

**THE EFFECTIVENESS OF MANIPULATION OF THE
SYMPTOMATIC SACROILIAC JOINT COMPARED TO
MANIPULATION OF BOTH THE ASYMPTOMATIC AND
SYMPTOMATIC SACROILIAC JOINTS IN THE TREATMENT OF
UNILATERAL SACROILIAC SYNDROME**

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Technology in partial compliance with the requirements for the Master's Degree in
Technology: Chiropractic**

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DEDICATION

I dedicate this to my family, without whose love and support
I would not have been able to achieve my dream.

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ABSTRACT

Low back pain (LBP) is a significant public health problem that has had a marked impact on quality of life and on health care costs (Weiner, et al. 2000:450). Toussaint, et al. (1999:134) established that the prevalence of sacroiliac joint dysfunction in the population has been noted in the medical literature to be between 19.3% and 47.9%. There is a lack of consensus among medical practitioners, chiropractors, osteopaths, physiotherapists and others as to the most appropriate therapy or management for sacroiliac syndrome.

This study was designed to determine the effectiveness of manipulation of the symptomatic sacroiliac joint compared to manipulation of both the symptomatic and the asymptomatic sacroiliac joints in the treatment of unilateral sacroiliac syndrome.

Anecdotal evidence would seem to indicate that the direction of the chiropractic manipulation is immaterial to clinical improvement (Till, 1994). Bilateral manipulation of the symptomatic and asymptomatic joints has been used in clinical practice in an attempt to increase the efficacy of chiropractic management for unilateral sacroiliac joint syndrome (Till, 1994, Lewis, 2001 and Nook, 2000).

Walker (1992:914) was of the opinion that "Unless reliability and validity of assessments and effectiveness of treatment procedures can be demonstrated, clinicians should temper their claims of measurement of, and direct effects on, the sacroiliac joint."

This randomized, comparative clinical trial consisted of sixty voluntary subjects each suffering from sacroiliac joint syndrome. There were two groups of thirty subjects, each of whom received five treatments within a three week period. Group one received manipulation of the symptomatic sacroiliac joint

alone, whilst group two received manipulation of both the symptomatic and asymptomatic sacroiliac joints.

The outcome measures included the response of the subjects to the Numerical Pain Rating Scale-101 and the Revised Oswestry Low Back Pain Disability Questionnaire. Objective data was gathered from the Orthopaedic Rating Scale and digital Algometer measurements. Data was collected prior to the initial treatment, before the third treatment and after the fifth treatment.

Statistically both groups showed improvements, subjectively and objectively, with regards to sacroiliac joint syndrome. Inter-group findings indicated that a slight difference existed in favour of the bilateral manipulation group, however this was not statistically significant for all the outcome measures.

TABLE OF CONTENTS

CHAPTER ONE	1
1.1. Introduction.	1
1.2. Objectives of the study.	2
CHAPTER TWO	3
2.1. Introduction.	3
2.2. Incidence of sacroiliac joint syndrome.	3
2.3. The sacroiliac joint syndrome.	5
2.4. Diagnosis of sacroiliac joint syndrome.	5
2.5. Anatomy of the sacroiliac joint.	9
2.5.1. Introduction.	9
2.5.2. Developmental anatomy.	9
2.5.3. Surface texture.	10
2.5.4. Ligamentous anatomy.	11
2.5.5. Muscles of the sacroiliac joint.	12
2.5.6. Innervation of the sacroiliac joint.	13
2.6. Biomechanics and functions of the sacroiliac joint.	15
2.6.1. Kinematics.	15
2.6.2. Kinetics.	17
2.7. Mechanism of sacroiliac syndrome.	18
2.8. Treatment of sacroiliac syndrome.	19
2.9. Chiropractic manipulation in sacroiliac joint syndrome.	21

