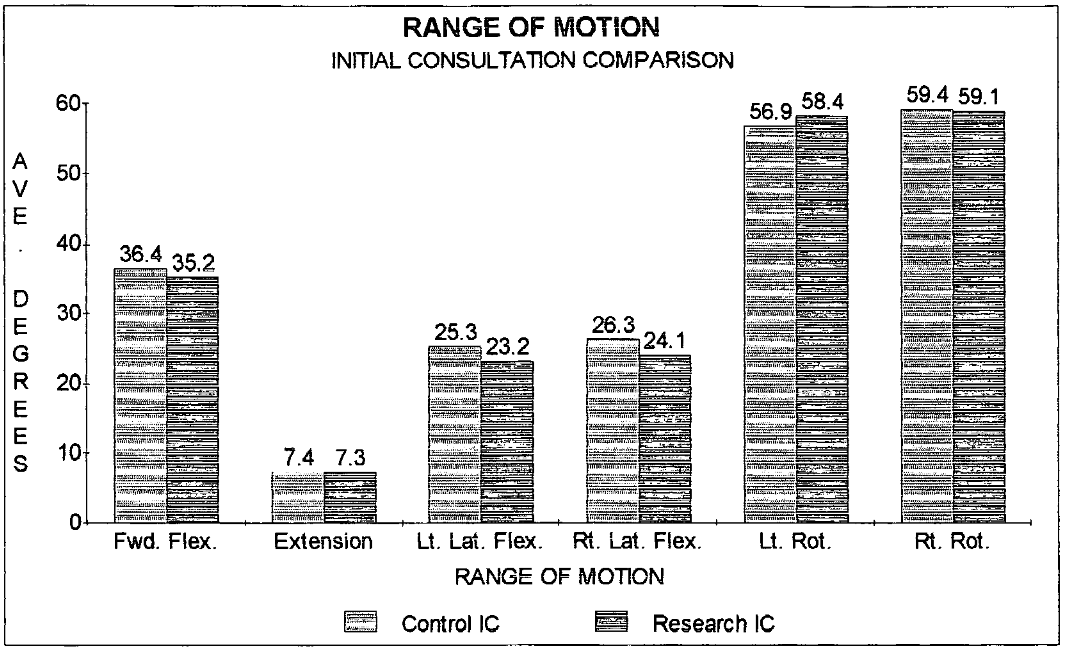
	IC - IC	LC - LC	FU - FU
Z VALUE	0.966802	0.983407	0.834902
P VALUE	0.483401	0.4917035	0.417451
SD / NSD	NSD	NSD	NSD

Table 31. **A sample analysis of the Ranges of Motion in Right Lateral Flexion comparing the initial consultation, the last consultation and the follow - up consultation of the control and research groups:**

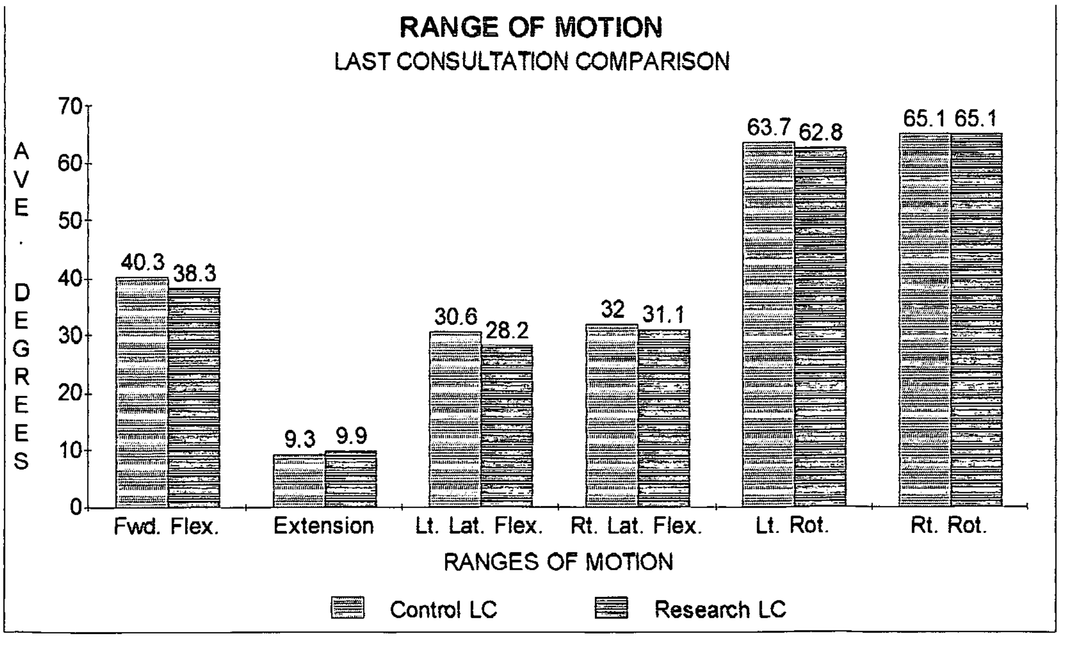
	IC - IC	LC - LC	FU - FU
Z VALUE	0.966876	0.819126	0.884365
P VALUE	0.483438	0.409563	0.4421825
SD / NSD	NSD	NSD	NSD

No statistically significant difference exists at the 5% level of significance between the initial consultation, the last consultation and the follow - up consultation of the two groups. Consequently the null hypothesis is accepted as neither group improved significantly more that the other. (Table 26 - 31)

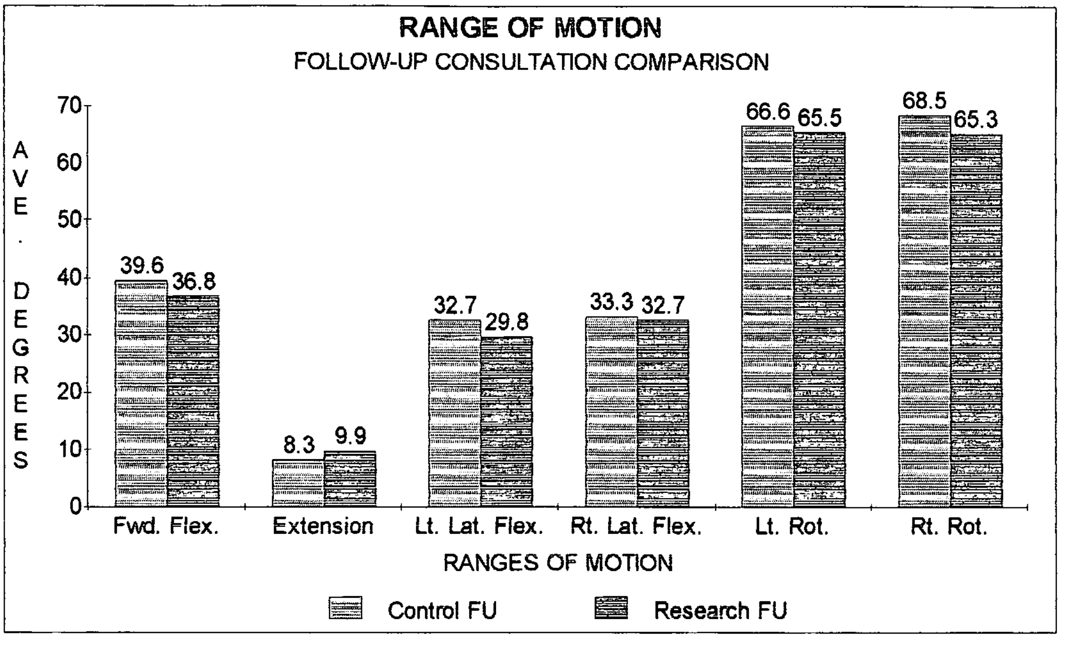
__Graph 4.7__ **A graph representing the relative ranges of motion for the control and research groups at the initial consultation before the subjects received any form of treatment.**



__Graph 4.8__ **A graph representing the relative ranges of motion for the control and research groups at the last consultation after the subjects received their respective treatments.**



<u>*Graph 4.9*</u> **A graph representing the relative ranges of motion for the control and research groups at the follow-up consultation after one month during which they received no form of treatment.**



Graphs 4.7, 4.8 and 4.9 serve to illustrate the relative improvement in all the ranges of motion in both the treatment groups as a direct result of the spinal manipulative therapy that the subjects underwent.

