THE RELATIVE EFFECTIVENESS OF SPINAL MANIPULATION AS OPPOSED TO EXERCISE THERAPY ON MECHANICAL LOW BACK PAIN IN POSTNATAL PATIENTS

by

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I, Brendon John Bailes , do declare that this dissertation is representative of my own work.

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DEDICATION

I dedicate this research to my family, with special mention to my exceptional parents for their belief in me. Without your love, support and encouragement I would not have achieved this goal.

To my nephew, Douglas Flanders Smith. Not only were you born on the 14th May 1997..... a new family was born .

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ABSTRACT

The cause of postnatal low back pain is not clearly understood. There have been few studies performed to determine the cause, and several theories have attempted to explain the occurrence of postnatal low back pain. It is suggested that an exaggerated lumbar lordosis, laxity of the ligaments due to relaxin, biomechanical strain on the muscles and ligaments of the lumbar spine and pelvis and temporary compensatory posture are possible aetiologies of postnatal low back pain. (Calguneri et al. 1982; Bullock et al. 1987 ; Berg et al. 1988 ; Wisneski et al.1992: 711 ; Mantle 1994:799.)

A great number of postnatal women experience postnatal low back pain at some stage in their recovery period to a prepregnant state. An incidence of between 49% to 65% of postnatal patients suffer from postnatal low back pain, with some still experiencing pain up to a year after birth.(Berg et al. 1988; Polden and Mantle 1990:224 ; Ostgaard and Andersson 1992 .) With this high incidence of postnatal low back pain, some obstetricians, general practitioners and midwives dismiss the low back pain experienced by the new mothers as inevitable and unimportant. (Polden and Mantle 1990:133) It was noted by Fast et al. (1987) that postnatal patients are not fully aware what treatment is available in terms of management of their mechanical low back pain, because some patients believe it is part of a normal pregnancy.

In response to this, the objective of this study was to compare two treatment therapies, namely exercise therapy and spinal manipulative therapy, in the management of postnatal mechanical low back pain, in order to determine the more effective treatment approach.

This study consisted of a controlled trial of a sample population of thirty patients diagnosed with postnatal mechanical low back pain. The thirty patients were randomly divided into two treatment groups of fifteen each; one group received exercise therapy and the remaining fifteen received spinal manipulative therapy.

Each subject was treated a maximum of eight times or until clinically symptomatic, twice a week over a period of four weeks, with a one month follow-up consultation after the eighth treatment.

The Numerical Pain Rating Scale and the Oswestry Low Back Pain Disability Questionnaire were used to evaluate the subjective responses. The Brom II goniometer was used to evaluate the objective readings. These subjective and objective data were collected before the commencement of the first treatment, eighth treatment and the one month follow-up consultation. The results were analyzed at a 95% confidence interval. The Wilcoxon Signed Rank test was used to analyze data within each group and the Mann-Whitney U-test was used to analyze data comparing the two groups.

The results indicated a statistically significant subjective and objective difference, in the form of decreased pain perception and functional disability, and an increase in all lumbar spine ranges of motion for the Spinal Manipulative therapy group. These statistically significant differences were noted at the treatment period (short term improvement) and at the one month follow-up consultation (long term benefit).

The Exercise therapy group only showed a statistically significant objective difference during the treatment period (short term improvement) for forward flexion and left lateral flexion lumbar motion and at the one month follow-up consultation (long term benefit) for right and left lateral flexion of the lumbar spine range of motion. Although the remaining results for the Exercise therapy group did not exhibit enough statistical significance to warrant interest, subjects demonstrated a favourable clinical response in terms of decreased mean scores for pain perception and functional disability and increased mean scores for lumbar spine ranges of motion.

In conclusion, Chiropractic Spinal Manipulative therapy was the most effective and favourable treatment for postnatal mechanical low back pain in terms of clinical findings.

Future studies should include greater population samples in order to identify subtle changes in the measurement parameters and to contribute to the validity of the results. It is recommended that long term clinical trials be conducted in which patients are monitored for at least 6 months to a year, in order to investigate the long term benefit of the treatment offered.

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LIST OF ABBREVIATIONS

SMT : Spinal Manipulative Therapy

ET : Exercise Therapy

IC : Initial consultation

FC : Final consultation

FU : Follow-up consultation

p value : Two Tailed probability of equaling or exceeding.

DEFINITION OF TERMS

(1) MANIPULATION : a manual procedure that involves a directed thrust to move a joint past the physiological range of motion without exceeding its anatomic limit (Gatterman 1995:12).

(2) ANTENATAL: time period before delivery;

(3) POST-PARTUM : time period directly after delivery;

(4) POSTNATAL : time period after birth.(Kitzinger 1993:384, 391)

(5) SUBJECTIVE CLINICAL FINDINGS : for the purpose of the study this refers to the data obtained from the patients through the use of the Numerical Pain Rating Scale 101 and the Oswestry Back Disability Index.

(6) OBJECTIVE CLINICAL FINDINGS : for the purpose of the study this refers to the data obtained from the patients' lumbar spine ranges of motion using the goniometer.

CHAPTER 1

1.0. INTRODUCTION

The postnatal period is where the new mother's body, after giving birth, begins its recovery to the normal prepregnant state. During this postnatal period back pain is a very common complaint, which interferes with the quality of life experienced by the new mother. The back pain experienced by the new mother is not only confined to mothers that experienced back pain during pregnancy, but could be a result of labour, delivery of the newborn and caring of the newborn infant. (Polden and Mantle 1990: 222 - 254)

A study done by Fast et al. (1987) revealed that 56 % of patients suffer from low back pain during their pregnancy period. Their low back pain develops between the fifth and seventh month antenatally, and is sometimes looked upon as part of a normal pregnancy. With this high incidence of low back pain occurring during pregnancy, it was found in a study done by Fast et al. (1987) that two thirds of pregnant patients after delivery have backache persisting into their postnatal period, and that in some instances the pain persists for up to a year.

In response to this high incidence of postnatal low back pain and altered quality of lifestyle due to the postnatal low back pain, this study undertook to compare two different treatment therapies, namely exercise therapy and spinal manipulative therapy, in the management of postnatal mechanical low back pain, in order to determine which therapy is clinically more effective.

In a three year follow-up study on 741 patients, comparing chiropractic management to hospital outpatient management of low back pain, it was concluded that those patients who received chiropractic management derived more benefit and long term satisfaction, with particular mention of decreased pain intensity, than those who received traditional medical treatment. (Meade et al. 1995)

Many studies have been conducted in order to determine the effectiveness of spinal manipulative therapy for management of low back pain. Assendelft et al. (1992) found in a review of relevant randomized clinical trials of efficacy of chiropractic manipulation for low back pain, that chiropractic manipulation seemed to be an effective treatment for low back pain. In a summary of the related research on effectiveness of spinal manipulation, Manga et al. (1993) concluded that spinal manipulation applied by a chiropractor was more effective than any other alternative treatments for low back pain

Spinal manipulation offers the new mothers a drug free treatment for postnatal mechanical low back pain, which does not interfere with the nurturing of the newborn infant. Drugs such as NSAIDs, antibiotics and analgesics are contra-indicated for use in the postnatal period as they produce unwanted side effects in the quality of breast milk. (Klein 1996 : 59)

Exercise therapy is one of the most misunderstood approaches to the treatment of low back pain (Jackson and Brown 1983; Deyo 1994:168).

Deyo (1994: 154-155) stated that probably 98 % of back pain is a form of mechanical pain where therapeutic intervention by exercise therapy would be most beneficial. Exercise therapy is designed to strengthen muscles (paraspinal and abdominal), to stretch muscles and ligaments where mobility may have been restricted by pain, and to improve overall fitness and endurance. Other indications for exercise, especially in the postnatal period, are to decrease pain, decrease mechanical stress to the spine, stabilize hypermobile segments, and improve posture and mobility.(Jackson and Brown 1983)

The general effects of exercise are to decrease stress, improve the attitude of the postnatal patient and facilitate sleep, which may offer an alternative to prolonged use of medication in chronic low back pain patients. (Jackson and Brown 1983)

Upon review of the related literature, it appears that no controlled studies have been done, to this researcher's knowledge, to compare the clinical efficiencies of exercise therapy to spinal manipulative therapy in the management of postnatal mechanical low back pain.

With the above in mind , this study aimed to add validity to spinal manipulative therapy for the treatment of postnatal mechanical low back pain, in order to improve the quality of lifestyle of those patients suffering from postnatal mechanical low back pain.

1.1. OBJECTIVES

The first objective was to evaluate the efficacy of spinal manipulative therapy as well as that of exercise therapy in the treatment of subjects suffering from postnatal low back pain, in terms of objective clinical findings.

The second objective was to evaluate the efficacy of spinal manipulative therapy as well as that of exercise therapy in the treatment of subjects suffering from postnatal low back pain, in terms of subjective clinical findings.

The third objective was to integrate the data obtained from objectives one and two, in order to determine which would be a more effective treatment of postnatal mechanical low back pain.

1.2 HYPOTHESES

1.2.1. Hypothesis one

It was hypothesized that spinal manipulative therapy would be effective in the management of postnatal mechanical low back pain, in terms of subjective and objective clinical findings.

1.2.2. Hypothesis two

It was hypothesized that exercise therapy would be effective in the management of postnatal mechanical low back pain , in terms of subjective and objective clinical findings.

1.2.3. Hypothesis three

It was hypothesized that spinal manipulative therapy would be more effective than exercise therapy in the management of postnatal mechanical low back pain, in terms of subjective and objective clinical findings.

CHAPTER 2

2.0. REVIEW OF THE RELATED LITERATURE

2.1. INTRODUCTION

Immediately after the delivery of her new baby, the new mother's body begins its period of recovery and its return to normal. In the first few postpartum hours, many aspects such as the empty, sagging and still enlarged abdomen, intense fatigue, exhaustion and lowered pain threshold are overlooked because of the exhilaration of giving birth. (Polden and Mantle 1990: 222)

According to Mackay and Beischer (1986 : 519) the puerperium period is the six week period which follows childbirth and is the beginning of many challenges, both emotional and physical, and adjustments to be faced by the new mother. During the period of gestation the increase in the lumbar lordosis, thoracic kyphosis and pelvic inclination, places excessive strain on the trunk musculature, which leads to a mechanical disadvantage to the pregnant patient who may not be able to cope with these postural changes.(Fast et al. 1987)

Postnatally the back pain experienced may be a continuation of the pain from the antenatal period, or it may be a new low back pain.(Mantle 1994:806)

Another aspect of the postnatal period is the presence of the hormone relaxin, which causes ligamentous laxity through remodeling the connective tissue, which is a factor in perpetuating low back pain and sacroiliac instability in the postnatal period.(Fast et al. 1987)

2.2. INCIDENCE OF LOW BACK PAIN DURING PREGNANCY

According to Fast et al. (1987) 56% of patients suffer from low back pain during their pregnancy period. The study was done on two hundred women who were interviewed 24-36 hours after delivery of the newborn infant. The low back pain experienced by the pregnant patients generally started in the period between the fifth to the seventh month antenatally.

In another study it was concluded that out of eight hundred and sixty two patients, 49% had experienced low back pain during pregnancy.(Berg et al. 1988)

A review of the literature on the incidence of low back pain during pregnancy has revealed that about 50% of all pregnant women experience low back pain at some stage during the pregnancy period.(Mantle 1994:799)

2.3. INCIDENCE OF LOW BACK PAIN POSTNATALLY

With this high incidence of low back pain occurring during pregnancy it was noted in a study done by Berg et al. (1988) that two thirds of the pregnant patients after delivery had backache persisting into their postnatal period, and that in some patients the pain persisted for at least one year.

In a study done by Ostgaard and Andersson (1992) in which eight hundred and seventeen women had been followed through pregnancy and up to a period of twelve months after delivery, it was noted that 67 % of women experienced low back pain directly after delivery.

At the twelve month follow-up examination after delivery, 37 % of the women still had some low back pain and on the 18 month follow-up examination, 7 % of the women had serious low back pain.

Polden and Mantle (1990: 224) suggested that back pain may not have been troublesome during pregnancy but that it frequently developed following birth. They argued that the passage of the foetus through the pelvis with the resultive ligamentous stretching and lax joints, is a causative factor of low back pain.

In a study done by Fraser (1976) on one hundred and fifteen postpartum women, it was noted that 95,65% of the women presented with sacroiliac torsion with associated signs of muscular imbalance. During pregnancy there is extensive movement of the sacroiliac joints due to relaxin, which affects the efficiency of the locking mechanism within the sacroiliac joint. After delivery, sacroiliac strain develops which results in the locking mechanism being placed in a position of rotation, leading to sacroiliac torsion.

2.4. CAUSES OF LOW BACK PAIN IN PREGNANCY

Several theories attempt to explain the occurrence of low back pain during pregnancy. According to Berg et al. (1988) the increased biomechanical strain on the ligaments, muscles and the skeletal system is the most common cause of low back pain, but they stated that scientific studies are scarce when determining the cause of low back pain during pregnancy.

Commonly the pain is attributed to an excessive lumbar lordosis, laxity of ligaments due to the secretion of relaxin, fatigue and temporary compensatory posture. (Fast et al. 1987 ; Bullock et al. 1987 ; Berg et al. 1988 ; Wisneski et al. 1992 :711 ; Mantle 1994 : 799)

During the period of gestation the following factors are either causal factors or perpetuating factors , which render the patient more susceptible to low back pain :

2.4.1. Fatigue;

2.4.2. Asymmetrical and increasing weight gain;

2.4.3. Role of relaxin on connective tissue.

(Mantle 1994: 800)

It is also important to remember that although the patients are pregnant, they are still prone to the normal ailments of their particular age group. Pregnant women become more accident prone and with the distended abdomen making some activities awkward. Together with the psychological effects of pregnancy, these factors could also make the pregnant patient more susceptible to low back pain, since judgment about caring for the spinal column may be impaired.(Polden and Mantle 1990: 143)

2.4.1. Fatigue

During pregnancy women commonly complain of lack of strength, severe tiredness and emotional strain, which occur predominately in the first and third trimesters. With these factors affecting the pregnant patient, they naturally adopt an altered posture, in addition to the compensatory postural changes, which predisposes them to backache. (Mantle 1994: 800)

Pain is produced by movement of joints in unusual positions, stretching and straining muscles, ligaments and other soft tissue, affecting blood flow and altering load bearing on the spinal column.(Mantle 1988:70)

According to Fraser (1976) the pain is caused by the subluxation of the sacroiliac joint which imposes a certain degree of tension on the ligaments.

2.4.2. Asymmetrical and increasing weight gain

As the pregnancy progresses, the abdomen expands in an anterior direction which alters the body's centre of gravity, thus causing compensatory postural changes. (Vleminckx 1988:113) The average weight gain is between ten to twelve kilograms, but some women experience twenty to twenty five kilogram weight gain, which increases the compressive loading and torsional strain on all spinal components, including the pelvic joints.(Mantle 1994:800)

With the increased loading of the spinal column the normal anatomical positioning of its components are altered, leading to narrowing of intervertebral disc space, decrease in size of the intervertebral foramen, causing nerve root compression / irritation and aggravation of an existing degenerated or lesioned disc. (Mantle 1988:70-71)

This increased lumbar lordosis combined with the gradual weight gain, may cause the lumbar facet joints to override and traumatize the joint capsules. (Polden and Mantle 1990 : 143)

2.4.3. Role of relaxin on connective tissue

The hormone relaxin is secreted by the corpus luteum and functions to prepare the endometrium for implantation, cervical ripening and inhibition of uterine activity during the gestation period. The main function of relaxin is the remodeling of connective tissue, leading to joint laxity in target organs to facilitate the delivery of the newborn infant. (Mac Lennan 1981)

The laxity of the joints is not only limited to the pelvic joints, but all joints of the body to some degree are affected.(Mantle 1988:74) The main target area is the symphysis pubis in which there is an average increase in the width from ten centimeters to twenty three centimeters. The mobility of the symphysis pubis increases by two and a half times, but rarely separates. The changes in joint laxity are only temporary changes and return to normal prepregnancy condition about five months after delivery of the newborn infant. (Mantle 1994 :801)

2.5. POSTURAL CHANGES DURING PREGNANCY

The postural changes are compensatory changes that occur due to the increase in weight gain, change in the centre of gravity and stretching or weakening of the abdominal muscles. (Bullock 1987)

In a study undertaken on seventy five pregnant women by Bullock (1987), it was shown that there were significant changes in the lumbar lordosis, thoracic kyphosis and pelvic inclination in the mid sagital plane near the end or 'late' pregnancy, which continued up until the twelfth week of the postnatal period. The level of relaxin during this twelve week period was relatively high and had a considerable influence on the ligaments aiding in postural alignment. With the daily activities of the new mother, the altered posture could be a major disadvantage leading to aggravation of an existing low back pain.