CHAPTER THREE	24
3.1. Introduction.	24
3.2. The data.	24
3.2.1. The primary data.	24
3.2.2. The secondary data.	25
3.3. The subjects.	25
3.4. Inclusion and exclusion criteria.	25
3.5. Ethical considerations.	27
3.6. The Sample Group.	27
3.7. Measurements.	28
3.7.1. Subjective measurements.	28
3.7.1.1. Numerical Pain Rating Scale.	28
3.7.1.2. Revised Oswestry Low Back Disability Index.	29
3.7.2. Objective measurements.	30
3.7.2.1. The Algometer.	30
3.7.2.2. Orthopaedic Rating Scale.	31
3.7.2.3. Orthopaedic tests.	32
3.8. Interventions.	32
3.8.1. Spinal manipulative therapy.	32
3.8.2. Manipulation.	32
3.9. Statistical analysis.	33
3.9.1. Comparison between independent samples.	33
3.9.2. Comparison between related samples.	33
3.9.3. Hypothesis testing and the decision rule.	34

CHAPTER FOUR- THE RESULTS	35
4.1. Introduction	35
4.2. Inter-group analysis of the subjective data.	37
4.2.1. Analysis of the Oswestry scores.	37
4.2.2. Analysis of the NRS scores readings.	37
4.3. Inter-group analysis of the objective data.	38
4.3.1. Analysis of the ORS scores.	38
4.3.2. Analysis of the Algometer readings.	38
4.4. Intra-group analysis of the subjective data for group 1.	40
4.4.1. Analysis of the NRS scores.	40
4.4.2. Analysis of the Oswestry scores.	41
4.5. Intra-group analysis of the subjective data for group 2.	44
4.5.1. Analysis of the NRS scores.	44
4.5.2. Analysis of the Oswestry scores.	45
4.6. Intra-group analysis of the objective data for group 1.	48
4.6.1. Analysis of the ORS scores.	48
4.6.2. Analysis of the Algometer readings.	49
4.7. Intra-group analysis of the objective data for group 2.	53
4.7.1. Analysis of the ORS scores.	53
4.7.2. Analysis of the Algometer readings.	54
4.8. Descriptive statistics.	58
4.8.1. Explanation of recruitment of patients.	58
4.9. Demographic data.	59

CHAPTER FIVE – DISCUSSION	66
5.1. Introduction.	66
5.2. Intra-group results.	66
5.2.1. NRS-101.	66
5.2.2. The Revised Oswestry Low Back Pain Disability Index.	67
5.2.3. The Orthopaedic Rating Scale.	67
5.2.4. The Algometer readings.	68
5.3. Inter-group results.	69
5.3.1. NRS-101.	69
5.3.2. The Revised Oswestry Low Back Pain Disability Index.	69
5.3.3. The Orthopaedic Rating Scale.	69
5.3.4. The Algometer readings.	70
5.4. Comparison of the results.	70
5.5. Summary.	71
CHAPTER SIX – RECOMMENDATIONS AND CONCLUSIONS	72
6.1. Recommendations.	72
6.2. Conclusion.	74
REFERENCES.	75

LIST OF TABLES

Table 1. Comparison of the Oswestry scores, of the final visits, of groups one and two using the Mann-Whitney U-test.	37
Table 2. Comparison of the NRS scores, of the final visits, of groups one and two using the Mann-Whitney U-test.	37
Table 3. Comparison of the ORS scores, of the final visits, of groups one and two using the Mann-Whitney U-test.	38
Table 4. Comparison of the Algometer readings of the symptomatic side between groups after the final visit using the Mann-Whitney U-test.	38
Table 5. Comparison of the Algometer readings of the asymptomatic side between groups after the final visit using the Mann-Whitney U-test.	39
Table 6. Comparison of NRS means between the initial, 3 rd and final visits.	40
Table 7. Comparison of NRS scores between the initial, 3 rd and final visits using Friedman's T-test.	40
Table 8. Comparison of the Oswestry means between the initial, 3 rd and final visits.	41
Table 9. Comparison of the Oswestry scores between the initial, 3 rd and final visits using Friedman's T-test.	42
Table 10. Comparison of NRS means between the initial, 3 rd and final visits.	44
Table 11. Comparison of the NRS scores between the initial, 3 rd and final visits, using Friedman's T-test.	44
Table 12. Comparison of the Oswestry means between the initial, 3 rd and final visits.	45
Table 13. Comparison of the Oswestry scores between the initial, 3 rd and final visits using Friedman's T-test.	46
Table 14. Comparison of the ORS scores of group 1 between the initial, 3 rd and final visits.	48
Table 15. Comparison of the ORS scores between the initial, third and final visits using Friedman's T-test.	48
Table 16. Comparison of the Algometer reading means, of group 1, of the symptomatic side between the initial, 3 rd and final visits.	49
Table 17. Comparison of the Algometer readings between the initial, third and final visits using Friedman's T-test.	50