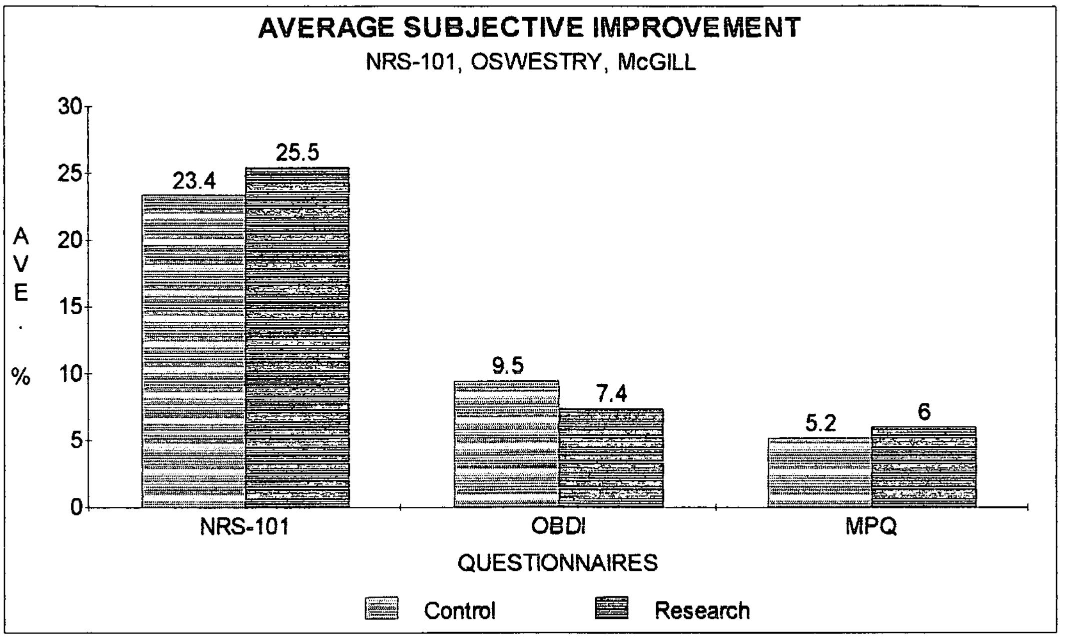
4.4 AVERAGE SUBJECTIVE DATA

Table 32. **The average subjective results of the Numerical Pain Rating Scale, Oswestry Back Disability Index and Mc Gill Pain Questionnaire as perceived by the patients.**

	Control	Research
Numerical Pain Rating Scale	23.40%	25.50%
Oswestry Back Disability Index	9.46%	7.43%
McGill Pain Questionnaire	5.20%	5.99%
Total Average Percentage	**12.68%**	**12.97%**

The improvement in the subjective data in the two groups was almost identical as can be seen from the figures in the table above. The research group only had a 0.29% greater improvement compared to that of the control group. (Table 32)

Graph 4.10 **The average accumulative subjective scores from the initial, last and follow-up consultations illustrating the improvement between the two groups:**



NRS-101	-	Numerical Pain Rating Scale
OBDI	-	Oswestry Back Disability Index
MPQ	-	McGill Pain Questionnaire

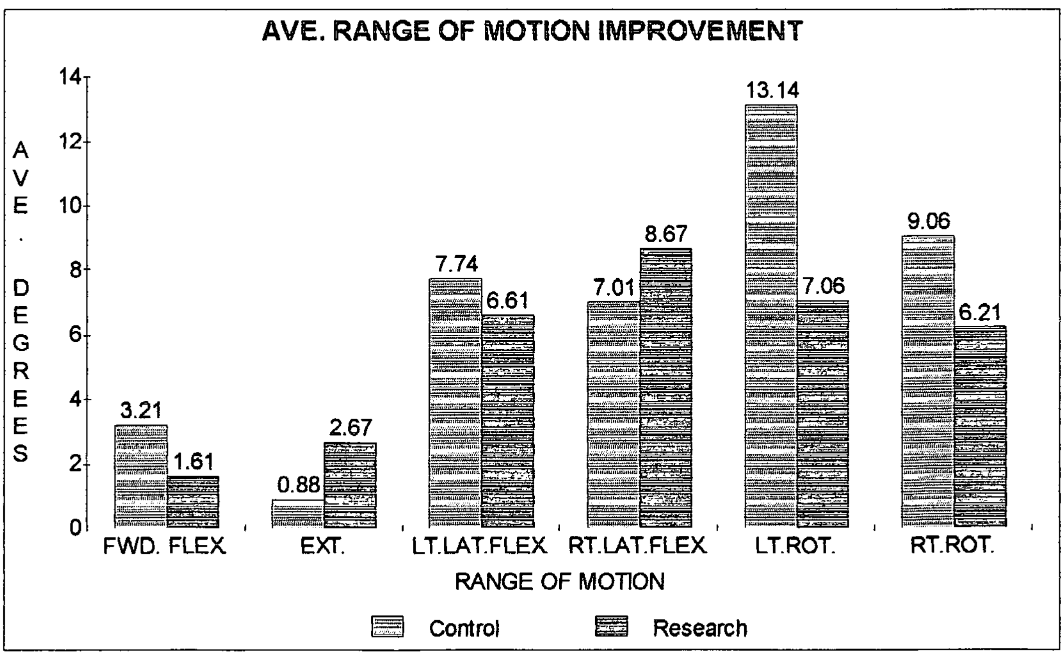
In Graph 4.8 above, the relative improvements between the two groups illustrate how the research group improved more with respect to sensory interpretation and pain intensity, whereas the control group had a greater improvement with respect to disability. These scores are the accumulative average over the three consultations.

4.5 AVERAGE OBJECTIVE DATA

Table 33. **The average improvement (measured in degrees) in the range of motion between the initial consultation and the follow - up consultation for the control and research groups taken in each plane.**

	Control	Research
Forward Flexion	3.21(+1.6)	1.61
Extension	0.88	2.67(+1.79)
LLF Left Lateral Flexion	7.74(+0.86)	6.61
RLF Right Lateral Flexion	7.01	8.67(+1.66)
LR Left Rotation	13.14(+6.08)	7.06
RR Right Rotation	9.06(+2.85)	6.21

Graph 4.11 **The average improvement in the range of motion between the control and research groups.**



We can deduce from table 33 and graph 4.11 above that the control group improved more than the research group in forward flexion, left lateral flexion, and left and right rotation. The research group nevertheless improved more in extension and right lateral flexion. Statistically analysed at the 5% level of significance there was no consequential difference in the improvement between the two groups.

4.6 DEMOGRAPHIC DATA OF THE SUBJECTS

Table 34. **Subject age and gender distribution.**

	16 - 25 yrs	26 - 35 yrs	36 - 45 yrs	46 - 60 yrs	TOTALS
Male	7	6	3	3	19
Female	2	6	2	1	11
TOTAL	9	12	5	4	30

Table 35. **Subject age and gender distribution of the control group.**

	16 - 25 yrs	26 - 35 yrs	36 - 45 yrs	46 - 60 yrs	TOTALS
Male	4	4	2	1	11
Female	1	1	1	1	4
TOTAL	5	5	3	2	15

Table 36. **Subject age and gender distribution of the research group.**

	16 - 25 yrs	26 - 35 yrs	36 - 45 yrs	46 - 60 yrs	TOTALS
Male	3	2	1	2	8
Female	1	5	1	0	7
TOTALS	4	7	2	2	15

Table 37. **Racial distribution within groups.**

	AFRICAN	INDIAN	WHITE
CONTROL	0	3	12
RESEARCH	1	1	13
TOTAL	1	4	25

4.7 CONCLUSION

From the statistical data elaborated on above, it is apparent that both the control and research groups improved as a result of the treatment. The discussion, interpretation and implication of these results will be dealt with in chapter five.

CHAPTER FIVE

DISCUSSION

5.1 INTRODUCTION

This chapter discusses the results obtained from the questionnaires, the goniometer and the algometer readings and attempts to put them into perspective with respect to the initial problem statements.