Significant postural changes are first noted from the fifth month antenatally and extend into the postnatal period. During this antenatal period it is important to encourage 'good posture' in order to minimize additional pressure on spinal components. With the increased lumbar lordosis and thoracic kyphosis, it is important to direct treatment to these areas. (Bullock et al .1987)

The weight gained during pregnancy, which is in an anterior direction, places strain on the sacral prominence which develops a compensatory altered posture in a forward and downward position, thus altering the pelvic angle. With the change in the pelvic

angle the lumbar lordosis increases to compensate accordingly, which may override the lumbar facet joints and put strain on the sacroiliac joints.(Mantle 1988:71)

Bernard and Kirkaldy-Willis (1992: 209) mention that posterior facet joint and sacroiliac joint syndromes commonly co-exist, with the result of strain being placed on either the former or latter, thus causing low back pain.

2.6. SPINAL JOINT DYSFUNCTION

2.6.1. Pathophysiology

An understanding of low back pain and its pathophysiology is necessary in order to formulate a logical plan of low back pain management.

Kirkaldy-Willis (1992:49) states that three aspects must be considered in the pathophysiology of low back pain, namely:

(a) emotional disturbance such as stress, tension, anxiety, fear and resentment which act on the autonomic nervous system to produce local areas of vasoconstriction in muscle ;

(b) this vasoconstriction leads to changes in muscle trigger point zones, which replaces the normal contractile elements by fine granular residue within the sarcomere sheath, resulting in sustained muscle contraction . The combined effect of vasoconstriction and sustained muscle contraction leads to muscle fatigue and the accumulation of metabolites within the muscle , which may develop into a myofascial syndrome ;

(c) changes in facet joints and intervertabral discs.

Synovitis is the earliest change within the facet joints and, if persistent, degeneration of the articular cartilage occurs which over a period of time becomes increasingly marked. Intra articular adhesions and joint capsule laxity are evident with advanced degenerative changes to articular cartilage, which finally produces subluxation of joint surfaces. (Kirkaldy-Willis 1992: 59)

According to Gatterman (1995:11) joint subluxation, also known as motion segment dysfunction, involves complex interaction of the pathologic changes in nerve, muscle, ligamentous, vascular and connective tissues of the motion segment involved. Schafer and Faye (1990:2) refer to 'subluxation' of a motion segment as a fixation, which produces a loss of segmental mobility within its normal physiologic range of motion.

Schafer and Faye (1990:46) mention that the clinical fixation-subluxation complex has five components, which are:

(1) **neuropathophysiologic component**: i.e.

(1.1.) irritation producing central nervous system fascilitation of:

(a) anterior horn producing hypertonicity;

(b) lateral horn producing vasomotor changes;

(a) posterior horn producing sensory changes;

(1.2.) pressure producing central nervous system degeneration which results in muscular atrophy and anaesthesia;

(2) **kinesiopathologic component**: i.e. hypomobility with diminished joint motion which results in compensatory segmental kinematic hypermobility;

(3) **myopathic component**: i.e. hypertonicity or muscle spasm ;

(4) **histopathologic component**: i.e. inflammation (heat, swelling and pain) as a result of hypermobile irritation / degeneration due to segmental hypomobility ;

(5) **biochemical component**: i.e. hormonal and chemical imbalance due to histamine, prostaglandin and bradykinin production.

2.6.2. Clinical signs of joint dysfunction

The classical changes associated with joint dysfunction are loss of joint motion, added asymmetry and tissue texture alteration.(Lamb 1994: 647)

Schafer and Faye (1990:43) stated that pain on motion, tenderness to palpation, limitation of motion, soft tissue swelling, bony subluxation, periarticular swelling and gait abnormalities are typical features observed in musculoskeletal disorders.

Any abnormal function (dysfunction) of a lumbar spinal motion segment, of one or more of its components, will over time lead to structural changes which may develop into segmental instability. Minor derangement of one posterior facet joint affects the function of the opposite posterior facet joint, and possibly the intervertabral disc. (Kirkaldy-Willis and Mierau 1995)

The most common conditions occurring in the phase of spinal dysfunction are lumbar facet syndrome and sacroiliac syndrome.(Cassidy and Kirkaldy-Willis 1988:295)

The three most common origins of low back pain as stated by Schafer and Faye (1990:45) are as follows: (a) lumbar facet syndrome;

(b) sacroiliac syndrome;

(c) lumbar radicular syndrome.

Patients suffering from conditions within the dysfunction phase, present with minor pathological changes which may be reversible.(Kirkaldy -Willis 1992:105)

2.7. LUMBAR ZYGAPOPHYSEAL JOINT

2.7.1 Anatomy

The junction between the superior and inferior articular facets of the articular processes on one side of two adjacent vertebra, is known as the zygopophyseal joint. They are diarthrodial synovial joints surrounded by a capsule posterolaterally and the ligamentum flavum anteromedially. A synovial membrane lines the articular capsule, ligamentum flavum and synovial joint folds. (Gatteman 1995:19)

2.7.2. Innervation

Each facet joint has a rich supply of sensory innervation which is supplied by the medial branch of the posterior primary division (dorsal ramus) at the level of the joint.(Dupuis 1992: 19)

Three types of sensory receptors occur in the facet joint capsule , namely:

(1) type Ⅰ : sensitive static and dynamic mechanoreceptors which fire constantly due to continual joint motion;

(2) type Ⅱ : less sensitive mechanoreceptors which fire only on joint motion;

(3) type Ⅲ : slow conducting mechanoreceptors.

(Gatterman 1995:21)

Since the facet articular cartilage is aneural, pain does not directly arise from this structure. Rather possible sources of pain from facet joints include :

(a) overloading of subchondral bone trabeculae;

(b) micro fracture of bone trabeculae;

(c) mechanical deformation or chemical irritation of joint capsule nociceptors;

(d) internal derangement from loose bodies within the joint;

(e) meniscoid synovial folds;

(f) vascular disturbance in soft tissue;

(g) joint inflammation.

(De Rosa and Porterfield 1994:124)

2.7.3. Muscles

The lumbar spine is surrounded by muscles which may be divided by means of functional grounds into three groups. These are:

(1) psoas major and minor which cover the anterolateral aspect of the vertebral bodies and intervertebral discs;

(2) quadratus lumborum and intertransversarii lateralis muscles which connect and cover the transverse processes anteriorly;

(3) lumbar back muscles which lie behind the plane of the transverse processes, which include the interspinalis, intertranversarii medialis, multifidis muscles and lumbar components of longissimus and illiocostalis muscles.

(Macintosh and Bogduk 1994:189)

2.8. THE SACROILIAC JOINT

2.8.1. Anatomy

The sacroiliac joint is formed by the articulation between the sacrum and the illium. The illiac surface is composed of thin fibrocartilage and the articular surface of the sacrum is composed of hyaline cartilage. (DeRosa and Porterfield 1994:125)

The roughening of the articular surfaces is thought to be a non-pathological adaption to the forces exerted at the sacroiliac joints. It is more pronounced in men than in women, which is probably due to the difference in the centre of gravity and childbearing aspects in the female. (Hendler et al. 1995)

Sacroiliac joint motion is affected by several factors which include age, gender and configuration of joint surfaces. Female sacroiliac joints tend to be flatter, with a wider retroarticular space and longer interosseous ligaments, all promoting increased mobility.(Gatterman and Panzer 1995:453)

Movement in the sacroiliac joints primarily occurs in the oblique sagittal plane, with the axis of rotation centred around the iliac tubercle. This motion is considered very slight (3-5 degrees), giving the joint a shock absorbing capability.(Gatterman and Panzer 1995:453)

2.8.2. Innervation

The posterior aspect of the sacroiliac joint is innervated by the posterior rami of L5 - S2 spinal nerves and the anterior aspect is innervated by both posterior branches from the L3 - S2 nerve roots and the superior gluteal nerve (L5-S2). (Moore 1985:390 ; Schafer and Faye 1990:244)

Irritation of the joint posteriorly refers pain to the buttocks, back and thigh, following a dermatomal distribution, and irritation of the joint anteriorly usually refers pain to the groin and anterior thigh.(Schafer and Faye 1990:244)

2.8.3. Ligaments of the sacroiliac joint

The investing ligaments, namely the anterior sacroiliac ligament, posterior sacroiliac ligament and the interosseous sacroiliac ligaments, contribute to the stability of the sacroiliac joint. The anterior sacroiliac ligament is thin and easily distended by intra-articular swelling. The posterior sacroiliac ligament is strong and thick, which is resistant to trauma. (Hendler et al .1995) The interosseous sacroiliac ligaments are short bundles of fibers which blend with the posterior sacroiliac ligament posteriorly, suspending the sacrum between the two illia. (Moore 1985:389)

2.9. THE POSTNATAL PERIOD

This is the period where the new mother's body, after giving birth, begins its recovery to the normal prepregnant state. (Polden and Mantle 1990:222)
Berg et al.(1988) found that 65% of pregnant women that had sacro iliac dysfunction in pregnancy, still suffered half a month to twelve months postnatally.

Low back pain experienced in the postnatal period may be a continuation of that which was experienced antenatally, or it could be a new low back pain caused by labour, delivery and caring for the newborn infant. (Mantle 1994:806)

It was noted by Ostgaard and Andersson (1991) that the longer the period of sick leave in the antenatal period for low back pain, the worse the prognosis for regression of postpartum low back pain. In the same study on eight hundred and seventeen women followed through their pregnancy and up to a period of twelve months postnatally, it was found that previous back pain, young age at their first pregnancy, physically heavy work during their antenatal period and monotonous work, were all factors more common among women with serious persistent postpartum back pain .

It was stated by Ostgaard and Anderson (1991) that 67 % of women experienced low back pain directly after delivery with a 7 % incidence of persistent low back pain at 18 months postnatally.

Tiredness, slack abdominal muscles, painful perineum (making sitting awkward) , poor posture while breast feeding, poor unsupported positions, mild depression, nappy changing on a low surface, increasing weight of newborn and heavy enlarged breasts are only a few adverse factors that could lead to possible postpartum low back pain. (Mantle 1994 : 806)

2.9.1. Connective tissue

As stated previously, the levels of serum relaxin are still significantly high in the postnatal period, up until the fourth month.(Calguneri et al. 1982)

The role of relaxin in the pregnant woman is to cause alteration in ligamentous support of the joints to facilitate the birth process, but during the postnatal period the alteration of ligamentous support within the joints results in instability and creates abnormal stresses on particular joints.

Jeffcoate (1975) suggested that individual muscle spasms or ' groups' of muscle spasms may be the cause rather than the effect of low back pain in the puerperium period. In his discussion he mentioned such conditions as lumbago, acute and chronic strains of the muscle attachments and sacroiliac strain, and based his findings on local tenderness and pain within that region. Jeffcoate further suggested that the muscle spasms were the cause of the pain experienced rather than the effect of the pain. In his conclusion, no reason was given for the suggestion that the muscle spasms were the cause of the pain.

All neuromusculoskeletal tissues are organic viscoelastic substances. An important factor in all organic viscoelastic substances is stability which is directly affected by the amount of load applied and the time period applied to these substances. When viscoelastic substances such as bones, muscles, tendons, ligaments and cartilage are exposed to loading, elongation occurs in tendons, ligaments and muscles, while deformation occurs in bones and cartilage, with the resultant loss of energy from these structures, known as hysteresis. With sustained loading, as seen in the antenatal period during pregnancy with a shift of the centre of gravity in an anterior direction with increasing weight gain, a compensatory increase in the lumbar lordosis occurs which may override the lumbar posterior facet joints, resulting in segmental instability and tissue alteration. (Bullock et al. 1987; Mantle 1988:71; Schafer and Faye 1990:188-190)

With the increase of the hormone relaxin, especially at the peak of labour and postnatally, connective tissue and joint stability ~~are compromised, resulting~~ in abnormal stresses placed on these structures. (Calguneri et al. 1982) The abnormal stresses will stimulate the nociceptive nerve endings, where once stimulated, a state of hyperalgesia develops. Therefore once structures are injured or compromised, they are more sensitive to pain until healing has occurred or the stresses are removed. Pain of spinal origin is often a result of damage to several structures, resulting in a state of hyperalgesia. (Gatterman 1995:28)

Most pain of spinal origin has a physical cause. Gattermann (1995:28) suggests that one way of organizing possible pain generators is by listing them according to four main sources of neural innervation to spinal structures. These sources are as follows:

(1) the anterior primary division (ventral ramus) which innervates the following:

(1.1.) psoas muscle ;

(1.2.) quadratus lumborum muscle ;

(1.3.) intertransversarii muscles ;

(1.4.) referred pain from structures innervated by plexus ;

(2) the posterior primary division (dorsal ramus) which innervates the following:

(2.1.) deep back muscles ;

(2.2.) zygapaphyseal joints ;

(2.3.) periosteum of posterior vertebral arch ;

(2.4.) interspinous, supraspinous, intertransverse ligaments and ligamentum flavum. ;

(2.5.) erector spinae muscles ;

(2.6.) skin ;

(3) the recurrent meningeal nerve which innervates the following:

(3.1.) epidural adipose tissue ;

(3.2.) internal vertebral veins ;

(3.3.) posterior intervertebral disc ;

(3.4.) posterior longitudinal ligament ;

(3.5.) anterior spinal dura mater ;

(4) sensory fibres that course with the sympathetic nervous system innervate:

(4.1.) periosteum of the anterior and lateral vertebral bodies ;

(4.2.) lateral intervertebral disc ;

(4.3.) anterior intervertebral disc ;

(4.4.) anterior longitudinal ligament.

2.9.2. Abdominal musculature

As the abdomen becomes increasingly larger during pregnancy, increased pressure results in stretching and elongation of the two recti abdominis muscles with a possibility of a split occurring along the linea alba. With the weakened abdominal musculature combined with ligamentous laxity and connective tissue alteration, the lumbar spine is even more susceptible to trauma resulting from incorrect use. (Polden and Mantle 1990:223)

2.9.3. Pelvic floor

During pregnancy the growing neonate pushes down on the pelvic brim, which causes it to tilt forward altering the pelvic tilt angle. This changed pelvic tilt and the growing weight that is being carried, puts strain on the ligaments and muscles, which is suggested as a possible cause for low back pain. (Stoppard 1995 :87)

2.9.4. Other factors that need consideration

Most antenatal education ends with the birth of the newborn and many postnatal women are unprepared for the changes, both physically and psychologically, in the postnatal period. The new mother will now be required to make the transition from pregnant woman to a responsible mother, who must be able to care for the newborn, doing daily lifting, breast feeding and changing of nappies. The mother's sleep cycle will be disturbed which brings upon fatigue and tiredness, all of which will lead to the recurrence of the existing low back pain. (Conway 1995 : 258)

Looking at the postnatal period from a broader perspective, the following factors could play a role in the progression of low back pain: heavy enlarged breasts, swollen and aching legs, mood (postnatal depression) and increasing demands made by either the newborn infant or other children or the partner.(Polden and Mantle 1990:224)

It is important to know that during the initial weeks into the postnatal period, the new mother's interest in herself is very small and her concentration span is shorter, which places her in considerable risk of aggravating or developing postpartum low back pain, especially if accentuated by further perpetuating factors.(Mantle 1994:806)

2.9.5. Implications of low back pain in postnatal period

With the activities performed by a postnatal patient for the care and nurturing of the newborn infant, the postnatal patient should not have any discomfort in any task undertaken, because this could either be detrimental to the newborn who may not receive the necessary care, or to the postnatal patient whose low back pain becomes progressively worse. (Mackay and Beischer 1986 :519)

With the progression of an existing low back pain, the condition could lead to chronic low back pain for which most patients will seek medical advice.

Chiropractors, Homeopaths, acupuncturists and other alternative therapists have a more increasingly important role with pain control in patients who are in their childbearing year and they offer a wide variety of complementary therapies. (Tiran 1995:26)

Chiropractic treatment involves a non drug treatment to patients suffering from low back pain, which will not interfere with the care of the newborn. It has been mentioned that drugs such as NSAIDs, analgesics and antibiotics are contra indicated in the postnatal period as they interfere with the quality of the milk produced during breast feeding. (Klein 1996:59)

2.10. EFFECTIVENESS OF SPINAL MANIPULATION

Out of twenty four trials of assessing the efficacy of spinal manipulative therapy for the treatment of low back pain, it was agreed that spinal manipulative therapy is a safe therapeutic approach that in many cases offers the patient more immediate relief than any other form of conservative treatment.(Bronfort 1992:420)

Meade et al. (1995) stated that in their study, which involved comparing hospital outpatient treatment to chiropractic treatment in managing mechanical low back pain, chiropractic treatment was the more effective of the two treatments. In the three year follow-up, patients who received chiropractic care derived more benefit and long term satisfaction, especially in decreased pain intensity, than those treated by hospitals.