Table 18. Comparison of the Algometer reading means, of group 1, of the asymptomatic side between the initial, 3 rd and final visits.	51
Table 19. Comparison of the Algometer readings between the initial, third and final visits using Friedman's T-test.	51
Table 20. Comparison of the ORS mean scores of group 2, between the initial, third and final visits.	53
Table 21. Comparison of the ORS scores between the initial, third and final visits using Friedman's T-test.	53
Table 22. Comparison of the Algometer reading means of group 2, of the symptomatic side between the first, third and final visits.	54
Table 23. Comparison of the Algometer readings between the initial, third and final visits using Friedman's T-test.	55
Table 24. Comparison of the Algometer reading means of group 2, of the asymptomatic side between the first, third and final visits.	56
Table 25. Comparison of the Algometer readings between the initial, third and final visits using Friedman's T-test.	56

LIST OF FIGURES

Figure 4.1. Pie chart of gender.	59
Figure 4.2. Pie chart of age.	59
Figure 4.3. Pie chart of race.	60
Figure 4.4. Pie chart depicting the symptomatic sacroiliac joint.	60
Figure 4.5. Bar graph of mean ORS scores.	61
Figure 4.6. Bar graph of mean algometer readings (symptomatic side).	61
Figure 4.7. Bar graph of mean algometer readings (asymptomatic side).	62
Figure 4.8. Bar graph of mean oswestry scores.	62
Figure 4.9. Bar graph of mean NRS scores.	63

LIST OF APPENDICES

APPENDIX A. Numerical pain rating scale-101.	86
APPENDIX B. Revised Oswestry low back disability questionnaire.	87
APPENDIX C. Algometer readings and orthopaedic rating scale.	88
APPENDIX D. Case history.	89
APPENDIX E. Physical examination.	90
APPENDIX F. Low back regional examination.	91
APPENDIX G. Letter of information.	92
APPENDIX H. Informed consent form.	93

DEFINITION OF TERMS

Adjustment

A manual maneuver specific in direction, point of contact, amplitude, and velocity intended to partly or wholly correct a subluxation (Redwood, 1997:333).

Afferent impulse

The sensory function of neural elements (Redwood, 1997:333).

Anatomic barrier

The limit of anatomic integrity or movement, as imposed by an anatomic structure; forced movement beyond this barrier results in damage to the limiting tissues (Redwood, 1997:333).

Biomechanics

The application of mechanical principles to living structures (Redwood, 1997:334).

Compensation

The counterbalancing of a defect in structure or function (Redwood, 1997:335).

Contraindication

Any symptom or circumstance denoting the inappropriateness of a form of treatment that would otherwise be advisable (Redwood, 1997:335).

Efferent impulse

The motor or other effector function of a neural element (Redwood, 1997:336).

Facilitation

Lowered threshold for firing in a spinal cord segment, resulting from afferent bombardment associated with spinal lesions (Redwood, 1997:337).

Hypomobility

Restriction of joint movement; the fixation component of a subluxation (Redwood, 1997:338).

Hypermobility

Excessive joint movement, often involving laxity of ligaments (Redwood, 1997:338).

Incidence

A rate which refers to the number of persons with new back pain occurring over a given time period among a known number of persons who were previously without back pain (Giles and Singer, 1997:18).

Joint dysfunction

Joint mechanics showing functional disturbances without structural changes (Redwood, 1997:338).

Joint fixation (restriction)

The temporary immobilization of a joint in a position that it may normally occupy during any phase of normal movement (Redwood, 1997:338).

Kinematics

The complex study of motion of body parts and forces causing motion (with emphasis on displacement, acceleration, and velocity) that is mainly the result of muscle activity (Schafer and Faye, 1989:30).

Kinetic chain

The orderly function of all musculoskeletal structures required to perform an activity (Redwood, 1997:338).