5.1.1 Redefining the Study Objectives

This study set out to determine which of the following two treatment approaches was more effective in the management of mechanical low back pain:

1. Full spinal adjustments, or
2. lumbar spine adjustments only.

The results are discussed below in two separate sections:

1. subjective results, and
2. objective results.

Each section comprises statistical evaluations of both the intra-treatment and the inter-treatment data. Discussing it in this format lends itself to the ease with which the results can be critically assessed.

The intra-treatment evaluation gives an indication of the efficacy of each approach and it helps to determine during which treatment interval the most beneficial results were obtained.

The inter-treatment evaluation assesses any differences observed in the subjective and objective findings and assists in the decision making process to determine which of the two treatment approaches was more effective.

5.2 The Subjective Data

5.2.1 The Numerical Pain Rating Scale - 101

5.2.1.1 Intra - treatment Comparison

The paired analysis of the mean measurements of the Numerical Pain Rating Scale - 101 indicated that there was a statistically significant improvement in both the control and the research groups with respect to the patient's subjective assessment of their pain intensity improvement (Table 1 and 12). The null hypothesis was therefore rejected for both groups.

5.2.1.2 Inter - treatment Comparison

Analysis of the inter treatment data revealed that there was no significant difference in the improvement between the two groups with respect to the reduction of pain intensity, (Table 22) thus indicating that both groups were as effective as each other. When interpreting the Graph 4.3, which utilised the average scores as opposed to the median values, it is clear that the average decrease in the subjective pain in both groups is almost identical (control group decreased by 35.06% and the research group decreased by 35.04%).

Further comparison of the two groups reveals that the control group showed a greater reduction in pain between the initial consultation and the last consultation, whereas the research group showed a greater reduction between the last consultation and the follow-up consultation. Interestingly this last period is the period in which no treatment was administered and may be an indication that full spinal manipulation may have a longer lasting effect than does regional manipulation.

5.2.2 The Oswestry Back Disability Index

5.2.2.1 Intra - treatment Comparison

Statistical analysis of the data collected with regards the Oswestry Back Disability Index showed that there was a significant difference between the initial consultation and the last consultation, and between the initial consultation and the follow-up consultation. However, there was no significant improvement from the last consultation to the follow - up consultation. This would indicate that during the month in which there was no treatment there was also no improvement in the subject's disability caused by the back pain (Table 2 and Table 13). This result may raise the issue of the psychological and emotional support that chiropractors are able to offer their patients while they are under the chiropractors care. This would therefore support the conclusions made by Borenstein <u>et al</u>. (1995) in which they state that it is not so much the manipulation but the talking before and after the manipulation which helps the patient improve.

5.2.2.2 Inter - treatment Comparison

When the two groups median values were compared statistically (Table 23), no significant difference was found. This indicates that neither group improved more than the other although they both showed an improvement with regards to the disability. Graph 4.4 supports the median results illustrating the linear relationship of the decrease in back disability between the two groups.

Graph 4.4 also shows that the control group, having more than double the amount of men in that group than women, started off with more disability than did the control group (Tables 35 and 36). This supports the theory by Waalen and Waalen (1993) which states that more men seek medical care with regards low back pain than women do.

5.2.3 The McGill Pain Questionnaire

5.2.3.1 Intra - treatment Comparison

A comparison of the sample analysis of the McGill Pain Questionnaire showed that there was a significant difference between the initial consultation and the last consultation and between the initial consultation and the follow-up consultation. However there was no significant improvement between the last consultation and the follow - up consultation. This again shows that during the month in which there was no treatment there was also no improvement in the subject's quality of pain (Table 3 and Table 14).

5.2.3.2 Inter - treatment Comparison

The inter-treatment analysis showed that there was no statistically significant difference between the improvements of the control and the research groups with reference to the McGill Pain Questionnaire. Consequently neither group improved more than the other (Table 24) indicating a comparable improvement in pain intensity.

On a more visual scale however, it is evident that when plotting the average pain scores (Graph 4.5), the research group responded more favourably between the initial and the last consultations when compared to the control group.

5.2.4 Problems Encountered with Respect to the Subjective Data

This study did not utilise any blinding procedures and as such it was found that subjects tried to please the doctor by subjectively reporting improvements in their conditions at each successive consultation. This finding was however not only restricted to the one group and consequently did not prejudice the one group more than the other.

From the literature reviewed, it was clear that lumbar spinal manipulation would be effective in the treatment of mechanical low back pain. Subjectively therefore, the patients all reported improvements in their lumbar spine as all the subjects received lumbar spine adjustments. The statistical evaluation consequently did not reveal any significant differences between the two groups as the questionnaires may not have been sensitive enough to subtle changes in the pain intensity and subject disability.

Larger sample sizes may contribute to capturing statistical data of greater significance. The inclusion of questionnaires enquiring about any changes in the cervical and thoracic spine, may also help add to the pool of knowledge with regards to possible changes in these regions as a result of the adjustments they have received.

5.3 Objective Data

5.3.1 Algometer Readings

5.3.1.1 Intra - treatment Comparison

The mean algometer measurements of the control group and research group were statistically analysed revealing that there was a significant improvement between the initial consultation and the last consultation and between the initial consultation and the follow-up consultation. These findings confirm those of Terret et al. (1984) who investigated the effect that spinal manipulation had on paraspinal pain tolerance.

There was however, no a statistically significant improvement in either of the groups between the last consultation and the follow-up consultation (Table 4 and Table 153). This once again reiterates the fact that there was no significant improvement after one month of no treatment.

5.3.1.2 Inter - treatment Comparison

There was a statistically significant difference seen in the data obtained from the algometer readings when comparing the two treatment groups

(Table 25). This difference demonstrates that both groups responded to their treatments and at the time the algometer readings were taken both groups showed a significant improvement.

5.3.2 Lumbar Spine Range of Motion

5.3.2.1 Intra - treatment Comparison

All six ranges of motion were measured at the initial, last and follow - up consultations. For the control group there was a statistically significant difference found in forward flexion between the initial and last consultation, for left and right lateral flexion and left and right rotation between the initial and last and between the initial and follow-up consultations (Tables 6 - 11). This suggests that with the exception of lumbar spine extension every other range of motion demonstrated a significant improvement as a result of the treatment.

For the research group however there was no significant improvement in forward flexion, extension or right rotation between any consultation. There was nevertheless a significant difference found between the initial and last consultation and between the initial and follow-up consultation for left and right lateral flexion and left rotation (Tables 16 - 21 and Graphs 4.1, 4.2, 4.7, 4.8 and 4.9).

These results demonstrate that the management of low back pain by spinal manipulation is effective and has no major significance other than to demonstrate that there was some improvement in some ranges of motion for both groups. This supports the findings of Brunarski (1984), Greenland (1980), Shekelle (1992), Hoehler et al. (1981) and Meade et al. (1995). It does stress nevertheless, that further research be conducted in this field and on larger sample sizes in order to acquire more statistically valid results.

5.3.2.2 Inter - treatment Comparison

The statistical comparison of the ranges of motion at the different consultations between the groups failed to demonstrate any significant difference (Tables 26 - 31 and Graphs 4.7 - 4.9). This suggested that both treatments had a positive influence with respect to the lumbar spine ranges of motion and it indicated that they were equally effective over the same treatment period (Graph 4.11).

This statistical evidence therefore neither supports nor refutes the use of cervical and thoracic spinal manipulation in the treatment of mechanical low back pain. Also, it does not dispute the findings of Shekelle et al. (1992), who state that cervical manipulations are rarely used as a specific treatment for low back pain. It does however not rule out the possibility that full spinal manipulation for the specific treatment of mechanical low back pain, may have positive long term benefits and that it should not be ruled out as a potential treatment of choice.

5.3.3 Problems Encountered with Respect to the Objective Data

The goniometric readings should be deciphered with discretion as user error may have contributed to variations in the authenticity of the range of motion readings. This together with the fact that the goniometer was calibrated in increments of two degrees, could have led to questionable measurement accuracy.

The algometer values should also be viewed mindfully, considering intra-examiner reliability of test-retest reproducibility, which according to Waldorf et al. (1991) are at best "quite good".