A summary of clinical trials and related research on the effectiveness of manipulation by Manga et al. (1993), found that spinal manipulation applied by chiropractors is the more effective treatment than any other alternative treatment of low back pain. In a similar study utilizing meta-analytical techniques, it was found that spinal manipulative

therapy was consistently more effective in the treatment of low back pain than any other form of treatment. (Anderson et al. 1992)

DiFabio (1992), in assessing valid trails of manual therapy in the treatment of low back pain, indicated that there was clear evidence that manual therapy, in particular manipulation, was effective in the treatment of low back pain

In a study done by Fraser (1976) on one hundred and fifteen women, it was found that postpartum backache, which is an apparently 'normal' condition , improved 'dramatically' with manipulation after pregnancy

A study was done on two hundred and eighty three patients who suffered from chronic low back pain and leg pain. Emphasis in this study was on a accurate diagnosis for each patient and in which phase the clinical lesion appeared. The inclusion criteria for subjects to participate in the study were limited to those who did not respond to simple conservative treatment, had back pain for many years and were disabled by pain at the start of their treatment.

Subjects were given a two to three week program of daily spinal manipulations. The results, which were calculated separately for each condition diagnosed and treated, were recorded as asymptomatic recovery percentages, which were as follows:

(a) sacroiliac syndrome (72 % asymptomatic) ;

(b) posterior joint syndrome (64% asymptomatic);

(c) combined sacroiliac and posterior joint syndromes (67 % asymptomatic)

(d) posterior joint and sacroiliac syndromes and lumbar instability (26% asymptomatic)

It was concluded that spinal manipulation had great clinical importance in carefully diagnosed patients. (Cassidy and Kirkaldy-Willis 1988:294)

Cassidy et al. (1992:291), suggest that an indication for manipulative therapy involves an accurate diagnosis of mechanical low back pain, which includes the following: (a) posterior joint dysfunction ;

(b) sacroiliac dysfunction ;

(c) paraspinal muscle dysfunction ;

(d) disc herniation ;

(e) joint dysfunction in lateral and central canal stenosis;

(f) joint dysfunction in spondylolithesis;

(g) sacroiliac syndrome in post-operative low back pain.

2.11. EFFECTS OF SPINAL MANIPULATIVE THERAPY

Hertzog (1995) stated that spinal manipulative therapy consists of a thrusting, impulse-like force of specified intensity, direction and time applied to a target vertebrae on the spine. These forces exert reflex responses in the mechanoreceptors located in the capsule and articular facet joints and muscle spindle propriocepters, which lead to reflex inhibition of spastic muscles in the treatment area.

According to Hertzog et al. (1993), other benefits of spinal manipulative therapy such as the release of anti inflammatory agents and the increase in joint motion, are directly associated with the magnitude of the treatment force.

Panzer (1995:424) suggests that spinal manipulation directed to a facet articulation is the treatment of choice in facet syndrome. The following effects occur in the facet joint due to manipulation: (1) release entrapped meniscoids;

(2) reduce articular cartilage displacement ;

(3) pain relief by co-activation of various receptors ;

(4) reduce weight bearing ;

(5) reduce intracapsular and extracapsular adhesions ;

(6) relief of abnormal tension on the joint capsule ;

(7) release of osseous mechanical locking.

It was noted by Erhard et al. (1996) that manipulative reduction is utilized not to increase movement, but to restore normal joint alignment. During the antenatal period, hormonally induced hypermobility occurring within the sacroiliac joints causes joint subluxation. Subluxation of the sacroiliac joint compromises the normal locking mechanism of the joint and pain is a result of unusual tension and stresses imposed on the sacroiliac ligaments. After childbirth, the ligaments normally retighten and the locking mechanism of the sacroiliac joints becomes more effective, but in some cases the locking mechanism occurs in the position of rotation of the hip bones that occurs during pregnancy, with the possibility of recurrent sacroiliac joint subluxations.

The manipulative reduction of the sacroiliac joint subluxation results in the locking mechanism of the joint becoming more effective, thus relieving the strain on the ligaments around the joint.(Erhard et al. 1996)

The hormonally mediated joint laxity is not limited to the sacroiliac joints. There is also an increase in general joint laxity throughout the musculoskeletal system, and it may take up to six months postnatally for joint laxity to regress to its prepregnancy state.(Polden and Mantle 1990:38)

During pregnancy the weight gained during the antenatal period shifts the centre of gravity in an anterior direction, with the development of a compensatory increase in the normal lumbar lordosis resulting in hyperextension of the lumbar spine. (Bullock et al. 1987) Lumbar facet joints normally carry approximately one sixth of the total axial load of the vertebral motion segment, with hyperextension increasing zygapophyseal joint weight bearing which causes overriding of the facet joints of adjacent vertebra. Pain is produced by increased irritation and stretching of the joint capsule of the facet joints. (Panzer 1995:414-425)

Clinically, facet syndrome presents with the following symptoms and signs:

(a) hip and buttock pain;

(b) local paralumbar tenderness ;

(c) pain on hyperextension ;

(d) absence of neurological deficit ;

(e) low back stiffness.

(Panzer 1995:421)

2.12. CONTRA INDICATIONS FOR SPINAL MANIPULATION

It is of great importance to identify a condition in which spinal manipulation is contra-indicated. Triano et al. (1992) included the following as being absolute contra

indications for spinal manipulation : vertebral malignancy, osteomyelitis, tuberculosis of the spine, acute vertebral fracture, infectious arthritis, extreme osteoporosis, disc prolapse, metabolic bone disease, haemangioma, vertebral insufficiency and spondylisthesis.

Dvorak et al. (1992) used broader categories in which contra indications for spinal manipulative therapy was classified. These are the following:

a) **Inflammation and infection** e.g. rheumatoid arthritis and ankylosing spondylitis.

b) **Degeneration** e.g. degenerative joint disease.

c) **Discopathies** e.g. disc degeneration.

d) **Neoplasm** e.g. primary and secondary tumors of the spine.

e) **Metabolic disturbances** e.g. pathological fractures.

f) **Congenital malformations** e.g. instability of spinal segment.

g) **Trauma** e.g. macro trauma to spine.

2.13. ROLE OF EXERCISE THERAPY IN THE POSTNATAL PATIENT

Every muscle possesses the capacity to contract and to be elongated. Exercise therapy is utilized to strengthen weak muscles and to lengthen short muscles for the purpose of restoring normal elasticity within the muscle fibres. Additional use of exercises is to increase endurance and co-ordination within the muscle and muscle groups.(Kendall et al. 1993:337)

Any exercise program performed on a regular basis is sufficient to induce adaptive responses by increasing the metabolic capacity of the motor units of the involved muscle. This induces synthesis of more myofibrils and hypertrophy of active muscle cells, thereby also inducing growth of tendons, muscle and bones. The exact cellular adaptive responses to exercise are difficult to determine, but the effects of exercise on muscle are quantative. (Berne and Levy 1983:307)

There is a paucity of controlled studies concerning the indications for exercise therapy in treating low back dysfunction.(Jackson and Brown 1983; Deyo 1994:16)

Deyo (1994:154), states that probably 98 % of patients with back pain have some form of mechanical pain, for which exercise therapy may be the appropriate preventative and therapeutic intervention.

The importance of any exercise therapy program is to strengthen and tone the body's musculature, and in the case of postnatal patients who were previously susceptible to strained and stretched muscles and ligaments in the antenatal period due to the increasing weight of the growing foetus, focus is directed to the abdominal and pelvic musculature.(McQuarrie 1988:348 ;Deyo 1994:155)

The postnatal patient must be warned that too vigorous exercise or daily activities are contra indicated in the postnatal period. If the postnatal patient experiences any pain that becomes progressively worse during the exercise program or daily activities, the task is immediately ceased. It is important to advise the postnatal patient on the exercises which they must perform, and even make the patients verbalize the exercise so that they have a clear understanding of what to do. (Polden and Mantle 1990 : 235)

Long-term compliance and understanding are often problems experienced with any exercise program, which according to Deyo (1994:168), can be overcome by supplying written instructions, supervision and close follow-up appointments.

Included in exercise therapy programs are breathing techniques for relaxation of the patient and to improve circulation, muscle toning exercises and muscle stretching exercises. The Cox exercise program is an exercise therapy program for low back pain treatment and management, which consists of twelve basic strengthening and toning exercises.(Cox 1987: 500-501) Although the major focus is on the abdominal and pelvic musculature, the Cox exercises for low back pain also target the hamstrings, erector spinae, hip adductors and gluteal muscles in order to restore normal functioning of the muscular support of the lumbar spine.(Cox 1987:500)

The role of exercise therapy in the treatment of low back pain is not only to regain strength of the supporting musculature, but has also been indicated for the improvement of posture, improvement of mobility, the decrease of pain, to stabilize a hypermobile segment and to decrease mechanical stress to the spinal structure.(Jackson and Brown 1983)

Every postnatal patient should have their perineum inspected in order to ascertain whether she is able to contract the muscles of the pelvic floor. Particular attention must be given in the event of a forceps delivery, episiotomy and 2^{nd} / 3^{rd} degree tears.(Polden and Mantle 1990:236)

According to Panzer (1995:426), pelvic floor exercises are prescribed to decrease lumbar lordosis in a therapeutic approach in the management of lumbar facet syndrome. Other exercises, which include abdominal strengthening and knee-chest exercises, are recommended in the management of lumbar facet syndrome

The primary aims of the abdominal musculature are to shorten stretched muscle fibres, close any diastasis and strengthen the weakened muscles. (Polden and Mantle 1990: 236)

2.14. SUMMARY

It is important to note that studies such as those done by Cassidy and Kirkaldy-Willis (1988) and Meade et al. (1995) demonstrated the fact that spinal manipulative therapy is of great value in the treatment and management of mechanical low back pain.

The presence of neuromusculo-skeletal conditions in the pregnancy and postnatal periods can be accounted for by the increased levels of hormone relaxin coupled with the increased weight gained and postural changes during pregnancy.(Calguneri et al. 1982 ; Bullock et al. 1987 ; Bullock 1987)

The above factors, combined with other additional causative factors for low back pain previously stated, make the postnatal patient more susceptible to low back pain if necessary preventative measures have not been taken. (Mantle 1994:806)

A review on exercise therapy programs has indicated that exercises are one of the most beneficial contributions to the management of mechanical low back pain.(McQuarrie 1988:348)

According to Rippe et al. (1987), exercise exerts a positive impact on many aspects of health. Some of the benefits include improvement of the cardiovascular system, metabolic benefits, enhanced mental processes and aid in weight loss.

In conclusion, low back pain experienced by the postnatal patient may interfere with daily activities in the nurturing and caring of the newborn infant. There is a need for conservative treatment of mechanical low back pain in postnatal patients, in order to give immediate maximum relief which would enable the new mother to function at her full potential.

CHAPTER 3

3.0. MATERIALS AND METHODS

3.1. INTRODUCTION

This chapter deals with the collection of data and the research methodology used. The treatment interventions and the process of statistical analyses are also discussed.

3.2. MEASUREMENT AND OBSERVATION

3.2.1. Subjective Measurement

1. Oswestry Back Pain Disability Index (Appendix G)

The Oswestry Back Pain Disability Index (Fairbank et al .1980) is designed to give the researcher an indication of how low back pain affects the patient's ability to function in everyday living. There are ten sections of six questions each, with the maximum score for each section being five and the minimum score being zero. The questionnaire has a maximum score of fifty, which is decreased by a score of five for each section not completed.

The final score is converted into a percentage and is recorded for each individual subject. Haas and Nyiendo (1992) stated that the Oswestry Back Pain Disability Index is frequently used due its ease of administration and scoring in quantifying functional impairment in patients with low back pain.

2. Numerical Pain Rating Scale 101 (Appendix F)

The Numerical Pain Rating Scale 101 (Jensen et al. 1986) supplies the researcher with an indication of the average pain intensity experienced by the subject participating in the particular study prior to treatment. The patient is required to indicate by means of a percentage the intensity of the pain experienced before a treatment when a) the pain is at its least , and b) when the pain is at its worst. The average pain intensity was calculated by adding the percentages representing the worst and least pain and then dividing this total by two. The average pain intensity values were then used for statistical analyses.

Jensen et al . (1986) conducted a study where six methods of judging pain intensity were compared according to five criteria:

(a) ease of administration of scoring; (b) relative rates of incorrect responding; (c) sensitivity as defined by the number of available response categories; (d) sensitivity as defined by statistical power; and (e) the magnitude of the relationship between each scale and a linear combination of pain intensity indices.

The results of this comparative study indicated that the Numerical Pain Rating Scale 101 (NRS 101) had the following practical advantages over the other methods : (1) it was simple and practical to administer and score; (2) it could be administered either verbally or in written form; and (3) the scale did not seem to be associated with age.

Jenson et al. (1986) state that " ...the 101- point Numerical Pain Rating Scale appears to be the most practical index."

3.2.2. Objective Measurement

The objective data collected for this study consisted of an investigation of the range of motion in the Lumbar spine of each patient. This was measured by a Brom II (back range of motion) goniometer, supplied by Performance Attainment Associates (36600 La Bore Road, Suite 6, St. Paul, MN 55110-4144). Measurement values were read and recorded in flexion, extension, right lateral flexion, left lateral flexion, right rotation and left rotation.(Appendix H) Measurements were recorded as degrees prior to the first, eighth and one month follow-up consultations. The readings produced by the BROM II goniometer allowed for statistical analyses of the objective data.

(A) Flexion / Extension measurements - The subject stood erect with her feet shoulder width apart. Two landmarks , T12 and S1, were then located and marked. The BROM II apparatus was then secured on the sacrum with the pivot point on S1, with the Velcro straps secured around the lower abdominal area. The movable arm tip was then placed on T12 and an initial reading from the outer scale was recorded. The subject was instructed to bend forward as far as possible whilst the BROM II unit was held firm so as to prevent any movement. The arm tip was then replaced on T12 and a full flexion recording was recorded. To obtain a true flexion reading , the initial flexion reading was subtracted from the full flexion reading .

The subject was then asked to stand erect with her arms across her chest and hands on opposite shoulders. The movable tip was place on T12 to obtain an initial recording on the outer scale. The subject was then asked to extend backwards, and the tip of the movable arm was placed on T12 and a full extension reading was obtained. The initial and the full extension readings were subtracted to obtain a true extension reading.

(B) Left and Right Lateral Flexion - The subject was asked to stand erect, and the rotation/lateral flexion unit was placed in line with T12, and adjusted until the meter reading was set at zero. The subject was then placed as per extension movement, and instructed to lean slowly to the right initially, and a reading was recorded. This procedure was repeated for the left side and a reading was recorded .

(C) Rotation measurements - The subject was asked to stand erect, feet slightly apart. The rotation/ flexion unit was aligned with the T12 segment, until the meter reading was set at zero. The subject was instructed to rotate her shoulder to the right and a reading was recorded. This setup procedure was repeated on the left and a reading was recorded.

In a study done by Breum et al. (1995) on forty seven asymptomatic patients, the BROM II was found reliable in the measurement of lumbar mobility in flexion and lateral flexion, and to a lesser degree in rotation and extension. The reliability of the instrument was questioned since the study was conducted on asymptomatic patients only. They recommended that further research on symptomatic patients be done since the reliability of the instrument may alter with patients having difficulty performing lumbar spine motion.

In conclusion Breum et al . (1995) mentioned that it is vital to determine the reliability of the BROM II on symptomatic patients before being utilized as an assessment tool in clinical trials. In this study the BROM II supplied by the Chiropractic Day Clinic, was utilized as the most reliable instrument in measuring lumbar spine motion in order to obtain the objective data needed for statistical analyses.

3.3. STUDY PROTOCOL

3.3.1. Aim of the study

The aim of the study was to determine the efficacy of each treatment method in terms of the subjective and objective clinical measurements. The study attempted to determine the more effective treatment method which could be used in the future by the Chiropractic profession in the treatment of mechanical low back pain in postnatal patients.

3.3.2. Allocation of the subjects

Patients were recruited by placing advertisements in local hospital maternity units, private postnatal clinics and local community clinics indicating that free treatment would be given to patients suffering from mechanical low back pain after giving birth, up to a period of 12 months postnatally. Further recruitment of patients involved discussions and meetings with gynaecologists, midwives and medical practitioners, in order to obtain patient referrals of those patients suffering from postnatal mechanical

low back pain. Upon enquiry, the study program was explained to the patient and an initial consultation was arranged.

Thirty four subjects were randomly divided into two equal groups, each consisting of 17 subjects. (Only 30 subjects were required, but thirty four numbers were drawn to allow for drop outs.) Treatment group one received Spinal Manipulative therapy and group two received Exercise therapy. The randomization process was done as follows: 17 pieces of paper with the letters 's' (representing the Spinal Manipulative therapy group) and 17 pieces of paper with the letters 'e'(representing the Exercise therapy group) were made available. All pieces were placed in a box, which was then shaken to mix the pieces. Each piece of paper was drawn out of the box in the sequence counting from one to thirty four. The letter on the piece of paper was recorded next to the number counted as the paper was drawn. (Appendix I)

3.3.3. Inclusion and exclusion criteria

All subjects accepted to participate in the study had to meet the following criteria:

a) each subject underwent a full case history (Appendix C) ;

b) each subject underwent a full physical examination (Appendix D) ;

c) each subject underwent an Orthopaedic Low Back regional examination (Appendix E);

d) to be included in the study no subjects were to exhibit any of the following :

(1) vertebral malignancy;

(2) osteomyelitis;

(3) tuberculosis of the spine;

(4) acute vertebral fracture;

(5) infectious arthritis;

(6) extreme osteoporosis;

(7) disc prolapse;

(8) spondylisthesis;

(9) second and third degree vaginal tearing;

(10) episiotomy;

(11) severe diastasis recti;

(12) severe perineal pain;

(13) forceps delivery;

(14) ventouse extraction.

g) all subjects gave informed consent before they were treated (Appendix B);

h) subjects presenting with postnatal low back pain of no more than and including twelve months duration were included;

i) subjects were not accepted if they were on medication for their pain, or if they were undergoing any other treatment for their pain;

j) when required, subjects had to undergo X-ray examination to exclude any pathologies of the lumbar spine;

k) subjects diagnosed as having mechanical low back pain according to the Kirkaldy-Willis classification, which included posterior facet syndrome, sacroiliac syndrome, maigne's syndrome, myofascial syndrome, disc herniation, lateral and central stenosis and multilevel stenosis were included in the study. (Appendix A)

3.3.4. Treatment

All subjects in treatment group 1 and treatment group 2 were treated until clinically asymptomatic, with a maximum of eight treatments, two treatments per week over a four week period. This treatment protocol in the Exercise therapy group was chosen as any regular exercise program over a period of time induces adaptive responses to the target muscles. (Berne and levy 1983:307)

For the spinal manipulative therapy group it was indicated that the most favourable response to manipulation normally occurs between seven and ten days.(Gatterman 1990:163) The protocol of two treatments per week over a four week period provides sufficient treatment time for the effects of manipulation to occur, namely to increase joint mobility and restore normal joint alignment. (Erhard et al. 1996)

Prior to treatment the symptomatic joints were located and identified by motion palpation of the lumbar spine and sacroiliac joints.(Schafer and Faye 1990:211-217)

During the orthopaedic examination specific tests were performed to diagnose mechanical low back pain which included: Kemp's test and facet challenge (Schafer and Faye 1990:217 ; Magee 1992:274) for posterior facet syndrome, and Gaenslen's test (Magee 1992:319), Patrick's faber test (Magee 1992:343) and Erichsen's test (Schafer and Faye 1990: 270) for sacroiliac syndrome.

According to Cassidy and Mierau (1992:219-220) it is important to differentiate hip joint pathology, as these tests place equal strain on the hip joints. In most cases two of the three tests mentioned above were positive in sacroiliac syndrome, differentiating it from any hip dysfunction.

The subjects in the first treatment group received chiropractic adjustments to the area of dysfunction previously diagnosed according to the Kirkaldy-Willis model (Kirkaldy-Willis 1988:134) at the initial consultation. The Diversified adjusting technique (Szaraz 190:137-160) was used , which included the following adjustments to the lumbar spine and pelvis:

a) lumbar roll;

b) upper and lower sacro-iliac;

c) sitting lumbar;

d) side posture -lateral spinous;

e) spinous push;

f) spinous pull;

g) prone sacro-iliac;

Each subject in treatment group one received soft tissue massage prior to manipulation of the affected spinal segment as an adjunctive physiological procedure in aid of increasing the blood flow to the area, breaking up adhesions and fibrosis, and maintenance of muscle flexibility and viability. (Mc Dowell 1990:330-331, 371.) The lumbar roll, sitting lumbar and spinous hook/push techniques were used for manipulation of the lumbar spine. The choice of manipulation for the lumbar spine was based on the success of the manipulation on the individual subject. For a manipulation to be considered effective for this study, an audible cavitation had to accompany the spinal manipulative treatments. If no cavitation sound accompanied a specific manipulative technique, a different manipulative technique was repeated on the affected spinal segment. (Hertzog et al. 1993 ; Gal et al. 1995)

The choice of manipulation administered to the sacroiliac joints , was based on motion palpation findings of restricted motion. The standard side posture upper or lower joint manipulative techniques are indicated for sacroiliac fixations. (Schafer and Faye 1990:282) No other adjunctive therapy, such as exercise therapy and home stretches, was allowed to be performed by the subjects participating in treatment group one.

Treatment group 2 only received exercise therapy for their postnatal low back pain, which was based on the Cox exercises (Cox 1987:500-501) for low back pain (Appendix J). Each subject in this treatment group was given 12 exercises which were designed to stretch and strengthen the low back musculature and pelvic musculature. During their initial consultation a sheet containing the twelve exercise was given to each subject. The subject was instructed to read the exercises before further commencement of the consultation. Once the exercises were understood by the patient, each individual exercise was demonstrated to the subject, with the subject performing it immediately afterwards in order to prevent any complications with exercise performance.

All exercises were performed at the Chiropractic Day Clinic, twice per week for a period of four weeks. All exercises performed during consultations were observed by the researcher in order to correct and prevent variation to the exercise treatment protocol. Subjects were advised to perform exercises at home on a daily basis. In order to achieve compliancy with performing the home exercises, each subject was

supplied with an exercise sheet and the benefits each of exercise were explained. (Deyo 1994:168)

3.3.5. Specific treatment of each objective

Statistical analyses were conducted on the objective and subjective data collected on the initial , eighth and one month follow-up consultation. The data were analyzed using the computer software program Statagraphics Plus version 6, manufactured by Manugistics. The results obtained from the data were then used to address each of the objectives.

The sample size per group was small (15<30), therefore non-parametric tests (i.e. Wilcoxon's Signed Rank test and Mann-Whitney U-test) were utilized for statistical analysis. Parametric tests such as the two-sample unpaired t-test were not used as the sample size was too small. (Gulezian 1979:335)

The Wilcoxon's Signed Rank test (intra-group analysis) was used to determine whether any significant differences occurred between the initial(IC) and final consultations(FC), the initial(IC) and follow-up consultations(FU) and between the final(FC) and one month follow-up consultations(FU) within the two treatment groups. All tests were done at the α =0.05 level of significance.

The null hypothesis (Ho) in each respective hypothesis testing, stated that there would be no significant improvement between the initial consultation and final consultation, initial consultation and follow-up consultation, and the final consultation and the follow-up consultation.

The alternative hypothesis (Ha) stated the contrary to what the null hypothesis stated (i.e. there would be a significant improvement).

The Mann-Whitney U-test (inter-group analysis) was used to determine whether there was any significant difference between the two groups at the initial consultation, final consultation and one month follow-up consultation. Each hypothesis test conducted was treated similarly to that mentioned for the Wilcoxon's Signed Rank test .

The decision rule stated that to reject the null hypothesis(Ho) , $p \leq \alpha / 2 = 0.025$ and to accept the null hypothesis (Ho) , $p > \alpha / 2 = 0.025$, where 'p' equals the observed significance level of the test.

The first objective was to evaluate the effectiveness of Spinal manipulative therapy in terms of objective and subjective clinical findings in the treatment of Postnatal mechanical low back pain.

The second objective was to evaluate the effectiveness of Exercise therapy in terms of objective and subjective clinical findings in the treatment of Postnatal mechanical low back pain.

The third objective was to interpret the data obtained during this study, in terms of the objective and subjective data collected, in order to determine which of the treatment methods was more effective in the treatment of Postnatal mechanical low back pain. The Mann-Whitney U-test was chosen because of its application to an inter-group statistical analysis of a small sample size. (Daniel 1978:82-86)

CHAPTER FOUR

4.1. INTRODUCTION

This chapter covers the results obtained from the statistical analyses of the data collected from the :

(a) the Oswestry Low Back Pain Disability Questionnaire ;

(b) the Numerical Pain Rating Scale-101 ; and

(c) the lumbar spine ranges of motion.

KEY FOR ABBREVIATIONS

SMT :Spinal Manipulative therapy.

ET : Exercise therapy.

IC: Initial consultation.

FC: Final consultation.

FU: Follow-up consultation.

p value: Two tailed probability of equaling or exceeding.

4.2. TREATMENT OF THE DATA

4.2.1.1. Treatment of the Objective data

To solve the objective component, the data were treated as follows:

i) the readings obtained with the Brom II goniometer were recorded separately for treatment group 1, and treatment group 2;

ii) the data then underwent statistical analysis.

4.2.1.2. Treatment of subjective data

To solve the subjective component, the data were treated as follows:

i) the questionnaires were screened after completion by the subject, to ensure they were correctly completed;

ii) the units obtained from the two questionnaires were converted to percentages and these percentages were recorded separately for the two treatment groups;

iii) the data then underwent statistical analysis.

4.2.2. Statistical Analysis of the Data

The statistical analysis was conducted at 95% confidence level based on the advice given by the Technikon Natal statistician for the following reasons :

i) the study consisted of a small sample size (30 subjects) ;

ii) the statistical testing was of a non-parametric nature.

4.2.2.1. Non-Parametric Paired Hypothesis Testing

The Objective data:

The subjects' lumbar spine ranges of motion, measured with the Brom II goniometer, were analyzed by means of the Wilcoxon Signed Rank Test, for each of the two treatment groups. The units (in degrees) compared were taken from :

(i) the initial consultation (IC) and the final consultation (FC) ;

(ii) the initial consultation (IC) and the one month follow-up consultation (FU);

(iii) the final consultation (FC) and the one month follow-up consultation (FU) .

i.e.	Treatment group 1	Treatment group 2
	IC : FC	IC : FC
	IC : FU	IC : FU
	FC : FU	FC : FU

These values were compared to the level of significance set at 0.05 for all tests.

The Subjective data :

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

(i) the initial consultation (IC) and the final consultation (FC) ;

(ii) the initial consultation (IC) and the one month follow-up consultation (FU) ;

(iii) the final consultation (FC) and the one month follow-up consultation (FU) .

i.e.	Treatment group 1	Treatment group 2
	IC : FC	IC : FC
	IC : FU	IC : FU
	FC : FU	FC : FU

The figures were compared to determine the level of significance . The Wilcoxon Signed Rank Test was chosen because of its less restrictive assumptions and near equivalence in the sensitivity to the parametric t-test.(Daniel 1978:31-36)

4.2.2.2. **Non-Parametric Unpaired Hypothesis Testing**

The Objective data :

The subjects' lumbar spine ranges of motion, measured with the Brom II goniometer, were analyzed using the Mann-Whitney U-Test, comparing the mean units of treatment group 1 and treatment group 2. The mean units (in degrees) compared were taken from:

(i) the initial consultations (IC) of treatment group 1 and treatment group 2 ;

(ii) the final consultations (FC) of treatment group 1 and treatment group 2;

(iii) the one month follow-up consultations (FU) of treatment group 1 and treatment group 2 .

i.e.	Treatment group 1	Treatment group 2
	IC : IC	IC : IC
	FC : FC	FC : FC
	FU : FU	FU : FU

These figures were compared to determine the level of significance.

The Subjective data :

The measurements, taken separately for each questionnaire, were analyzed by means of the Mann-Whitney U-Test, comparing the mean units of the two treatment groups. The mean units (in percentages) compared were taken from:

(i) the initial consultations (IC) of treatment group 1 and treatment group 2 ;

(ii) the final consultations (FC) of treatment group 1 and treatment group 2 ;

(iii) the one month follow-up consultations (FU) of treatment group 1 and treatment group 2.

i.e.	Treatment group 1	Treatment group 2
	IC : IC	IC : IC
	FC : FC	FC : FC
	FU : FU	FU : FU

4.3. RESULTS

4.3.1. DISABILITY - OSWESTRY BACK DISABILITY INDEX

The following results were recorded :

Table 4.1. The mean values and results of the Wilcoxon's Signed Rank test for the Oswestry Back Disability Index of the two groups between the first consultation (IC) and final consultation (FC).

	IC	FC	p value
SMT	15.73	9.6	0.00982331
ET	17.07	14	0.0433079

The null hypothesis was rejected for the Spinal Manipulative therapy group which indicated that at the 5% level of significance a statistically significant change took place during the treatment period.

The null hypothesis was accepted for the Exercise therapy group which indicated that at a 5% level of significance no statistically significant difference took place during the treatment period.

Table 4.2. The mean values and results of the Wilcoxon's Signed Rank test for the Oswestry Back Disability Index of the two groups between the first consultation (IC) and follow-up consultation (FU).

	IC	FU	p value
SMT	15.73	6	0.000512096
ET	17.07	11.47	0.0388669

The null hypothesis was rejected for the Spinal Manipulative therapy group which indicated that at the 5% level of significance a statistically significant change took place during the first consultation and the one month follow-up consultation.

The null hypothesis was accepted for the Exercise therapy group which indicated that at the 5% level of significance no statistically significant difference took place during the first consultation and the one month follow-up consultation.

Table 4.3. The mean values and results of the Wicoxon's Signed Rank test for the Oswestry Back Disability Index between the final consultation(FC) and the follow-up consultation (FU).

	FC	FU	p value
SMT	9.6	6	0.0704401
ET	14	11,47	0.546491

The null hypothesis was accepted in both treatment groups which indicated that at the 5% level of significance no statistically significant difference took place during the final consultation and the one month follow-up consultation.

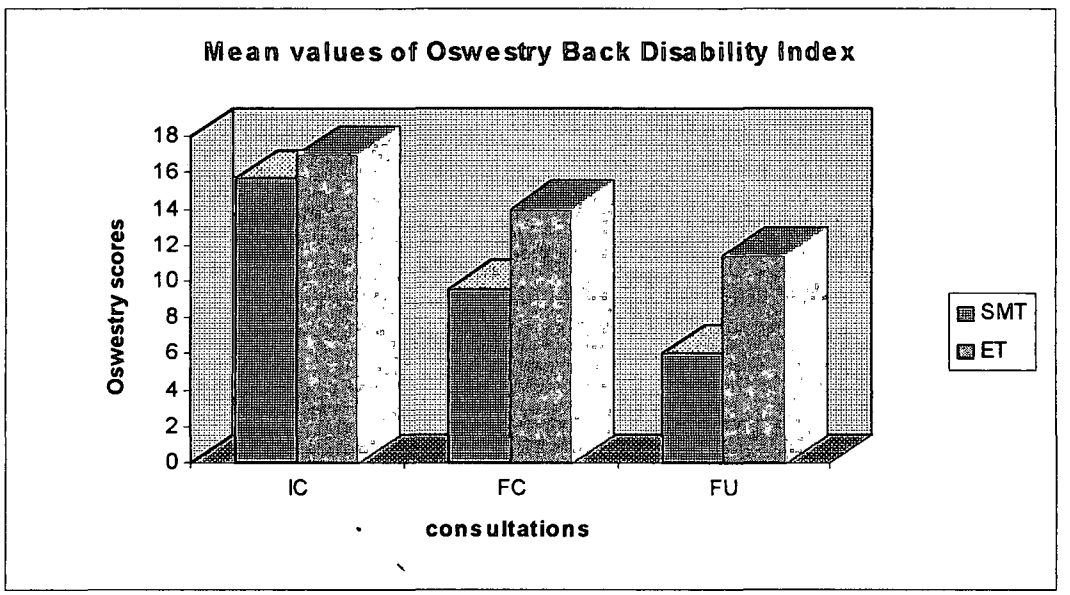
Table 4.4. The results of the Mann-Whitney U-test for the Oswestry Back Disability Index comparing the two treatment groups at the first consultation (IC) , final consultation (FC) and follow-up consultation(FU).

	IC	FC	FU
p value	0.359186	0.133597	0.0145061

The null hypothesis was accepted at the first and final consultation which indicated that at the 5% level of significance no statistically significant difference occurred between the two groups during treatment.

The null hypothesis was rejected at the follow-up consultation which indicated that at the 5% level of significance a statistically significant change took place between the final consultation and the one month follow-up consultation.

Figure 4.1. The mean values of the Oswestry Back Disability Index at the first consultation (IC), final consultation (FC) and one month follow-up consultation (FU).



4.3.2. PAIN INTENSITY - NUMERICAL PAIN RATING SCALE 101

The following results were obtained from the Numerical Pain Rating Scale 101(NRS 101):

Table 4.5. The mean values and results of the Wilcoxon's Signed Rank test for the Numerical Pain Rating Scale 101 of the two groups between the first consultation (IC) and the final consultation (FC).

	IC	FC	p value
SMT	48.67	33.33	0.000874
ET	52.8	43	0.0433079

The null hypothesis was rejected for the Spinal Manipulative therapy group which indicated that at the 5% level of significance a statistically significant change occurred during the treatment period.

The null hypothesis was accepted for the Exercise therapy group which indicated that at the 5% level of significance no statistically significant change occurred during the treatment period.