5.4 General Discussion on the Subjective and Objective Data

From the statistical evidence presented, it was quite apparent that both groups responded favourably to their respective treatments. However there was no statistically significant evidence to suggest that one treatment was more effective than the other. Findings such as these, only serve to support authors such as Zylbergold et al. (1981) in stating that there is confusion in our current system as to the most effective form of treatment for low back pain.

Both the subjective and objective results corroborated the final outcome with neither conclusively favouring one treatment over the other. The consistency of the data in this paper supports other research stating that spinal manipulation is effective in the treatment of mechanical low back pain. Thus supporting Kirkaldy-Willis and Burton (1992: 283) and Haldeman (1992:415) and refuting Sims-Williams et al. (1979).

As a result of the two treatment approaches being so similar in many respects there were only minor statistical differences between the two treatment protocols. It is postulated that with the use of larger sample sizes, there would be more conclusive variations in the statistical data.

Unfortunately no definite conclusions could be made with regard to the hypothesis testing other than to support the hypothesis that both treatment groups would respond favourably to spinal manipulation, which they did, thus adding to the pool of knowledge that manipulation is a treatment of choice in the treatment of mechanical low back pain.

In this study the adjustments were performed on two treatment groups, both of which received lumbar spine manipulations. The fact that spinal manipulation is effective in the treatment of low back pain is proven and undisputed. Therefore, it would seem logical, that both treatment groups would respond favourably. However, it was anticipated that by including adjustments of the thoracic and cervical spine to those of the lumbar spine, the results rendered would be of far greater significance in the light of Gatterman's findings (1990: 48) of the reflexogenic effects of spinal fixations. This paper was not able to directly contribute to substantiate these findings, but it did emphasise that further research was needed in this field.

This study cannot be compared to other studies, as to date there have been no other randomised, clinically controlled studies conducted in which adjustments administered to different areas of the spine are compared to each other in attempting to treat mechanical low back pain.

Due to the favourable results obtained in this manipulative study such as a reduction in perceived pain and increased range of motion the theories put forward by Wyke (1985) concerning the pain suppressive effect exerted by stimulation of articular mechanoreceptors during a spinal manipulation, and the EMG studies conducted by Hertzog et al. (1995) which show how manipulation causes EMG responses in the muscles immediately adjacent and opposite to the adjusted segment must be supported. Spinal manipulation reflexly causes relaxation of the paraspinal musculature and in doing so helps reduce nociceptive activity.

Favourable results, either for or against full spinal manipulation, in this paper could have helped establish more concrete evidence to substantiate the chain link concept of the spine. Unfortunately due to both manipulative groups showing equal responses to there respective therapeutic approaches no further scientific support was able to be given to this concept.

A long term follow-up study is necessary in order to illustrate which treatment approach is more effective in avoiding recurring spinal fixations. Bourdillon et al. (1989) suggests that avoiding areas of dysfunction which are no longer symptomatic will only predispose the patient to recurring dysfunctions. The author of this paper encourages further research into this field and suggests that a longer treatment follow-up period be utilised.

5.5 Ethical Considerations

What must not be overlooked in this research paper is the ethical consideration of adjusting asymptomatic, fixated segments in regions of the spine other than the lumbar spine and sacro-iliac joints. It is suggested that in future studies of this nature, patients be asked to complete questionnaires which could highlight possible side effects to the thoracic and cervical spine which may have been caused as a direct result of these areas being manipulation. This will help prove or disprove the hypothesis that states that adjusting asymptomatic joints is harmful.

5.6 Conclusion

Both groups showed a significant improvement regarding pain reduction, decrease in disability and improved ranges of motion of the lumbar spine. From the statistical evidence gathered it was concluded that there was no discernible benefit from the combination of lumbar, thoracic and cervical spine manipulation over lumbar spine manipulation alone. Both treatments were as effective as each other.

This research paper therefore thoroughly supports authors who advocate spinal manipulation in the treatment of mechanical low back pain.(Brunarski 1984:243, Wyke 1985, Greenland et al. 1980, Shekelle et al. 1992 and Kirkaldy - Willis 1992:283)

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The results show that there was a significant improvement in both treatment groups and that the rate of improvement was similar. The study illustrates the direct relationship between increase range of motion and the reduction in low back pain, as a result of manipulation.

From the results produced in the statistical evaluation of this research dissertation the outcome was twofold. Firstly, it was confirmed that spinal manipulation is therapeutically effective in reducing pain and disability and in improving lumbar spine range of motion in the management of mechanical low back pain. This serves to support authors such as Pustaver (1994) and many others (Kirkaldy-Willis 1992: 294, Haldeman 1992: 437 and Schafer and Faye 1990:16) in stating that there is mounting research evidence that manipulation is the most effective form of therapy in the treatment of mechanical low bak disorders. Secondly, on the basis of the information gained in this study it is not possible to conclude with any degree of certainty which of the two treatment protocols, lumbar spine adjustments alone or combined lumbar, thoracic and cervical spine adjustments, are more effective in the management of mechanical low back pain.

It should be noted that prior to drawing any strong conclusions, all outcome data gathered may have some degree of measurement error as both subjective and objective data are open to the criticism that they rely, to a greater or lesser extent, on patient interpretation (Bolton 1994).

6.2 Recommendations

In future research it is suggested that rather the emphasis be placed on the possible long term complications of adjusting non - symptomatic segments of the spine. This will enable chiropractors to determine the efficacy of their treatment approach and the possible iatrogenic side effects of adjusting these non painful areas.

It would be recommended that patient characteristics be taken into consideration i.e. patient age, gender and chronicity of the problem, as this would assist in the interpretation of any statistical variations.

More effort should be made to establish long term benefits of spinal manipulation as suggested by Abenhaim and Bergeron (1992), because lasting improvement will be of more value to the patient and to the medical fraternity as a whole. The benefits of mobilization and manipulation for low back pain are probably restricted to hastening recovery in patients likely to rapidly improve spontaneously as reported by Sims - Williams et al. (1979) and it is therefore also suggested that future research be aimed at the long term benefits of different spinal manipulative approaches. Shekelle et al. (1992) state that research is needed to establish the efficacy of manipulation for patients with chronic low back pain and the rate of complications produced by different chiropractic approaches. (Shekelle et al. 1992) This study supports the findings of Shekelle et al. (1992).

Further studies will also benefit greatly from the use of larger sample sizes to improve the statistical relevance of the data.

To conclude, this research paper has shown that manipulation is effective in the management of mechanical low back pain. It has however failed to produce any conclusive evidence to substantiate the use of full spinal adjustments and it is suggested that further research be conducted to establish not only the efficacy, but also the ethical considerations for adopting this approach in the treatment of this common condition.

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APPENDIX A

CASE HISTORY FORM

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

CASE HISTORY

Patient:________________________________ Date_____________
File #_____________
X-Ray #___________

Age:_________ Sex___ Occupation_____________________

FOR CLINICIAN'S USE ONLY

Initial visit clinician Signature__________

Case History

Examination :

	Previous:	TN Other	Current:	TN Other

X - Ray Studies:

	Previous:	TN Other	Current	TN Other

Clinical Path. Lab.:

	Previous:	TN Other	Current	TN Other

Case Status:
PTT: Conditional: Signed Off: Final Sign Out:

Recommendations:

<u>Intern's case history</u>

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

3. **Present illness:**

   Location

   Onset

   Duration

   Frequency

   Pain (character)

   Progression

   Aggravating factors

   Relieving factors

   Associated signs and symptoms

   Previous occurrences

   Past treatment and outcome

4. **Other complaints:**

5. **Past history**

   General health status

   Childhood illnesses

   Adult illnesses

   Psychiatric illnesses

   Accidents / illnesses

   Surgery

   Hospitalizations

6. **Current health status and lifestyle:**

   Allergies

   Immunizations

Screening tests

Enviromental hazards (home, school,work)

Safety measures (seat belts, condoms)