Table 4.6. The mean values and results of the Wicoxon's Signed Rank test for the Numerical Pain Rating Scale 101 of the 2 groups between the first consultation (IC) and the follow-up consultation(FU).

	IC	FU	p value
SMT	48.67	22.67	0.0019459
ET	52.8	39.67	0.0388669

The null hypothesis was rejected for the Spinal Manipulative therapy group which indicated that at the 5% level of significance a statistically significant change occurred during the first consultation and the one month follow-up consultation.

The null hypothesis was accepted for the Exercise therapy group which indicated that at the 5% level of significance no statistically significant change occurred during the first consultation and the one month follow-up consultation.

Table 4.7. The mean values and results of the Wicoxon's Signed Rank test for the Numerical Pain Rating Scale 101 of the two groups between the final consultation (FC) and the follow-up consultation (FU).

	FC	FU	p value
SMT	33.33	22.67	0.0265001
ET	43.	39.67	0.121335

The null hypothesis was accepted in both treatment groups which indicated that at the 5% level of significance no statistically significant change occurred during the final consultation and the one month follow-up consultation.

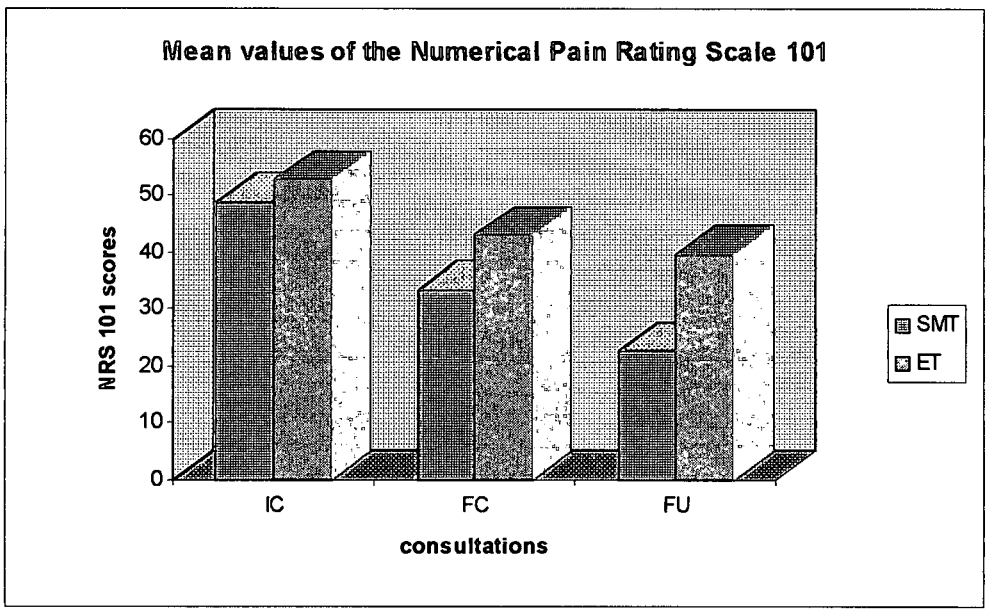
Table 4.8. The results of the Mann-Whitney U-test for the Numerical Pain Rating Scale 101 comparing the two treatment groups at the first consultation(IC), final consultation (FC) and the follow-up consultation (FU).

	IC	FC	FU
p value	0.440732	0.139432	0.00923814

The null hypothesis was accepted at the first and final consultation which indicated that at the 5% level of significance no statistically significant difference occurred between the two groups during the treatment period.

The null hypothesis was rejected at the follow-up consultation which indicated that at the 5% level of significance a statistically significant difference occurred between the final consultation and one month follow-up consultation.

Figure 4.2. The mean values of the Numerical Pain Rating Scale 101 at the first consultation (IC) , final consultation (FC) and one month follow-up consultation(FC).



4.3.3. LUMBAR SPINE RANGES OF MOTION

4.3.3.1 FORWARD FLEXION

Table 4.9. The mean values and results of the Wilcoxon's Signed Rank test for flexion of the two groups between the first consultation (IC) and final consultation (FC).

	IC	FC	p value
SMT	23	32.87	0.000512096
ET	22.27	28.4	0.00328359

The null hypothesis was rejected in both groups which indicated that at the 5% level of significance a statistically significant difference occurred during the treatment period.

Table 4.10 The mean values and results of the Wilcoxon's Signed Rank test for flexion of the two groups between the first consultation (IC) and the follow-up consultation (FU).

	IC	FU	p value
SMT	23	37.73	0.000300669
ET	22.27	28	0.0613685

The null hypothesis was rejected for the Spinal Manipulative therapy group which indicated that at the 5% level of significance a statistically significant difference occurred between the first consultation and the one month follow-up consultation.

The null hypothesis was accepted for the Exercise therapy group which indicated that at the 5% level of significance no statistically significant difference occurred between the first consultation and the one month follow-up consultation.

Table 4.11. The mean values and results of the Wilcoxon's Signed Rank test for flexion of the two groups between the final consultation (FC) and the follow-up consultation (FU).

	FC	FU	p value
SMT	32.87	37.73	0.0388669
ET	28.4	28	0.772826

The null hypothesis was accepted in both treatment groups which indicated that at the 5% level of significance no statistically significant difference occurred during the final consultation and the one month follow-up consultation.

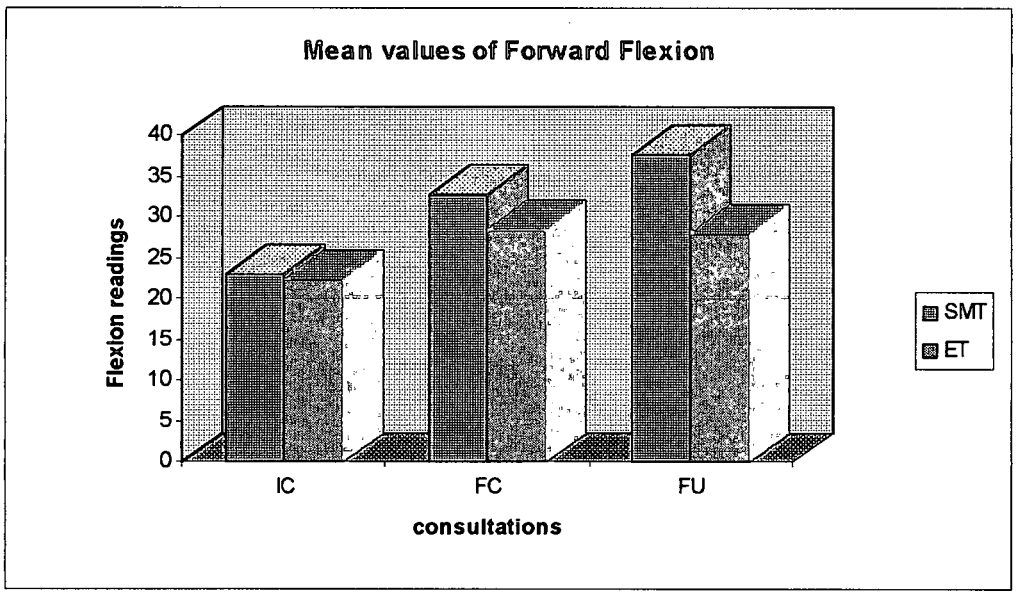
Table 4.12. The results of the Mann-Whitney U-test for flexion comparing the two groups at the first consultation (IC), final consultation (FC) and the follow-up consultation (FU).

	IC	FC	FU
p value	0.586554	0.204325	0.00456824

The null hypothesis was accepted at the first consultation and final consultation which indicated that at the 5% level of significance no statistically significant difference occurred between the two groups during the treatment period.

The null hypothesis was rejected for the follow-up consultation which indicated that at the 5% level of significance a statistically significant difference occurred between the final treatment and the one month follow-up consultation of the two treatment groups.

Figure 4.3. The mean values of Forward Flexion at the first consultation (IC), final consultation (FC) and the one month follow-up consultation(FU).



4.3.3.2. EXTENSION

Table 4.13. The mean values and results of the Wilcoxon's Signed Rank test for extension of the two groups between the first consultation (IC) and final consultation (FC).

	IC	FC	p value
SMT	7.8	9.33	0.301698
ET	7.73	9.4	0.227799

The null hypothesis was accepted in both treatment groups which indicated that at the 5% level of significance no statistically significant difference occurred during the treatment period.

Table 4.14. The mean values and results of the Wilcoxon's Signed Rank test for extension of the two groups between the first consultation(FC) and the follow-up consultation (FU).

	IC	FU	p value
SMT	7.8	12.8	0.000512096
ET	7.73	9.93	0.301698

The null hypothesis was rejected for the Spinal Manipulative therapy group which indicated that at the 5% level of significance a statistically difference occurred during the first consultation and the one month follow-up consultation

The null hypothesis was accepted for the Exercise therapy group which indicated that at the 5% level of significance no statistical significant difference occurred during the first consultation and the one month follow-up consultation.

Table 4.15. The mean values and results of the Wilcoxon's Signed Rank test for extension of the two groups between the final consultation(FC) and the follow-up consultation (FU).

	FC	FU	p value
SMT	9.33	12.8	0.000874198
ET	9.4	9.93	0.751826

The null hypothesis was rejected for the Spinal Manipulative therapy group which indicated that at the 5% level of significance a statistically significant difference occurred between the final consultation and the one month follow-up consultation.
The null hypothesis was accepted for the Exercise therapy group which indicated that at the 5% level of significance no statistically significant difference occurred between the final consultation and the one month follow-up consultation.

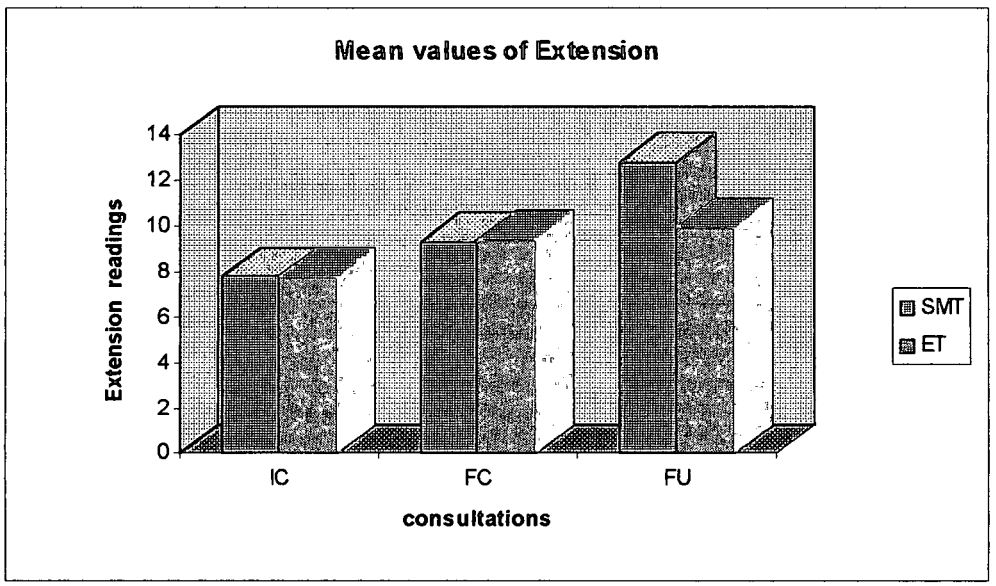
Table 4.16. The results of the Mann-Whitney U-test for extension comparing the two treatment groups at the first consultation (IC) , final consultation (FC) and the follow-up consultation (FU).

	IC	FC	FU
p value	0.46193	0.983293	0.0122292

The null hypothesis was accepted at the first consultation and final consultation which indicated that at the 5% level of significance no statistically significant difference occurred between the two groups during the treatment period.

The null hypothesis was rejected at the follow-up consultation which indicated that at the 5% level of significance a statistically significant difference occurred between the final consultation and the one month follow-up consultation of the two groups.

Figure 4.4. The mean values of Extension at the first consultation(IC) , final consultation(FC) and the one month follow-up consultation(FU).



4.3.3.3. LEFT ROTATION

Table 4.17. The mean values and results of the Wilcoxon's Signed Rank test for left rotation of the two groups between the first consultation (IC) and the final consultation (FC).

	IC	FC	p value
SMT	5.2	7.5	0.00149629
ET	5.3	5.9	0.133614

The null hypothesis was rejected for the Spinal Manipulative therapy group which indicated that at the 5% level of significance a statistically significant difference occurred during the treatment period.

The null hypothesis was accepted for the Exercise therapy group which indicated that at the 5% level of significance no statistically significant difference occurred during the treatment period

Table 4.18. The mean values and results of the Wilcoxon's Signed Rank test for left rotation of the two groups between the first consultation (IC) and the follow-up consultation (FU).

	IC	FU	p value
SMT	5.2	8.9	0.00328359
ET	5.3	6.5	0.0455

The null hypothesis was rejected for the Spinal Manipulative therapy group which indicated that at the 5% level of significance a statistically significant difference occurred during the first consultation and the one month follow-up consultation.

The null hypothesis was accepted for the Exercise therapy group which indicated that at the 5% level of significance no statistically significant difference occurred during the first consultation and the one month follow-up consultation.

Table 4.19. The mean values and results of the Wilcoxon's Signed Rank test for left rotation of the two groups between the final consultation (FC) and the follow-up consultation (FU).

	FC	FU	p value
SMT	7.5	8.9	0.113846
ET	5.9	6.5	0.288843

The null hypothesis was accepted in both groups which indicated that at the 5% level of significance no statistically significant difference occurred between the final consultation and the one month follow-up consultation.

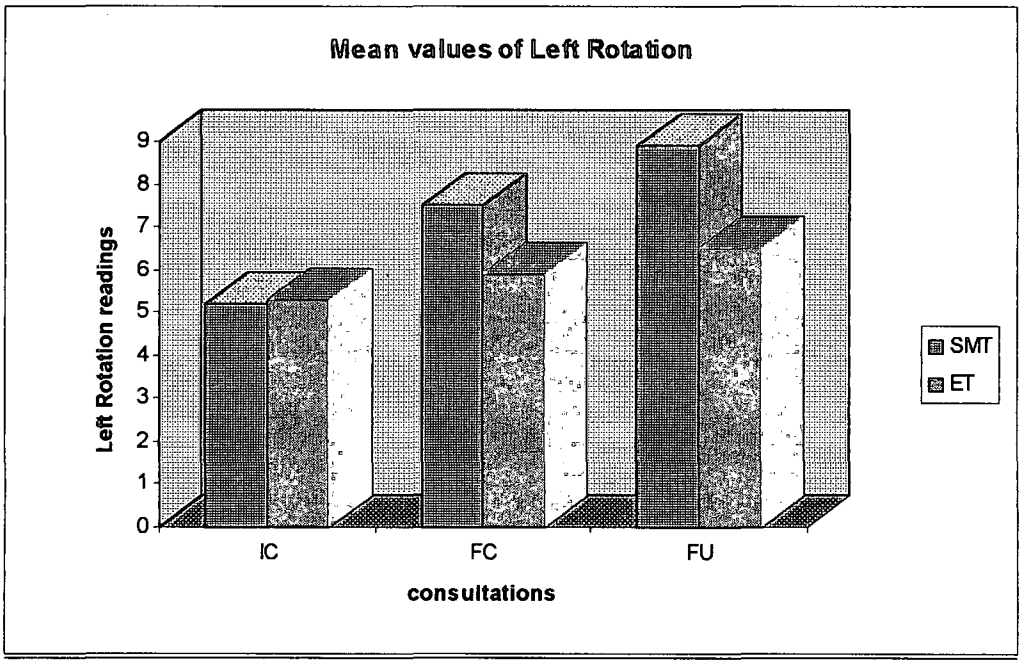
Table 4.20. The results of the Mann-Whitney U-test for left rotation comparing the two groups at the first consultation (IC) , final consultation (FC) and the follow-up consultation (FU).

	IC	FC	FU
p value	1	0.0222885	0.0136411

The null hypothesis was accepted at the first consultation which indicated that at the 5% level of significance no statistically significant difference occurred between the first consultation and the final consultation.

The null hypothesis was rejected at the final consultation and the follow-up consultation which indicated that at the 5% level of significance a statistically significant difference occurred between the final consultation and the one month follow-up consultation.

Figure 4.5. The mean values of left rotation at the first consultation (IC) , final consultation (FC) and the follow-up consultation (FU).



4.3.3.4. RIGHT ROTATION

Table 4.21. The mean values and results of the Wilcoxon's Signed Rank test for right rotation of the two groups between the first consultation (IC) and the final consultation (FC).

	IC	FC	p value
SMT	5.7	7.1	0.0133283
ET	5.1	5.9	0.0412266

The null hypothesis was rejected for the Spinal Manipulative therapy group which indicated that at the 5% level of significance a statistically significant difference occurred during the treatment period.

The null hypothesis was accepted for the Exercise therapy group which indicated that at the 5% level of significance no statistically significant difference occurred during the treatment period.

Table 4.22. The mean values and results of the Wilcoxon's Signed Rank test for right rotation of the two groups between the first consultation (IC) and the follow-up consultation (FU).

	IC	FU	p value
SMT	5.7	7.7	0.0158613
ET	5.1	6.4	0.096092

The null hypothesis was rejected for the Spinal Manipulative therapy group which indicated that at the 5% level of significance a statistically significant difference occurred during the first consultation and the one month follow-up consultation.

The null hypothesis was accepted for the Exercise therapy group which indicated that at the 5% level of significance no statistically significant difference occurred during the first consultation and the one month follow-up consultation.

Table 4.23. The mean values and results of the Wilcoxon's Signed Rank test for right rotation of the two groups between the final consultation (FC) and the follow-up consultation (FU).

	FC	FU	p value
SMT	7.1	7.7	0.683088
ET	5.9	6.4	0.72367

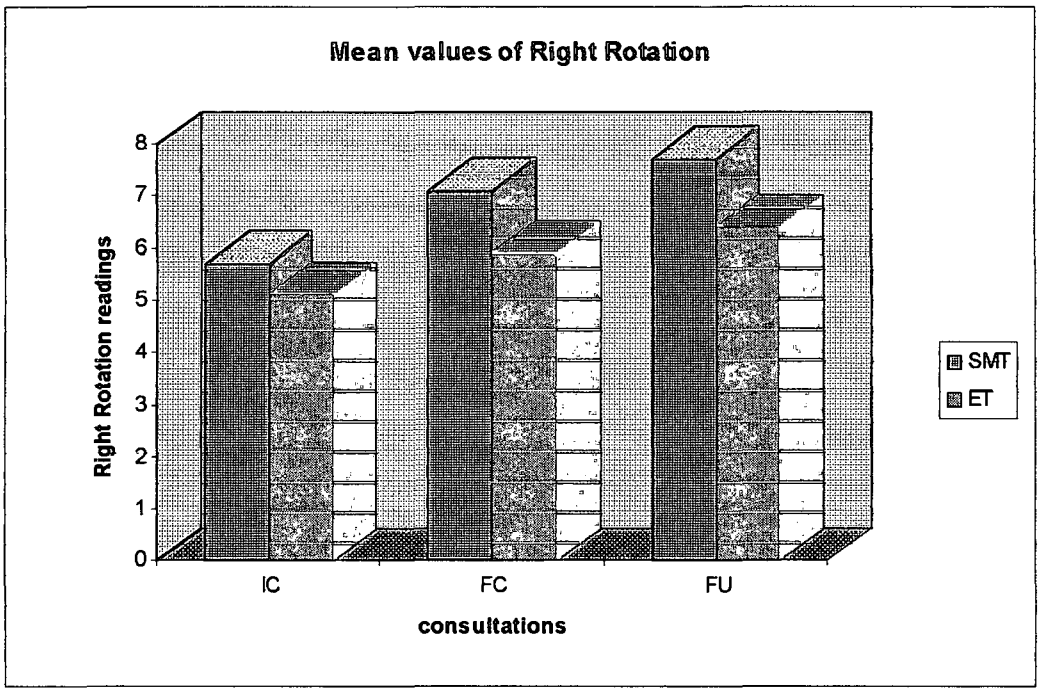
The null hypothesis was accepted for both groups which indicated that at the 5% level of significance no statistically significant difference occurred between the final consultation and the one month follow-up consultation

Table 4.24. The results of the Mann-Whitney U-test for right rotation comparing the two groups at the first consultation (IC) , final consultation (FC) and the follow-up consultation (FU).

	IC	FC	FU
p value	0.250088	0.0931041	0.113813

The null hypothesis was accepted at all three consultations which indicated that at the 5% level of significance no statistically significant difference occurred between the two groups during the treatment period or between the final consultation and the one month follow-up consultation.

Figure 4.6. The mean values of right rotation at the first consultation (IC) , final consultation (FC) and the follow-up consultation (FU).



4.3.3.5. LEFT LATERAL FLEXION

Table 4.25. The mean values and results of the Wilcoxon's Signed Rank test for left lateral flexion of the two groups between the first consultation (IC) and the final consultation (FC).

	IC	FC	p value
SMT	20.4	27.3	0.000300669
ET	21.3	24.7	0.0158613

The null hypothesis was rejected in both groups which indicated that at the 5% level of significance a statistically significant difference occurred during the treatment period.

Table 4. 26. The mean values and results of the Wilcoxon's Signed Rank test for left lateral flexion of the two groups between the first consultation (IC) and the follow-up consultation (FU).

	IC	FU	p value
SMT	20.4	30.8	0.000300669
ET	21.3	25.8	0.00554577

The null hypothesis was rejected in both treatment groups which indicated that at the 5% level of significance a statistically significant difference occurred between the first consultation and the one month follow-up consultation.

Table 4.27. The mean values and results of the Wilcoxon's Signed Rank test for left lateral flexion of the two groups between the final consultation(FC) and the follow-up consultation (FU).

	FC	FU	p value
SMT	27.3	30.8	0.000874198
ET	24.7	25.8	0.546491

The null hypothesis was rejected for the Spinal Manipulative therapy group which indicated that at the 5% level of significance a statistically significant difference occurred between the final consultation and the one month follow-up consultation. The null hypothesis was accepted for the Exercise therapy group which indicated that at the 5% level of significance no statistically significant difference occurred between the final consultation and the one month follow-up consultation.

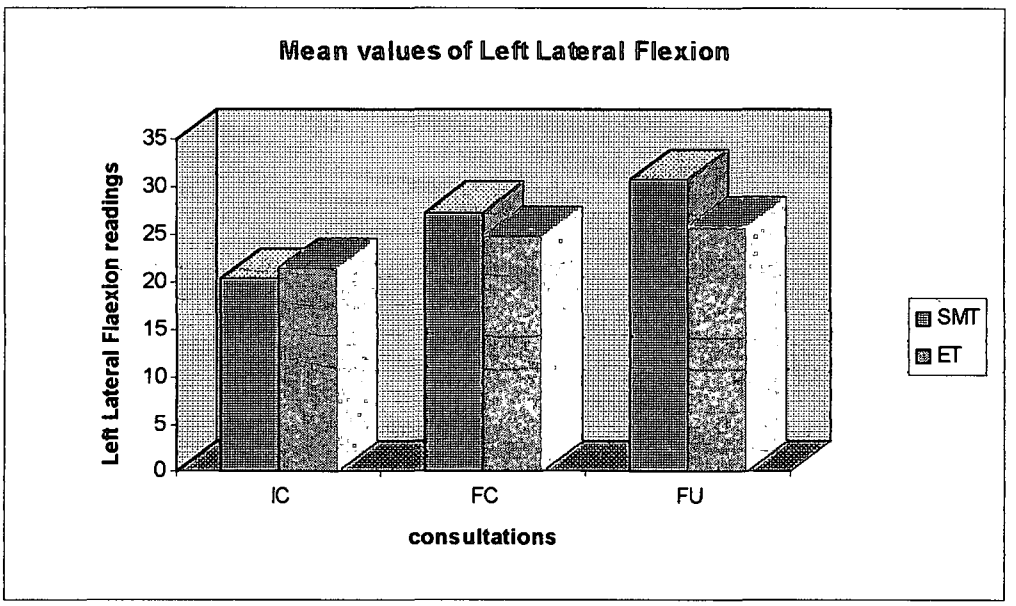
Table 4.28. The results of the Mann-Whitney U-test for left lateral flexion comparing the two groups at the first consultation (IC), final consultation (FC) and the follow-up consultation (FU).

	IC	FC	FU
p value	0.421925	0.0625433	0.00143096

The null hypothesis was accepted at the first consultation and the final consultation which indicated that at the 5% level of significance no statistically significant difference occurred between the two groups during treatment.

The null hypothesis was rejected at the follow up consultation which indicated that at the 5% level of significance a statistically significant difference occurred between the final consultation and the one month follow-up consultation.

Figure 4.7. The mean values of left lateral flexion at the first consultation (IC), final consultation and the one month follow-up consultation (FU).



4.3.3.6. RIGHT LATERAL FLEXION

Table 4.29. The mean values and results of the Wilcoxon's Signed Rank test for right lateral flexion of the two groups between the first consultation (IC) and the final consultation (FC).

	IC	FC	p value
SMT	21.9	28.1	0.000512096
ET	21.3	24.9	0.0265001

The null hypothesis was rejected for the Spinal Manipulative therapy group which indicated that at the 5% level of significance a statistically significant difference occurred during the treatment period.

The null hypothesis was accepted for the Exercise therapy group which indicated that at the 5% level of significance no statistically significant difference occurred during the treatment period.

Table 4.30. The mean values and results of the Wilcoxon's Signed Rank test for right lateral flexion of the two groups between the first consultation (IC) and the follow-up consultation (FU).

	IC	FU	p value
SMT	21.9	33.2	0.000300669
ET	21.3	26.4	0.00328359

The null hypothesis was rejected for both treatment groups which indicated that at the 5% level of significance a statistically significant difference occurred between the first consultation and the one month follow-up consultation.

Table 4.31. The mean values and results of the Wilcoxon's Signed Rank test for right lateral flexion of the two groups between the final consultation (FC) and the follow-up consultation (FU) .

	FC	FU	p value
SMT	28.1	33.2	0.000874198
ET	24.9	26.4	0.34278

The null hypothesis was rejected for the Spinal Manipulative therapy group which indicated that at the 5% level of significance a statistically significant difference occurred between the final consultation and the one month follow-up consultation.

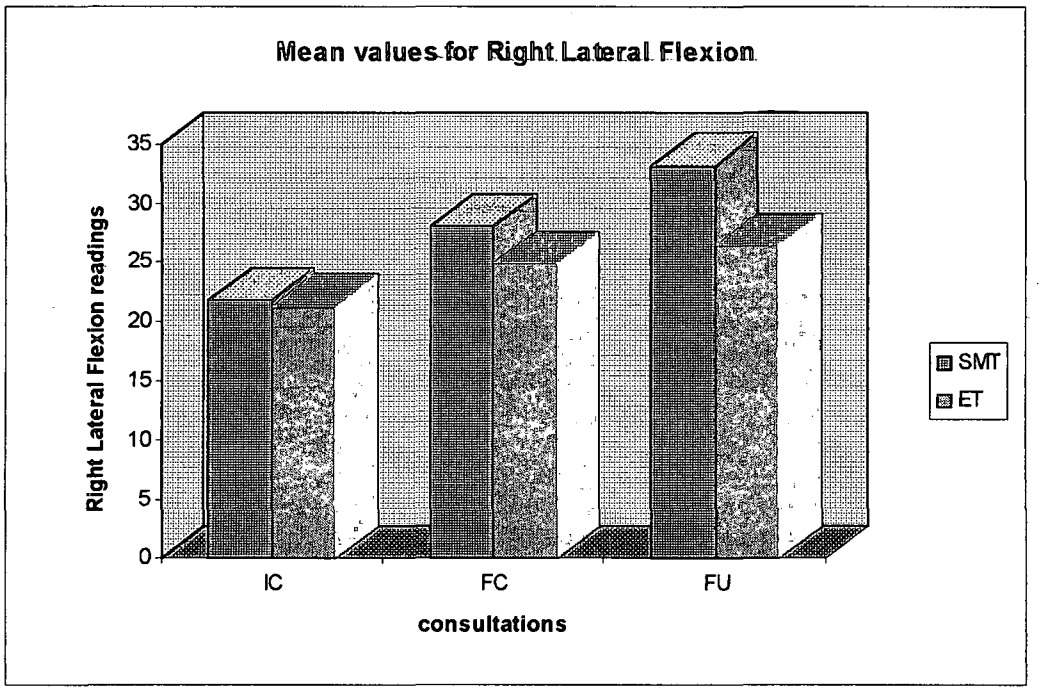
The null hypothesis was accepted for the Exercise therapy group which indicated that at the 5% level of significance no statistically significant difference occurred between the final consultation and the one month follow-up consultation.

Table 4.32. The results of the Mann-Whitney U-test for right lateral flexion comparing the two groups at the first consultation (IC), final consultation (FC) and the follow-up consultation (FU).

	IC	FC	FU
p value	0.44382	0.116707	0.00152819

The null hypothesis was accepted at the first consultation and the final consultation which indicated that at the 5% level of significance no statistically significant difference occurred between the two groups during the treatment period.
The null hypothesis was rejected at the follow-up consultation which indicated that at the 5% level of significance a statistically significant difference occurred between the final consultation and the one month follow-up consultation of the two groups.

Figure 4.8. The mean values of right lateral flexion at the first consultation (IC) , final consultation (FC) and the one month follow-up consultation (FU).



4. 4. DEMOGRAPHIC DATA

Table 4.33. Demographic data.

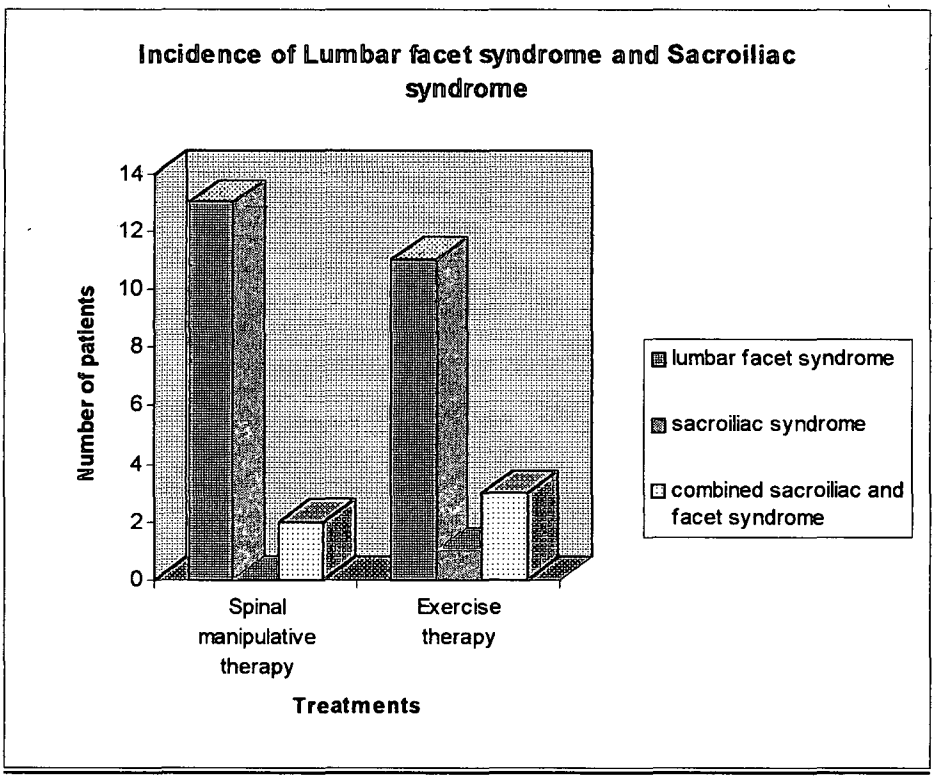
	Spinal manipulative therapy	Exercise therapy	Total
Age distribution			
Age range	23 → 40	20 → 37	20 → 40
Average age	31.6	27.07	29.33
Racial distribution			
White	12	8	20
Indian	2	4	6
Coloured	0	4	4
Occupation			
Housewife	4	8	12
Teacher	5	0	5
Secretary	2	3	5
Credit clerk	1	1	2
Photographer	0	1	1
Self employed	2	0	2
Student	0	1	1
Journalist	0	1	1
Book keeper	1	0	1

4.5. INCIDENCE OF LUMBAR FACET SYNDROME AND SACROILIAC SYNDROME

Table 4.34. The incidence of lumbar facet syndrome and sacroiliac syndrome.

	Spinal manipulative therapy	Exercise therapy	Total
Lumbar facet syndrome	13	11	24
Sacroiliac syndrome	0	1	1
Combined lumbar facet and Sacroiliac syndrome	2	3	5

Figure 4.9. The incidence of Lumbar facet syndrome and Sacroiliac syndrome.



CHAPTER FIVE

DISCUSSION

5.1. INTRODUCTION

This chapter involves the discussion of the results obtained from the Oswestry Back Pain Disability Index, Numerical Pain Rating Scale 101 and BROM II goniometer readings for lumbar spine ranges of motion.

5.1.1. Intra-treatment data comparison

The evaluation of the intra-treatment results of the first consultation to the final consultation (treatment period), provided an indication of the efficacy of the treatment regime. Evaluation of the results between the final consultation and follow-up consultation (follow-up period) indicated whether the treatment efficiency was maintained. Evaluation of the results of the first consultation to the follow-up consultation (overall consultation period) indicated the long term efficiency and most favorable response to treatment.