Exercise and leisure

Sleep patterns

Diet

Current medication

Tobacco

Alcohol

Social drugs

7. **Family History:**

Immediate Family

Age

Health

Cause of death

Heart disease

Diabetes

TB

HBP

Stroke

Kidney disease

CA

Arthritis

Anaemia

Headaches

Thyroid disease

Epilepsy

Mental illness

Alcoholism

Drug addiction

Other

8. **Psychosocial History**

Home situation

Dialy life

Important experiences

Religious beliefs

9. **Review of Systems**

General

Skin

Head

Eyes

Ears

Nose / Sinuses

Mouth / Throat

Neck

Breasts

Respiratory

Cardiac

Gastro - intestinal

Urinary

Genital

Vascular

Musculoskeletal

Neurological

Haematological

Endocrine

Psychiatric

APPENDIX B

PHYSICAL EXAMINATION FORM

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

Patient:________________ File:__________________

Clinician:______________ Signature:______________

Intern:_________________ Signature:______________

Date:___________________

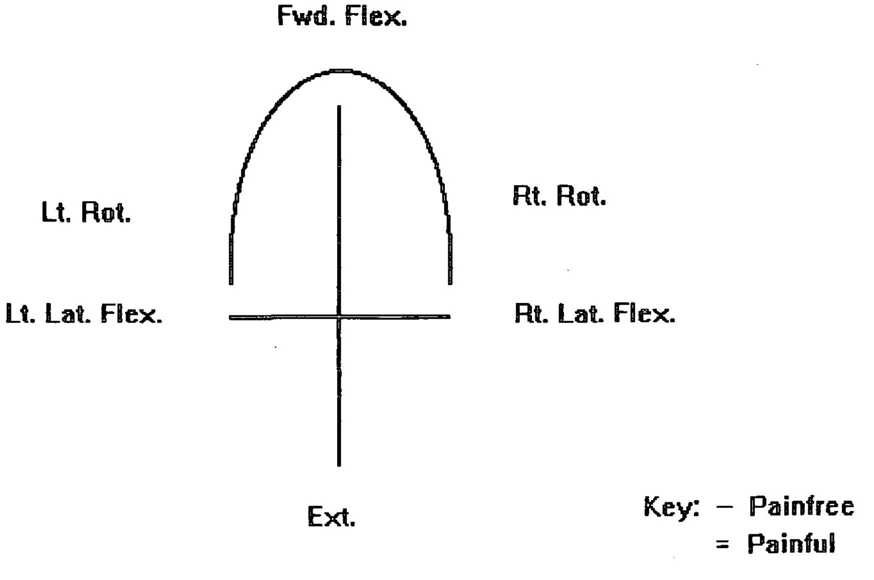
Vitals: Height______ Weight______ Temp_______
Rates: Heart_______ Pulse_______ Resp_______
Blood Pressure: Arms L ________
R________

General appearance:

Standing Examination

Minors sign
Skin changes
Posture Erect Adams

Ranges of motion



Romberg's sign
Pronator drift
Trendelenburg's sign
Gait
- Rhythm
- Balance
- Pendulousness
- On toes
- On heels
- Tandem

Half squat
Scapular winging
Muscle tone
Spasticity / Rigidity

Shoulder
- Skin
- Symmetry
- ROM
  - Glenohumeral
  - Scapulo-thoracic
  - Acromioclavicular
  - Elbow
  - Wrist

Chest measurement
- Inspiration
- Expiration

Visual acuity

Breast examination
- Inspection
  - Skin
  - Size
  - Contour
  - Arms overhead
  - Hands on hips
  - Leaning fwd.
- Palpation
  - Upper outer quad.

Seated Examination

Spinal posture
- Head
  - scalp
  - skull
  - face
  - skin
- Eyes
  - conjunctiva
  - sclera
  - eyebrows
  - eyelids

lacrimal gland
nasolacrimal ducts
alignment
corneal reflex
ocular movement
left iii iv vi

right iii iv vi
visual fields
accommodation
iris
pupils
red reflex
optic disc
blood vessels
general background
macula
vitreous
lens

Ears
- auricle
- ear canal
- drum
- auditory acuity
- Weber test
- Rinne test

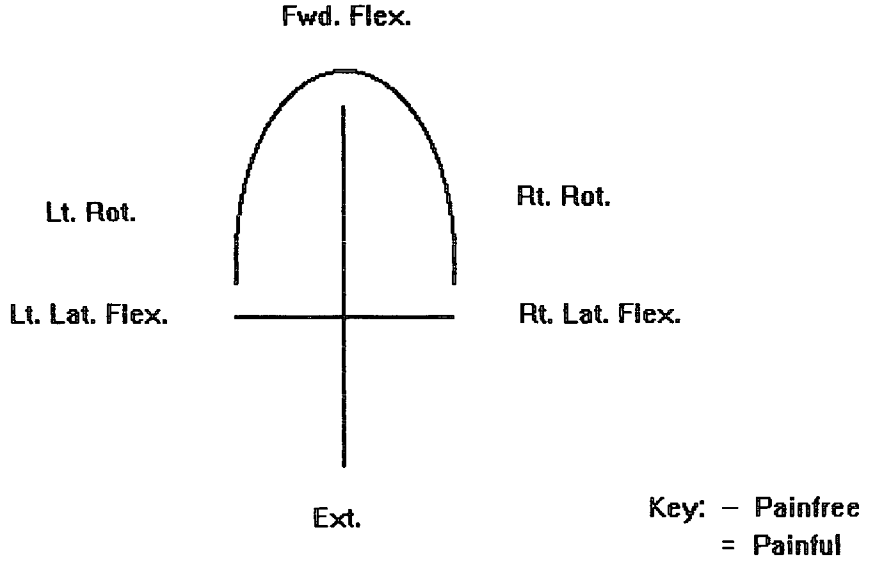
Nose
- external
- internal
  - septum
  - turbinates
  - olfactory

Sinuses (frontal and maxillary)
- tenderness
- transillumination

Mouth and Pharynx
- lips
- buccal mucosa
- gums and teeth
- roof
- tongue
  - inspection
  - movement
  - taste
  - palpation
- pharynx

inspection
CN X

Neck
- posture
- size
- swelling
- scars
- discolouration
- hair line
- lymph nodes
- trachea
- thyroid
- carotid arteries
- ROM



CN V
CN VII
CN VIII (nystagmus)
CN IX
CN XI

TMJ
- inspection
  - ROM
  - deviation
- palpation
  - crepitus
  - tenderness

Neurological
- Dermatomes
  - C5
  - C6
  - C7
  - C8
  - T1

- Myotomes
  - C5
  - C6
  - C7
  - C8
  - T1

- Tendon reflexes
  - biceps
  - triceps
  - brachioradialis

Coordination
- point - to - point
- dysdiadochokinesia

Thorax
- Chest
- Inspection
  - skin
  - shape
  - respiratory distress
  - rhythm
  - depth
  - effort
  - intercostal / supraclavicular retraction
- Palpation
  - tenderness
  - masses
  - respiratory expansion
  - tactile fremitus
- Percussion
  - lungs (posterior)
  - diaphragmatic excrusion
  - kidney punch

- Auscultation
  - breathe sounds
    - vesicular
    - bronchial
  - adventitious sounds
    - crackles
    - wheeses (rhonchi)
  - voice sounds
    - bronchophony
    - whispered pectoriloquy
    - egophony
- Cardiovascular
  - auscultation (aortic murmurs)
  - Allen's test

Supine Examination

- JVP
- PMI
- heart auscultation (lt. lat. recumbent)
- respiratory excrusion
- ant. chest percussion
- breast palpation
- Abdomen
  - Inspection
    - skin
    - umbilicus
    - contour
    - peristalsis
    - pulsations
    - hernias (umbilicus / incisional)
  - Auscultation
    - bowel sounds
    - bruit
  - Percussion
    - general
    - liver
    - spleen
  - Palpation
    - superficial reflexes
    - cough light
    - rebound tenderness
    - deep
    - liver
    - spleen
    - kidneys
    - aorta
    - intra - / retro - abdominal wall mass
    - shifting dullness
    - fluid wave

Acute abdomen
- where pain began
- where pain now
- cough
- tenderness
- guarding / rigidity
- rebound tenderness
- Rovsing sign
- psoas sign
- obturator sign
- cutaneous hyperaesthaesia
- rectal examination
- Murphy's sign

Male genitals and hernias
- Inspection
  - skin
  - prepuce
  - glans
  - meatus
  - nits / lice
  - scrotum
  - inguinal / femoral bulges
- Palpation
  - penis (tenderness / induration)
  - testes
  - epididymus
  - inguinal canal
  - cremastreric reflex
- Auscultation
  - scrotal mass

Peripheral vasculature
- Inspection
  - skin nail beds
  - pigmentation
  - hair loss

Palpation
- pulses

radial	popliteal
brachial	post. tibial
femoral	dorsalis pedis

- lymph nodes
  - epitrochlear
  - femoral — horizontal, vertical
- temperature — feet, legs

Manual compression test
Retrograde filling test
Arterial insufficiency test

Musculoskeletal
ROM

Hips	flex.	90/120	add.	30
	int.rot.	40	ext.rot.	45
	ext.	15	abd.	45
Knee	flex.	130		
	ext.	0/15		
Ankle	plantar flex.	45		
	dorsiflex.	20		
	inversion	30		
	eversion	20		

Leg length	Lt.	actual
		apparent
	Rt.	actual
		apparent

Neurological
- Dermatomes
  - L1
  - L2
  - L3
  - L4
  - L5
  - S1
- Myotomes
  - hip flexion
  - knee extension
  - ankle dorsiflexion
  - plantar flexion
- Tendon reflexes
  - patellar
  - achilles
  - plantar

Rectal examination
- Inspection
  - sacrococcygeal and perianal areas
- Palpation
  - sphincter tone
  - tenderness
  - induration
  - nodules
  - prostate gland
  - seminal vesicles

Mental status
- Appearance and behaviour
  - level of consciousness
  - posture and motor behaviour
  - dress, grooming and personal hygiene
  - facial expression
  - affect

- Speech and language
  - quantity
  - rate
  - volume
  - fluency
  - aphasia
- Mood
- Thought processes (logical, relevant and organised)
- Memory and attention
  - orientation (time, place and person)
  - remote memory
  - recent memory
  - new learning ability
- Higher cognitive functions
  - information and vocabulary
  - abstract thinking

APPENDIX C

LUMBAR SPINE ORTHOPAEDIC EXAMINATION

Technikon Natal Chiropractic Day Clinic.
Regional Examination -- Lumbar Spine and Pelvis.

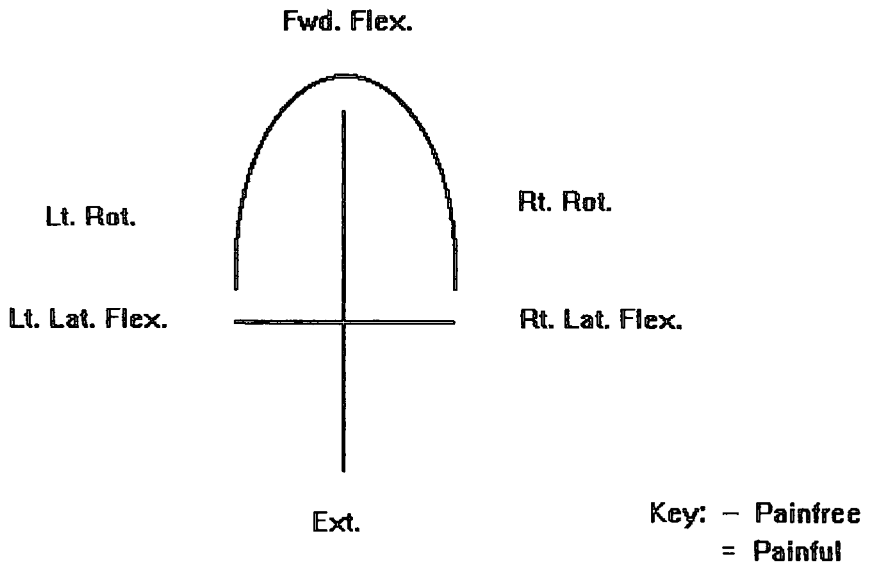
Patient: ____
File # : ____________________ Date : ____________________
Intern/ Resident:____________________
Supervising Clinician:______________________________

Standing:

Posture
Minor's Sign
Skin
Scars
Discolouration
Muscle tone

Spinous percussion
Schober's Test (6 cm)
Treadmill
Body Type
Attitude
Bony and soft tissue contours

Range of Motion.



Supine:

Skin
Hair
Nails

Observe abdomen
Fasciculations
Abdominal reflexes
Auscultate abdomen/ groin
Palpate abdomen/ groin
Pulses (abdomen)
Pulses (extremities)

SLR
Bowstring
Plantar reflex
Circumference (thigh, calf)
Leg length : actual
apparent
Sciatic notch
Patrick Faber
Gaenslen's Test
Gluteus Maximus Stretch
Hip medial rotation
Psoas Test
Thomas' Test : hip joint
rectus femoris

LATERAL RECUMBENT :

S - I compression
Ober's Test
Femoral nerve stretch
Myotomes ; QL
Gluteus Medius

NON - ORGANIC SIGNS :

Pin Point Pain.
Axial Compression.
Trunk Rotation.
Burn's Bench Test
Flip Test.
Hoover's Test.
Ankle Dorsiflexion Test.

MOTION PALPATION :

T 10
T 11
T 12
L 1
L 2
L 3
L4
L 5
S 1

PRONE :

Gluteal skyline
Skin rolling
Iliac crest compression
S -I tenderness
Erichson's Test
Pheasant's Test
Myotomes : Gluteus Maximus
Active MF Trigger Points :
QL
Glut. Med.
Glut. Max.
Glut. Min.
Piriformis.
Hamstrings
TFL

GAIT :

Rhythm
On toes (standing)
On heels (standing)
Half - squat on one leg

Remarks : ____
____
____

NEUROLOGICAL EXAMINATION :

Dermatomes:	T12	L1	L2	L3	L4	L5	S1	S2	S3
Myotomes:	T12	L1	L2	L3	L4	L5	S1	S2	S3
Reflexes:				L3	L4	L5	S1		

Tripod Kemp's Test

Comments: ____
____
____

APPENDIX D

THORACIC SPINE ORTHOPAEDIC EXAMINATION

THORACIC SPINE ORTHOPAEDIC EXAMINATION

PATIENT:____

FILE#:________________________ DATE:__________________

OBSERVATION : Respiration -shallow / strained
Scoliosis -structural / functional
Rib Hump
Scapular Winging
Skin - discoloration

PALPATION : Motion Palpation

T1	T7
T2	T8
T3	T9
T4	T10
T5	T11
T6	T12

Kemp's Test
Hyperextension
Myofascial trigger points
Neurological - Abdominal reflexes

AUSCULTATION : Breath sounds
Heart sounds

PERCUSSION : Spinous percussion
Lungs

APPENDIX E

CERVICAL SPINE ORTHOPAEDIC EXAMINATION

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

CERVICAL SPINE ORTHOPAEDIC EXAMINATION

PATIENT:____

FILE:___________________________ DATE: __________________

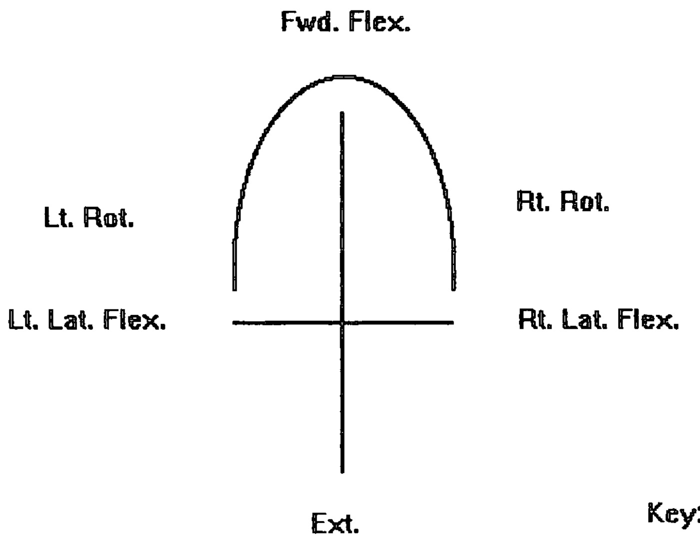
INTERN/RESIDENT:_______________________________________

SUPERVISING CLINICIAN:_________________________________

OBSERVATION:

Posture	Shoulder position: left
Swellings	right
Scars	Muscle spasm
Discoloration	Facial expression
Hair line	Bony and soft tissue contours

RANGE OF MOTION :



Key: – Painfree
= Painful

PALPATION : lymph nodes
trachea
thyroid gland

ORTHOPAEDIC EXAMINATION :

Tenderness

Active myofacial points:	SCM	Trapezius
	Scalenii	Levator scapulae
	Post. cervical mm.	