5.1.2. Inter-treatment data comparison

Evaluation of the inter-treatment data of the first consultation measurements illustrated any variance in the subjective and objective findings between the two groups in terms of their original signs and symptoms at the beginning of the study.

The comparison of the data obtained at the final consultations demonstrated any difference in the rate of improvement between the two groups.

The inter-treatment evaluation of the one month follow-up consultation measurements indicated which treatment method would be more effective on a long term basis.

5.2. SUBJECTIVE DATA

5.2.1. DISABILITY - The Oswestry Back Pain Disability Index

5.2.1.1. Intra-treatment comparison

Significant improvement was noted in the treatment period (Table 4.1.) and overall consultation period(Table 4.2.) for the Spinal Manipulative therapy group. However, no significant improvement was noted in the second treatment interval.(Table 4.3.) No significant improvement was noted between any period within the Exercise therapy group.(Table 4.1. ; 4.2. ; 4.3.) These findings suggest that Spinal Manipulative therapy was effective in terms of improving disability, which indicates that the patients perceived a reduction in pain and the effect it had on their daily activities. This supports hypothesis one, in terms of disability.

5.2.1.2. Inter-treatment comparison

When the results of the two groups were compared using the Mann-Whitney U-test, no significant differences were noted in the initial consultations between either group

which suggests a similarity between the two groups in terms of initial disability. (Table 4.4.) Evaluation of the data obtained at the final consultations indicated no significant difference between the rates of improvement for either of the two treatment groups (Table 4.4.). Evaluation of the data obtained at the one month follow-up consultation indicated that only Spinal Manipulative therapy had a significantly more effective improvement over the one month follow-up consultation, indicating that it was the more effective treatment in terms of disability improvement. This supports hypothesis three, in terms of disability.

5.2.2. PAIN PERCEPTION - Numerical Pain Rating Scale 101

5.2.2.1. Intra-treatment comparison

Significant improvement was noted for the treatment period (Table 4.5.) and overall consultation period (Table 4.6.) within the Spinal Manipulative therapy group. No significant improvement was noted between any period within the Exercise therapy group (Table 4.5. ; 4.6. ; 4.7.) These results suggest that Spinal manipulative therapy was effective in terms of decreasing pain intensity, as measured by the Numerical Pain Rating Scale 101. This supports hypothesis one, in terms of pain perception.

5.2.2.2. Inter-treatment comparison

No significant difference was noted between the two groups before the commencement of treatment. (Table 4.8.) Both groups at the final consultation perceived an improvement of their condition during the treatment period, but no

significant difference was noted between the two groups.(Table 4.8.) At the one month follow-up consultation (Table 4.8.; Figure 4.2.), significant improvement was noted for the Spinal manipulative therapy group which indicated that Spinal Manipulative therapy is the more effective treatment in the long term management of postnatal mechanical low back pain. This supports hypothesis three, in term of pain perception.

5.3. INTERPRETATION OF SUBJECTIVE FINDINGS

In terms of subjective clinical findings:

(a) hypothesis one stated that Spinal Manipulative therapy would be effective in the management of postnatal mechanical low back pain ; and

(b) hypothesis two stated that Exercise therapy would be effective in the management of postnatal mechanical low back pain.

Therefore, in terms of the patients' subjective response to treatment, it was shown that Spinal Manipulative therapy seems to be effective in improving disability and decreasing the perception of pain both in the short term (treatment period) and the long term (overall consultation period). These findings support hypothesis three, which states that Spinal Manipulative therapy would be more effective than Exercise therapy in the management of postnatal mechanical low back pain.

Although the readings for the Exercise therapy group resulted in no significant difference, they all demonstrated a decrease in the mean scores for both disability and pain perception during the treatment period, which indicates that a clinically significant improvement occurred. These mean scores for the Exercise therapy group

improved slightly at the overall consultation period , indicating that improvement was maintained at the one month follow-up consultation.

The results of this study agree with those of Anderson et al. (1992) , Di Fabio (1992), Pope et al. (1994) and Meade et al. (1995), in which it was demonstrated that subjects receiving Spinal Manipulative therapy alone, indicated significant reductions in pain perception and functional disability. Only the Spinal Manipulative therapy group in this study exhibited statistically significant effective subjective changes.
In a study done by Meade et al. (1995) comparing spinal manipulation to hospital out-patient treatment for low back pain, it was demonstrated at the three year follow-up that those patients who received Chiropractic spinal manipulative therapy indicated a 29% and 34% overall improvement for Oswestry and pain intensity scores respectively.

5.4. OBJECTIVE DATA

5.4.1. RANGES OF MOTION

The six lumbar spine ranges of motion were considered, which involved intra-group comparison with the Wilcoxon's Signed Rank test and inter-treatment comparison with the Mann-Whitney U-test.

5.4.1.1. Intra-treatment comparison

Upon evaluation of forward flexion, there were significant differences noted within both treatment groups during the treatment period, indicating the efficacy of both treatments. (Table 4.9.) However, no significance was noted at the follow-up period within either group. (Table 4.11.)

At the overall consultation period a significant difference was noted for the Spinal Manipulative therapy group, indicating long term efficiency and therefore that this was the more favorable treatment in terms of lumbar spine ranges of motion. (Table 4.10.) No significant difference was noted for the Exercise therapy group at the overall consultation period. (Table 4.10) These findings support hypothesis one, in terms of lumbar spine ranges of motion.

For extension, significant differences were noted in the follow-up period (Table 4.15) and overall consultation period (Table 4.14.) for the Spinal Manipulative therapy group. No significant difference were noted for any period within the Exercise therapy group, which indicates that Spinal Manipulative therapy is the most favourable and efficient treatment in terms of increasing lumbar spine extension range of motion. These results support hypothesis one, in terms of lumbar spine ranges of motion.

Upon evaluation of left and right rotation, significant differences were noted for the treatment period (Tables 4.17. ; 4.21.) within the Spinal Manipulative therapy group, indicating the efficacy of the treatment. Evaluation of the overall consultation period (Tables 4.18. ; 4.22.) further supported the efficiency of Spinal Manipulative therapy

indicating significant differences within the Spinal Manipulative therapy group . No significant differences were noted for any period within the Exercise therapy group. These results support hypothesis one, in terms of lumbar spine ranges of motion.

Upon evaluation of left lateral flexion, significant differences were noted within the spinal Manipulative therapy group and the Exercise therapy group for the treatment period (Table 4.25.), indicating the efficiency of both treatments. This efficiency was maintained by the Spinal Manipulative therapy group with significant differences noted at the follow-up period (Table 4.27.) and overall consultation period.(Table 4. 26.) Within the Exercise therapy group a significant difference was noted for the overall consultation period (Table 4.26.) indicating long term efficiency of the treatment. These results support hypothesis one and two, in terms of lumbar spine ranges of motion.

For right lateral flexion, significant differences were noted during the treatment period (Table 4.29.), follow-up period (Table 4.31.) and overall consultation period (Table 4.30.) within the Spinal Manipulative therapy group, indicating a favourable response to and long term efficiency of Spinal Manipulative therapy. Within the Exercise therapy group, no significant difference was noted for the treatment period (Table 4.29.) and follow-up period (Table 4.31.), whereas a significant difference occurred at the overall consultation period. (Table 4.30.) These results support hypothesis one and two, in terms of lumbar spine ranges of motion.

5.4.1.2. Inter-treatment comparison

When the results of the two treatment groups were compared in terms of forward flexion (Table 4.12.), extension (Table 4.16.), left rotation (Table 4.20.), right rotation (Table 4.24.), left lateral flexion (Table 4.28.) and right lateral flexion (Table 4.32.) using the Mann-Whitney U-test, it was found that no statistically significant difference existed between the two groups for all lumbar spine ranges of motion at the initial consultation. This suggests a similarity between the two groups in terms of degree of restriction in all lumbar spine ranges of motion caused by the low back pain.

Although neither group showed a statistically significant improvement at the final consultation, both groups' mean scores for all lumbar spine ranges of motion increased during the treatment period.

Evaluation at the one month follow-up consultation for forward flexion (Table 4.12.; Figure 4.3.), extension (Table 4.16.; Figure 4.4.), left rotation (Table 4.20.; Figure 4.5.), left lateral flexion (Table 4.28.; Figure 4.7.) and right lateral flexion (Table 4.32.; Figure 4.8.) indicated that only Spinal Manipulative therapy had a significantly more effective improvement over the one month follow-up consultation period, indicating that it is the more effective treatment in terms of lumbar spine ranges of motion .

These results support hypothesis three, in terms of lumbar spine range of motion.

No statistically significant improvement was noted for right rotation (Table 4.24. ; Figure 4.6.) at the one month follow-up consultation, indicating a similarity between

the two groups, so one group did not out-perform the other. This did not support hypothesis three, in terms of lumbar spine range of motion.

5.5. INTERPRETATION OF OBJECTIVE FINDINGS

In terms of objective clinical findings:

(a) hypothesis one stated that Spinal Manipulative therapy would be effective in the management of postnatal mechanical low back pain ; and

(b) hypothesis two stated that Exercise therapy would be effective in the management of postnatal mechanical low back pain.

Therefore, in terms of the patients' objective response to treatment, it was shown that Spinal Manipulative therapy seems to be effective in improving all lumbar spine ranges of motion both in the short term (treatment period) and the long term period (overall consultation period). These findings support hypothesis three, which states that Spinal Manipulative therapy would be more effective than Exercise therapy in the management of postnatal mechanical low back pain.

Although the readings for the Exercise therapy group resulted in no significant difference for forward flexion, extension, left rotation and right rotation, they all demonstrated an increase in the mean scores for all lumbar spine ranges of motion., which indicates that a clinically significant improvement occurred.

The results of this study agree with those of Anderson et al. (1992) and Pope et al. (1994) , in which it was demonstrated that subjects receiving Spinal Manipulative therapy alone, indicated significant increases in lumbar spine ranges of motion.

Only the Spinal Manipulative therapy group in this study exhibited significant effective objective changes for forward flexion, extension, left rotation and right rotation range of motion. For left and right lateral flexion, both treatment groups showed significant objective changes with Spinal manipulation being the superior treatment . (Figures 4.7.; 4.8.)

In a study done by Pope et al. (1994) comparing spinal manipulation to transcutaneous muscle stimulation, massage and corset therapy for the treatment of low back pain, it was demonstrated at the three week follow-up that only spinal manipulation therapy significantly increased forward flexion and extension lumbar spine ranges of motion . It was concluded that significant increases in lumbar spine ranges of motion are achieved by spinal manipulation.

When analyzing the statistics obtained from the objective and subjective data in this study, the results followed a particular pattern. The Spinal Manipulative therapy group showed statistically significant improvement during all treatment periods, indicating a favourable response to their perception of pain, functional daily activities and ranges of motion in the lumbar spine. At all the overall consultation periods, this statistically significant improvement was maintained, indicating that Spinal Manipulative therapy is the treatment of choice for postnatal mechanical low back pain. Exercise therapy , although exhibiting improvement in mean scores for perception of pain, functional disability and ranges of motion in the lumbar spine, only demonstrated statistically significant results for right and left lateral flexion lumbar motion.

5.6. SACROILIAC AND POSTERIOR FACET SYNDROMES

The Kirkaldy-Willis diagnostic model (Kirkaldy-Willis 1988: 134) for classification of mechanical low back pain includes several diagnoses previously mentioned in chapter three. In this study patients with sacroiliac syndrome, posterior facet syndrome or a combination of the two, were included because they were the most common conditions treated. (Table 4.34. ; Figure 4.9.) According to Cassidy and Kirkaldy-Willis (1988: 295), sacroiliac syndrome, posterior facet syndrome or a combination of the two were found to be the most common conditions within the classification system. In this study 80% of the patients were diagnosed as suffering from posterior facet syndrome, 3% had sacroiliac syndrome and 17% were suffering from a combination of facet and sacroiliac syndrome. Bernard and Kirkaldy-Willis (1992:209) found that posterior facet syndrome and sacroiliac syndromes commonly co-exist in patients diagnosed as suffering from mechanical low back pain.

5.7. COMMENTS

The results of this study support the use of Spinal Manipulative therapy in the management of postnatal mechanical low back pain. It was difficult to compare these results to those of previous studies, since to this author's knowledge, few clinical trials of Spinal Manipulative therapy for the management of postnatal low back pain have been performed during the postpartum period.

In a study done by Fraser (1976) on one hundred and fifteen postpartum women it was found that 95 % of the women suffered from sacroiliac subluxation which responded dramatically to manipulation. The manipulative technique involved, which was not mentioned in the study, resulted in leveling of the anterior superior iliac spine in the supine position. It was noted that after the pelvis was leveled, the patient was taught knee to chest flexion exercises to maintain the normal relationship of the ilia to the sacrum. No results were mentioned on the success rate of the manipulation applied, but it was stated that postpartum backache was a treatable condition.

In the past it was mentioned that obstetricians, general practitioners and midwives dismissed the prevalence of postpartum low back pain as inevitable and unimportant (Mantle 1990:133) and thought to be part of a normal pregnancy.(Fraser 1976, Fast et al. 1987)

Upon reviewing the literature on the management of postnatal low back pain, the prescription of exercise therapy and postural adaptation is well supported, both in the antenatal period and postnatal period. (Jackson and Brown 1983, Cox 1987:500, Mc Quarrie 1988: 348, Deyo 1994:154, Mantle 1994:807, Panzer 1995:426)

5.8. STUDY WEAKNESSES

The sample size of this study was too small and did not represent a normal distribution of the population. It is therefore argued that, to represent a normal distribution of the population, the sample size in each treatment group be increased from fifteen patients per group to thirty patients per group.

Inaccuracy of the questionnaires may have brought about a biased result due to human error, which could be improved by more strict supervision of the completion of the questionnaires . A larger sample size could possibly eliminate any discrepancies concerning small changes in pain intensity and disability.

Accuracy of the goniometer in symptomatic patients combined with human error may have had an effect on the validity of the results. These errors could possibly be reduced by use of more technologically advanced equipment (if available) that is less prone to human error.

In order to improve the validity of future studies, the possibility of treating a specific syndrome, such as sacroiliac syndrome or posterior facet syndrome, should be investigated.

Consideration towards natural regression of mechanical low back pain would add validity to future studies. In this study the mean values for both objective and subjective clinical data at the initial consultation for both treatment groups were similar. Comparison of the mean values at the one month follow-up consultation for both treatment groups, indicated a significant objective and subjective improvement in those patients who received spinal manipulative therapy as opposed to exercise therapy. A proposal of observing a third sample group, whereby no treatment is administered, but objective and subjective data be collected at equal intervals as compared to spinal manipulative therapy and exercise therapy treatment groups. The third sample group would be an indication of the natural regression of mechanical low back pain in postnatal women.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1. CONCLUSIONS

This study consisted of thirty subjects all of which were diagnosed with postnatal mechanical low back pain, specifically sacroiliac syndrome, posterior facet syndrome or a combination of both. The subjects were randomly divided into two treatment groups, with each group consisting of fifteen subjects. Group one received Spinal Manipulative therapy only , while group two received Exercise therapy only. Each patient received eight treatments, two per week over a four week period, with a one month follow-up consultation.

The results indicated a statistically significant subjective and objective difference, in the form of decreased pain perception and functional disability, and an increase in all lumbar spine ranges of motion for the Spinal Manipulative therapy group. These statistically significant differences were noted during the treatment period (short term improvement) and at the one month follow-up period (long term improvement) for the Spinal Manipulative therapy group.

The Exercise therapy group showed a statistically significant objective difference during the treatment period (short term improvement) only for forward flexion and left lateral flexion lumbar spine range of motion and at the one month follow-up period (long term improvement) for left and right lateral flexion lumbar spine range of motion. In terms of pain perception and functional disability, no statistically

significant subjective difference occurred within the Exercise therapy group. Although the results for the Exercise therapy group did not exhibit enough statistical significance to warrant interest, subjects demonstrated a favourable clinical response in terms of decreased mean scores for pain perception and functional disability and increased mean scores for lumbar spine ranges of motion.

From the above it is noted that there is strong evidence to conclude that Spinal Manipulation is an effective intervention for the treatment of postnatal mechanical low back pain.

6.2. RECOMMENDATIONS

The results of this investigation are based on a small sample size and require confirmation and modification using a larger sample size, which would represent a normal distribution of the population.

In future studies it would be advised to perform long term trials in which patients are monitored for a longer period of time, in order to investigate the long term benefit of the treatment.

In conclusion, Chiropractic Spinal Manipulation was the more effective and favourable treatment, both in the short term and long term, for postnatal mechanical low back pain in terms of clinical findings. However, studies with a larger sample size and better research methodology are required.