Doorbell sign	Cervical Compression
Kemp's Test	Lateral Compression
Cervical distraction	Adson's Test
Halstead's Test	Costoclavicular Test
Hyperabduction Test	Eden's Test
Shoulder abduction Test	Shoulder depression Test
Dizziness rotation Test	Lhermitte's Sign
Brachial Plexus Tension	O'Donoghue Manoeuvre

Remarks:____

NEUROLOGICAL EXAMINATION :

Dermatomes:		C2	C3	C4	C5	C6	C7	C8	T1
Myomes:	C1	C2	C3	C4	C5	C6	C7	C8	T1
Reflexes:					C5	C6	C7		

VASCULAR EXAMINATION:

	LEFT	RIGHT
BLOOD PRESSURE	____	____
CAROTIDS	____	____
SUBCLAVIAN ARTERIES	____	____
WALLENBERG'S TEST	____	____

MOTION PALPATION :

C0
C1
C2
C3
C4
C5
C6
C7
C8
T1
T2
T3
T4

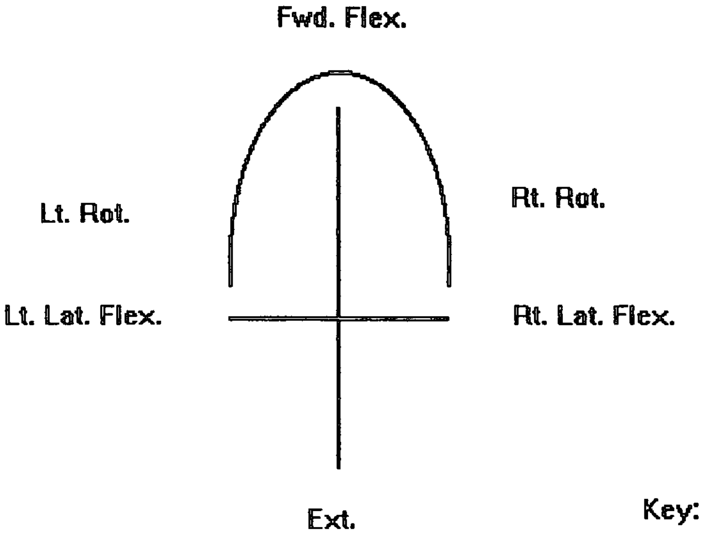
APPENDIX F

LUMBAR SPINE RANGE OF MOTION

GONIOMETRIC VALUES

Lumbar Spine Range of Motion

Goniometric Values



Key: – Painfree
= Painful

	STARTING POINT	END POINT
FORWARD FLEXION		
EXTENSION		
LEFT ROTATION		
RIGHT ROTATION		
LEFT LATERAL FLEXION		
RIGHT LATERAL FLEXION		

APPENDIX G

ALGOMETER READINGS

ALGOMETER READINGS

NAME............................

FILE NUMBER...............

C0

C1

C2

C3

C4

C5

C6

C7

T1

T2

T3

T4

T5

T6

T7

T8

T9

T10

T11

T12

L1

L2

L3

L4

L5

SI SI

APPENDIX H

Mc GILL PAIN QUESTIONNAIRE

SHORT-FORM McGILL PAIN QUESTIONNAIRE (SF-MPQ) R. MELZACK

Patient Name ....   **Date** ....

	None	Mild	Moderate	Severe
THROBBING	0)-----	1)-----	2)-----	3)-----
SHOOTING	0)-----	1)-----	2)-----	3)-----
STABBING	0)-----	1)-----	2)-----	3)-----
SHARP	0)-----	1)-----	2)-----	3)-----
CRAMPING	0)-----	1)-----	2)-----	3)-----
GNAWING	0)-----	1)-----	2)-----	3)-----
HOT-BURNING	0)-----	1)-----	2)-----	3)-----
ACHING	0)-----	1)-----	2)-----	3)-----
HEAVY	0)-----	1)-----	2)-----	3)-----
TENDER	0)-----	1)-----	2)-----	3)-----
SPLITTING	0)-----	1)-----	2)-----	3)-----
TIRING-EXHAUSTING	0)-----	1)-----	2)-----	3)-----
SICKENING	0)-----	1)-----	2)-----	3)-----
FEARFUL	0)-----	1)-----	2)-----	3)-----
PUNISHING-CRUEL	0)-----	1)-----	2)-----	3)-----

APPENDIX I

NUMERICAL PAIN RATING SCALE

NAME: ....
FILE :...
DATE: ....

NUMERICAL RATING SCALE 101

Please indicate on the line below the number between 0 and 100 that best describes the pain that you experience when the pain is at its WORST.

0 -- 100

Please indicate on the line below the number between 0 and 100 that best describes the pain that you experience when the pain is at its LEAST.

0 -- 100

APPENDIX J

OSWESTRY BACK DISABILITY INDEX

QUESTIONNAIRE

OSWESTRY BACK DISABILITY INDEX

PATIENT NAME:______________________________ FILE #:______ DATE:______

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

Section 1 - Pain Intensity
- ☐ I have no pain at the moment.
- ☐ The pain is very mild at the moment.
- ☐ The pain is moderate at the moment.
- ☐ The pain is fairly severe at the moment.
- ☐ The pain is very severe at the moment.
- ☐ The pain is the worst imaginable at the moment.

Section 2 - Personal Care (Washing, Dressing etc.)
- ☐ I can look after myself normally without causing extra pain.
- ☐ I can look after myself normally but it causes extra pain.
- ☐ It is painful to look after myself and I am slow and careful.
- ☐ I need some help but manage most of my personal care.
- ☐ I need help every day in most aspects of self care.
- ☐ I do not get dressed, I wash with difficulty and stay in bed.

Section 3 - Lifting
- ☐ I can lift heavy weights without extra pain.
- ☐ I can lift heavy weights but it gives extra pain.
- ☐ Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently positioned, for example on a table.
- ☐ Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned.
- ☐ I can lift very light weights.
- ☐ I cannot lift or carry anything at all.

Section 4 - Walking
- ☐ Pain does not prevent me walking any distance.
- ☐ Pain prevents me walking more than 1 mile (2.2 km).
- ☐ Pain prevents me walking more than 1/2 mile (1.1 km).
- ☐ Pain prevents me walking more than 1/4 mile (0.5 km).
- ☐ I can only walk using a stick or crutches.
- ☐ I am in bed most of the time and have to crawl to the toilet.

Section 5 - Sitting
- ☐ I can sit in any chair as long as I like.
- ☐ I can only sit in my favorite chair as long as I like.
- ☐ Pain prevents me from sitting more than 1 hour.
- ☐ Pain prevents me from sitting more than 1/2 hour.
- ☐ Pain prevents me from sitting more than 10 minutes.
- ☐ Pain prevents me from sitting at all.

Section 6 - Standing
- ☐ I can stand as long as I want without extra pain.
- ☐ I can stand as long as I want, but it gives me extra pain.
- ☐ Pain prevents me from standing for more than one hour.
- ☐ Pain prevents me from standing for more than 30 minutes.
- ☐ Pain prevents me from standing for more than 10 minutes.
- ☐ Pain prevents me from standing at all.

Section 7 - Sex Life
- ☐ My sex life is normal and causes no extra pain.
- ☐ My sex life is normal but causes some extra pain.
- ☐ My sex life is nearly normal but is is very painful.
- ☐ My sex life is severely restricted by pain.
- ☐ My sex life is nearly absent because of pain.
- ☐ Pain prevents any sex life at all.

Section 8 - Social Life
- ☐ My social life is normal and gives me no exta pain.
- ☐ My social life is normal but increases the degree of pain.
- ☐ Pain has no significant effect on my social life apart from limiting my more energetic interests, for example, dancing.
- ☐ Pain has restricted my social life and I do not go out as often.
- ☐ Pain has restricted my social life to my home.
- ☐ I have no social life because of pain.

Section 9 - Sleeping
- ☐ I have no trouble sleeping.
- ☐ I can sleep well only by using pills.
- ☐ Even when I take pills I have less than six hours sleep.
- ☐ Even when I take pills I have less than four hours sleep.
- ☐ Even when I take pills I have less than two hours sleep.
- ☐ Pain prevents me from sleeping at all.

Section 10 - Travelling
- ☐ I can travel anywhere without extra pain.
- ☐ I can travel anywhere but it gives me extra pain.
- ☐ Pain is bad but I manage trips over two hours.
- ☐ Pain restricts me to trips of less than one hour.
- ☐ Pain restricts me to trips under 30 minutes.
- ☐ Pain prevents me from travelling, except to the doctor or hospital.

APPENDIX K

PATIENT INFORMED CONSENT FORM

PATIENT INFORMED CONSENT DOCUMENT:

I, the undersigned, agree to participate in the research programme at the Chiropractic Day Clinic, Technikon Natal, 11 Ritson Road, Berea, Durban.

I understand and agree to abide by the instructions and conditions that have been explained to me.

Subject Name ______________________________ Date _______

Subject Signature ______________________________

Intern Name ______________________________ Date _______

Intern Signature ______________________________

APPENDIX L

PROCEDURE FOR MEASURING LUMBAR SPINE RANGE OF MOTION WITH THE BROM II

Procedure for Measuring Back Motion
with the BROM II

The BROM II (<u>B</u>ack <u>R</u>ange <u>O</u>f <u>M</u>otion) instrument is a product of:

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

Introduction

The BROM II (Back Range Of Motion) instrument measures range of motion of the lumbar and thoracic spine. The BROM II provides readings that can easily be reproduced by a second examiner. This procedure covers three types of measurements.

Flexion and Extension Measurements.

Rotation Measurements

Lateral Flexion Measurements.

There are three Appendices that provide supporting information.

Appendix A, Typical Values

Appendix B - Recording Sheet

Appendix C - Warranty

IMPORTANT : Accurate measurements require that all instrument contacts are on the skin.

Flexion/Extension Measurements

The Flexion/Extension Unit is a modified inclinometer that eliminates the need to measure sacral flexion. The pointer is part of the base that is placed on the sacrum so all readings are relative to the sacrum. The arm moves the scale with the upper measuring point so that the reading is the range of motion relative to the sacrum. Since only one hand is required for holding the BROM II the second hand is available to assist the patient in achieving maximum flexion. The reading (in centimeters) on the sliding arm scale can be used in future evaluations so the same spine segment will be measured. This assures that the measurements can be easily reproduced by a second examiner.

1) For lumbar measurements palpate and mark S1 and T12.

2) Place the BROM Flexion/Extension Unit on the sacrum with the pivot point <u>on S1</u>. Have the patient stretch the velcro straps across the <u>lower</u> abdomen. Check that <u>both</u> contact points on the unit are held firmly against the sacrum. The downward pull of the straps is essential to <u>maintain</u> the contact points against the sacrum during flexion and extension.

3) Demonstrate and have the <u>patient</u> perform flexion and extension movements. Emphasize the importance of smooth steady movements that go to end range. Check that <u>both contact points remain on the sacrum</u> and the pivot point <u>remains on S1</u> during patient flexion and extension.

4) Have the patient stand <u>erect</u>. Feet should be shoulder width apart. Place the moveable arm on the <u>upper measuring point</u> T12 and record the arm reading. This reading is the distance in centimeters between S1 and T12 and can be used to position the arm during future measurements to assure that the <u>same segment</u> of spine is measured. The typical reading for an adult is 15 centimeters.

5) With the arm tip on T12 record the initial reading from the outer scale. <u>Remove</u> the arm tip from T12 and place a finger securely on T12. Have the patient slowly bend forward trying to lay the palms of the hands on the floor. Replace the arm tip on T12 and record the full flexion reading. Subtract the initial flexion reading from the full flexion reading to obtain <u>true flexion</u> (Typical Value is 30 degrees). By placing a finger on the spine the examiner can follow the spine instead of a mark on the skin which would move relative to the spine during bending. Also by placing the finger on the spine the examiner can monitor if the patient is going to full flexion or extension.

6) Repeat step 5. If this true flexion reading is <u>within 3 degrees</u> of the first reading record the higher reading. If it is <u>not within 3 degrees</u> repeat step 5.

7) <u>Extension Measurements</u>. Check that the patient is standing <u>erect</u>. Have the patient put their arms across the chest with hands on their shoulders. Place the arm tip on T12 and record the initial reading from the outer scale. Remove the arm tip from T12 and have the patient extend backward (provide the necessary support to prevent the patient from falling backward). Place the arm tip on T12 and record the full extension reading. Subtract the full extension reading from the initial reading to obtain <u>true extension</u> (Typical Value is 12 degrees).

8) Repeat step 7. If this true extension reading is <u>within 2 degrees</u> of the first reading record the higher reading. If it is <u>not within 2 degrees</u> repeat step 7.

9) <u>Pelvic Tilt Measurement</u>. Remove the arm. Have the patient stand <u>erect</u>. Move the dial until the vial bubble is between the two lines. Record the pelvic tilt reading from the <u>inner scale.</u>

Thoracic Flexion can be measured by placing the pivot point on T12 and placing the tip of the long arm on T1.

Rotation Measurements

The magnetic angle meter measures to the magnetic reference placed on the spine thus eliminating unwanted spine movement below that point. An added advantage of this method is that measurements are made with the trunk in the vertical position. The meter unit is designed so when the examiner grasps the rib cage the unit becomes a part of the patient, thus eliminating tracking errors.

1) Utilize the markings made for S1 and T12 made during the flexion/extension measurements.

2) Place the belt <u>between</u> S1 and T12 with the velcro side out. Place the magnetic reference over the sacrum (approximately 4 cm below S1) and attach the velcro straps.

3) Have the patient sit erect on a <u>non</u> rotating stool facing west so the arrow on the magnetic reference points north. Feet should be flat on the floor. This sitting position will stabilize the pelvic area. The patient's arms should be crossed over the chest with the hands placed on the shoulders.

4) Demonstrate and have the patient do rotation movements. Emphasize the importance of smooth steady movements that go to end range.

5) Place the Rotation/Lateral Flexion Unit so the unit's feet are in line with T12. Hold the center of the unit firmly against the patient's back and zero the magnetic meter. Place the thumbs over the back of the unit's feet and grasp the rib cage with the fingers. Check that the meter is still zero.

6) Have the patient slowly turn the shoulders to the right making sure they go to full range. Record the reading (Typical Value is 10 degrees).

7) Have the patient slowly turn the shoulders to the left making sure they go to full range. Record the reading.

8) Repeat steps 5 & 6. If readings are within 2 degrees of the respective readings in steps 5 & 6 record the higher reading. If not repeat steps 5 & 6.

Thoracic/lumbar rotation can be measured by leaving the magnetic reference on the sacrum and placing the Rotation/Lateral Flexion Unit at T1. To measure only thoracic rotation the belt should be moved up so the magnetic reference can be placed on T12 and the meter unit should be placed at T1.

Lateral Flexion Measurements

The meter unit is designed so when the examiner grasps the rib cage the unit becomes a part of the patient, thus eliminating tracking errors. The protocol eliminates unwanted hip rotation and flexion.

1) Demonstrate and have the patient do lateral flexion movements. Emphasize the importance of smooth steady movements that go to end range.

2) Have the patient stand erect with nose nearly touching the wall. This position will keep the patient from bending forward during lateral flexion measurements.

3) Place the Rotation/Lateral Flexion Unit so the unit's feet are in line with T12. Place the thumbs over the back of the unit's feet and grasp the rib cage with the fingers. Adjust the unit's position on the back until the inclinometer reads zero.

4) For right lateral flexion have the patient slide their right hand down the back of their leg with the body weight shifted to the left foot and keeping the legs straight. Record the reading (Typical Value is 25 degrees).

5) For left lateral flexion have the patient slide the left hand down the back of the leg with the body weight shifted to the right foot and keeping the legs straight. Record the reading (Typical Value is 25 degrees).

6) Repeat steps 4 & 5. If readings are within 2 degrees of the respective readings in steps 4 & 5 record the higher reading. If not repeat steps 4 & 5.

Thoracic/Lumbar Lateral Flexion can be measured by placing the Rotation/Lateral Flexion Unit at T1.