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APPENDIX A

KIRKALDY-WILLIS MODEL OF CLASSIFICATION FOR MECHANICAL LOW BACK PAIN

Posterior facet syndrome

Sacroiliac syndrome

Maigne's syndrome

Disc herniation

Facet and Disc degeneration

Lateral stenosis

Central stenosis

Multilevel stenosis

Myofascial syndrome: 1)Gluteus maximus
2)Gluteus medius
3)Gluteus minimus
4)Quadratus lumborum
5)Piriformis
6)Tensor Fascia Lata
7)Hamstring

APPENDIX B

INFORMED CONSENT FORM

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

TITLE OF RESEARCH PROJECT

_____

_____

NAME OF SUPERVISOR

_____

NAME OF RESEARCH STUDENT

_____

PLEASE CIRCLE THE APPROPRIATE ANSWER

1. Have you read the research information sheet? YES/NO

2. Have you had an opportunity to ask questions regarding this study? YES/NO
3. Have you received satisfactory answers to your questions? YES/NO

4. Have you had an opportunity to discuss this study? YES/NO
5. Have you received enough information about this study? YES/NO

6. Who have you spoken to? _____

7. Do you understand the implications of your involvement in this study? YES/NO

8. Do you understand that you are free to withdraw from this study? YES/NO
   a) at any time
   b) without having to give a reason for withdrawing, and
   c) without affecting your future health care.

9. Do you agree to volumtarily participate in this study? YES/NO

PATIENT/SUBJECT* Name_____ Signature_____
(in block letters)

PARENT/GUARDIAN* Name_____ Signature_____
(in block letters)

WITNESS Name_____ Signature_____
(in block letters)

RESEARCH STUDENT Name_____ Signature_____
(in block letters)

APPENDIX C

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

CASE HISTORY

Patient:_____ Date # _____

File #:_____

X-ray #:_____

Age: _____ Sex:_____ Occupation: _____

Intern: _____ Signature: _____

FOR CLINICIAN'S USE ONLY

Initial visit clinician: Signature:

Case History:

Examination:

Previous:	TN	Current:	TN
	Other		Other

X-ray Studies:

Previous:	TN	Current:	TN
	Other		Other

Clinical path. lab.:

Previous:	TN	Current:	TN
	Other		Other

Case status:

PTT: Conditional: Signed off: Final sign out:

Recommendations:

Intern's case history

1. Source of history:

2. Chief complaint: (patient's own words)

3. Present illness:

Location

Onset

Duration

Frequency

Pain (character)

Progression

Aggravating factors

Relieving factors

Associated S & S

Previous occurrences

Past treatment and outcome

4. Other complaints:

5. Past history:

General health status

Childhood illnesses

Adult illnesses

Psychiatric illnesses

Accidents/injuries

Surgery

Hospitalizations

6. Current health status and life-style:
    - Allergies
    - Immunizations
    - Screening tests
    - Environmental hazards
      (home, school, work)
    - Safety measures
      (seat belts, condoms)
    - Exercise and leisure
    - Sleep patterns
    - Diet
    - Current medication
    - Tobacco
    - Alcohol
    - Social drugs

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

8. Psychosocial history:

   Home situation

   Daily life

   Important experiences

   Religious beliefs

9. Review of systems:

   General

   Skin

   Head

   Eyes

   Ears

   Nose/sinuses

   Mouth/throat

   Neck

   Breasts

   Respiratory

   Cardiac

   Gastro-intestinal

   Urinary

Genital

Vascular

Musculoskeletal

Neurologic

Haematologic

Endocrine

Psychiatric.

[redacted] NAVAL CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

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

Patient:_____ File #_____

Last name First name

Clinician:_____ Signature:_____

Intern:_____ Signature:_____

Date:_____

Height:_____ Weight:_____ Temp:_____

Rates: Heart:_____ Pulse:_____ Respiration:_____

Blood pressure: Arms: L / R /

Legs: L / R /

General appearance:

STANDING EXAMINATION.

Minor's sign
Skin changes
Posture
  erect
  Adam's
Ranges of motion:

T/L spine: Flexion: 90 Fingers to floor
Extension: 50
R.lat.flex.: 30 Fingers down leg
L.lat.flex.: 30 Fingers down leg
Rot.to R.: 35
Rot.to L.: 35

Flex.

L.Rot. R.Rot.

L.lat flex. R.lat. flex.

Ext.

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

Romberg's sign.
Pronator drift.
Trendelenburg's sign.
Gait.
  rhythm
  balance
  pendulousness
  on toes
  on heels
  tandem
Half squat.
Scapular winging.
Muscle tone.
Spasticity/Rigidity.

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

Chest measurement
- inspiration
- expiration

Visual acuity

Breast examination:
- Inspection:
  - skin
  - size
  - contour
  - nipples
  - arms overhead
  - hands against hips
  - leaning forward.
- Palpation:
  - axillary lymph nodes.

SEATED EXAMINATION.

Spinal posture

Head
- scalp
- skull
- face
- skin

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

	L			R		
	III	IV	VI	III	IV	VI

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

vessels
general background
macula
vitreous
lens

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

Nose:
external
internal
septum
turbinates
olfaction

Sinuses (frontal & maxillary):
tenderness
transillumination

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

Neck:
posture
size
swelling
scars
discoloration
hair line

ROM:

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

Flex.

L.Rot. R.Rot.

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

Ext.

lymph nodes
trachea
thyroid
carotid arteries (thrills, bruit)

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

TMJ —
- Inspection
  - ROM
  - deviation
- Palpation
  - crepitus
  - tenderness

Neurological:
- Dermatomes
  - C5
  - C6
  - C7
  - C8
  - T1
- Tendon reflexes
  - biceps
  - triceps
  - brachioradialis
- Muscle strength
  - C5
  - C6
  - C7
  - C8
  - T1
- Coordination:
  - point-to-point
  - dysdiadochokinesia

Thorax:
- Chest:
  - Inspection:
    - skin
    - shape
    - respiratory distress
    - rhythm (respiratory)
    - depth "
    - effort "
    - intercostal/supraclavicular retraction
  - Palpation:
    - tenderness
    - masses
    - respiratory expansion
    - tactile fremitus
  - Percussion:
    - lungs (posterior)
    - diaphragmatic excursion
    - kidney punch
  - Auscultation:
    - breath sounds
      - vesicular
      - bronchial
    - adventitious sounds
      - crackles (rales)
      - wheezes (rhonchi)
    - voice sounds
      - broncophony
      - whispered pectoriloquy
      - egophony

Cardiovascular:
- auscultation (aortic murmurs)
- Allen's test

SUPINE EXAMINATION

- JVP
- PMI
- auscultation heart (L.lat.recumbent)
- respiratory excursion
- percussion chest (anterior)
- breast palpation

The abdomen:

Inspection:
- skin
- umbilicus
- contour
- peristalsis
- pulsations
- hernias (umbilical/incisional)

Auscultation:
- bowel sounds
- bruit

Percussion:
- general
- liver
- spleen

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

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

Male genitals and hernias.
Inspection:
skin
prepuce
glans
meatus
nits/lice
scrotum
inguinal/femoral bulges
Palpation:
penis (tenderness/induration)
testes
epididymis
inguinal canal
femoral canal
cremasteric reflex
Auscultation:
scrotal mass.
Peripheral vasculature:
Inspection:
skin
nail beds
pigmentation
hair loss
Palpation:
pulses - radial, brachial, femoral, popliteal, post.tibial, dorsalis pedis
lymph nodes - epitrochlear, femoral (horizontal & vertical)
temperature (feet & legs)
Manual compression test
Retrograde filling (Trendelenburg) test
Arterial insufficiency test

Musculoskeletal:
ROM
hip
flex. 90/120
ext. 15
abd. 45
add. 30
int rot 40
ext rot 45
knee
flex. 130
ext. 0/15
ankle
plantar flex 45
dorsiflex 20
inversion 30
eversion 20
leg length

Neurological:
- dermatomes
  - L1
  - L2
  - L3
  - L4
  - L5
  - S1
- muscle strength
  - hip flexion
  - knee extension
  - ankle dorsiflexion
  - plantar flexion
- tendon reflexes
  - patellar
  - Achilles
- plantar reflex

Rectal examination:
- Inspection
  - sacrococcygeal & perianal areas
- Palpation
  - sphincter tone
  - tenderness
  - indurat:
  - nodules
  - prostate
  - seminal vesicles

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

APPENDIX E

TECHNIKON NATAL

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC.

REGIONAL EXAMINATION -- LUMBAR SPINE AND PELVIS.

PATIENT:_____

FILE # :_____ DATE:_____

INTERN/RESIDENT:_____

SUPERVISING CLINICIAN :_____

STANDING :

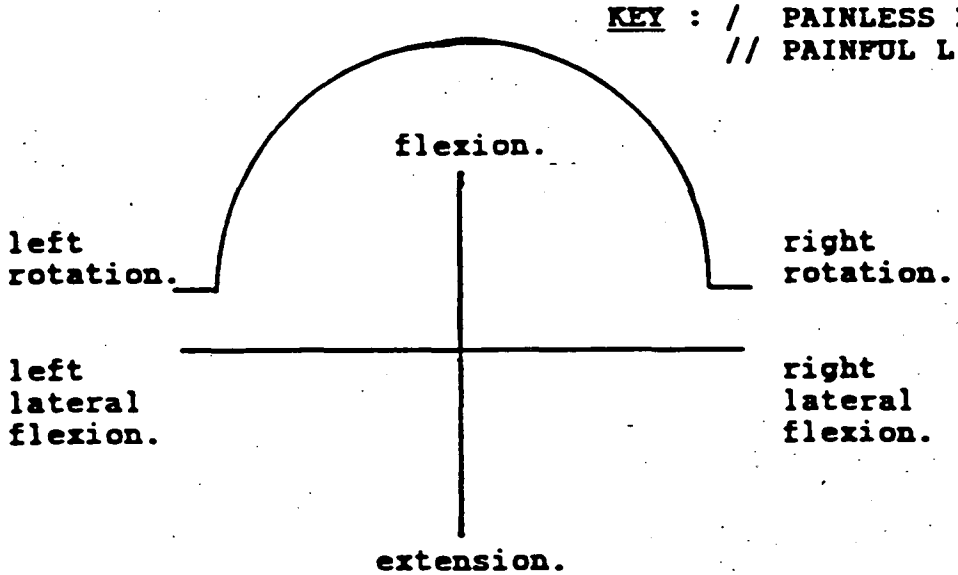
Posture
Minor's Sign
Skin
Scars
Discoloration
Muscle tone
Bony and soft tissue contours

Spinous percussion
Schober's Test (6cm)
Treadmill
Body Type
Attitude

RANGE OF MOTION.

Forward Flexion = 40-60 degrees.(15cm from floor)
Extension = 20-35 degrees.
L/R Rotation = 3-18 degrees.
L/R Lateral flexion = 15-20 degrees.

KEY : / PAINLESS LIMITATION.
// PAINFUL LIMITATION.



GAIT :

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

Remarks : _____

_____

_____

_____

NEUROLOGICAL EXAMINATION :

DERMATOMES: Left	Right	MYOTOMES: Left	Right	REFLEXES: Left	Right
T12		hip flex		C5	
L1		hip int rot		C6	
L2		hip ext rot		C7	
L3		hip abd			
L4		hip add			
L5		knee flex			
S1		knee ext			
S2		dorsiflex			
S3		plantarflex			
		eversion			
		ext.hall.long			

Tripod
Kemp's Test

COMMENTS: _____

_____

_____

_____

SUPINE :

Skin.
Hair.
Nails.

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

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

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.

PRONE :

Gluteal skyline
Skin rolling
Iliac crest compression
Facet joint challenge
S-I tenderness
Erichson's Test
Pheasant's Test
Myotomes :
- GluteusMaximus

Active MF Trigger Points:
- QL
- Glut. Med.
- Glut. Max.
- Glut. Min.
- Piriformis
- Hamstrings
- TFL

MOTION PALPATION :

Jt.play		Left						Right					Jt.pl	
P/A	Lat	Fle	Ext	LF	AR	PR		Fle	Ext	LF	AR	PR	P/A	L
							T10							
							T11							
							T12							
							L1							
							L2							
							L3							
							L4							
							L5							
					U	L	SI	U	L					

APPENDIX F

Patient name:_____ Res.No:_____ Date:_____

NUMERICAL RATING SCALE-101 QUESTIONNAIRE

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

_____

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

_____

APPENDIX G

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 ppevents 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 it 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 H

PATIENT NAME:.....
DATE.....

RANGES OF MOTION :LUMBAR SPINE

	FIRST TREATMENT	FINAL TREATMENT	ONE MONTH FOLLOW-UP
INITIAL FLEXION			
FULL FLEXION			
TRUE FLEXION			
INITIAL EXTENSION			
FULL EXTENSION			
TRUE EXTENSION			
LEFT ROTATION			
RIGHT ROTATION			
LEFT LATERAL FLEXION			
RIGHT LATERAL FLEXION			
CENTIMETERS FROM T12			

APPENDIX I

PATIENT RANDOMIZATION:

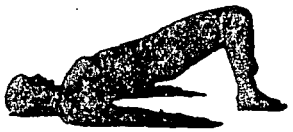
1	S	18	S
2	S	19	S
3	E	20	S
4	S	21	S
5	E	22	E
6	S	23	S
7	E	24	E
8	E	25	S
9	E	26	E
10	S	27	E
11	S	28	S
12	E	29	S
13	E	30	E
14	E	31	E
15	E	32	S
16	S	33	S
17	E	34	E

S= SPINAL MANIPULATIVE THERAPY
E= EXERCISE THERAPY

APPENDIX J

The Cox exercises for Low Back Pain

Exercise 1



Lie on your back with your knees flexed and your feet flat on the floor as close to the buttocks as possible. Keep the knees together.Tighten the muscles of the lower abdomen and buttocks so as to flatten your low back against the floor.Slowly raise your hips up from the floor and hold for slow count of 8. Repeat this exercise 4 times.If you cannot raise your hips from the floor, merely tighten the belly, the abdominal and buttock muscles and wait until you can raise the hips.

Exercise 2

Lie on your back and draw the right knee up to the chest and pull the knee down upon chest while attempting to touch the chin to the knee. Do this for a slow count of 8 and repeat 4 times. Repeat the same exercise with the left knee brought to the chest. Relax between each session.Repeat with both knees brought up to the chest.

Exercise 3

While lying tighten the abdominal and buttock muscles so as to flatten your low back.Contract the muscles and relax for approximately 8 times at each session.

Exercise 4

Repeat exercise 1 above but be sure to hold the knees firmly together.

Exercise 5

Lie flat on your back and raise the right leg straight upward without bending the knee. Place your hands behind the knee while keeping the knee straight, pull the leg straight up so as to stretch the muscles behind your thigh. Repeat this 8 times on the right and then on the left.Relax your low back muscles during this exercise.

Exercise 6

Lie on stomach and raise the right leg off the floor while keeping the knee straight. Hold the leg up in this position for a count of 4 and slowly let it down. Repeat this 4 times. Repeat the same exercise with the opposite leg.

Exercise 7

Lie flat on stomach with arms along side, palms down. Slowly raise chest off the floor. Feel the muscles of the low back tighten.Hold the chest off the floor for a slow count of 6 and slowly let it down.Repeat this 6 times with a rest between each session.

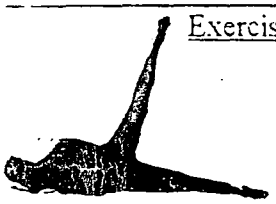
Exercise 8

Sit on floor on your knees.Extend your right leg as far to the side as possible, keeping the knee straight and the arch of the foot on the floor. Slide the foot along the floor until you feel the stretch of muscles inside your thigh. Do slowly and hold for a count of 5.Repeat it 3 times on the right leg and then repeat with the left side.

Exercise 9

Lie on your back with knees flexed and feet on the floor.Bring chin to chest as shown.Now tighten the abdominal muscles so as to lift and curl the shoulders up to about 1 foot off the floor. Feel the abdominal muscles tighten.Do this 10 to 30 times depending on your stamina.

Exercise 10



Lie on side. Turn the toes on the right foot and lift leg upward. Repeat this 6 times on the right and then 6 times on the left. You will feel pulling in the outer thigh and pelvis.

Exercise 11

Lie on back and draw knees to chest, arms extended level with shoulders, roll hips to side in attempt to touch the knees to floor.Turn your head in the opposite direction to which your knees are bending. Repeat this 4 times going first to the right and then to the left. This exercise brings all spinal movements in a smooth forceful manipulation of the spinal articulations. Since the exercise involves rotation, it should only be done under researchers instruction.

Exercise 12

Lie on back.Bend knees and bring feet up to the buttocks.Now lift and staighten the legs so that the legs are at right angle to the body.Raise the buttocks from the floor and place the hand beside the buttocks and support your pelvis as you raise the pelvis off the floor.Allow the legs to go over the head with the feet over the head and legs parallel to the floor.Hold this position for 10 seconds and repeat 2-3 times. Slowly lower your pelvis and legs to the starting position.