Kinetics

The study of the rate of change of a specific factor in the body that disregards the cause of the motion (Schafer and Faye, 1989:30).

Manipulation

A passive manual maneuver during which a joint is quickly brought beyond its restricted physiologic range of movement and beyond its elastic barrier, without exceeding the boundaries of anatomic integrity (Redwood, 1997:339).

Manual therapy

Procedures by which the hands directly contact the body to treat the articulations of soft tissues (Redwood, 1997:339).

Mechanoreceptor

A receptor that is excited by mechanical pressures or distortions, as those responding to sound, touch and muscular contractions (Redwood, 1997:339).

Nociceptor

A receptor preferentially sensitive to a noxious stimulus or to a stimulus that would become noxious if prolonged (Redwood, 1997:341).

Palpation

Manual examination of a body part (Redwood, 1997:342).

Physiologic barrier

The end point of a joints active range of motion (Redwood, 1997:342).

Prevalence

The number of persons who have experienced back pain ever, even if they are not affected at present (Giles and Singer 1997:18).

Sacroiliac joint

A true diarthrodial joint formed by articulations between the right and left articular portions of the sacrum and the right and left iliac bones (Mior, Ro and Lawrence, 1999:209).

Subluxation

An alteration of alignment, movement, integrity and or physiologic function of a motion segment, while the joint surfaces remain in contact; resulting neurophysiological disturbance may be local or widespread (Redwood, 1997:343).

CHAPTER ONE: INTRODUCTION

1.1. Introduction.

Sacroiliac syndrome has been described as pain and decreased mobility of the sacroiliac joint resulting from mechanical derangement of the sacroiliac joint (Burton and Cassidy, 1992:418).

Sacroiliac syndrome is a relatively common disability affecting a large percentage of society. A study done by Bernard and Kirkaldy-Willis (1987:2107-2130) showed that the sacro-iliac joint was the primary source of low back pain in 22.5% of 1293 patients presenting with back pain. Yet despite this high incidence, the sacroiliac joint is still commonly viewed as an "enigma" by medical practitioners (McCulloch and Transfeldt, 1997:180).

Motion palpation is generally used by chiropractors to identify a manipulable lesion despite many clinical trials proving the interexaminer unreliability of this method (Harrison, Harrison and Troyanovich, 1997:613). Unilateral manipulation of the symptomatic sacroiliac joint is used by chiropractors to reduce pain in patients. Harrison, Harrison, and Troyanovich (1997:616), stated that in a review of the medical literature it was found that present chiropractic manipulation techniques, two-dimensional X-ray listings and motion palpation of the sacroiliac joints were insufficient in the diagnosis and treatment of dysfunctions in this region.

According to Vleeming, Pool-Goudzwaard, Stoeckart, van Wingarden and Snijders, (1995:753) pain in the area of the sacroiliac joints is not necessary a local problem, it can be symptomatic of a failed load transfer system between the spine and lower extremities. This load transfer system is made up of both sacroiliac joints, intervening soft tissues, the sacrum and pelvis.

Greatly contrasting theories as to the nature of sacroiliac syndrome exist, including joint immobility, hypomobility and hypermobility, nonetheless, a

growing body of evidence suggests that chiropractic manipulation is effective in the management of sacroiliac syndrome (Cooperstein, et al. 2001:410).

Bilateral manipulation of both the symptomatic and asymptomatic joints has been used in clinical practice in an attempt to increase the efficacy of chiropractic management for unilateral sacroiliac joint syndrome (Till, 1994, Lewis, 2001 and Nook 2000) and yet no existing clinical trial exists to document the results of this approach.

1.2. Objectives of the study.

The aim of this investigation is to evaluate the effectiveness of manipulation of the symptomatic sacroiliac joint compared to manipulation of both the asymptomatic and symptomatic sacroiliac joints, in terms of subjective and objective clinical findings in the treatment of unilateral sacroiliac syndrome.

The first objective is to determine the effectiveness of manipulation of the symptomatic sacroiliac joint compared to manipulation of both the asymptomatic and symptomatic sacroiliac joints, in terms of objective clinical findings, in the treatment of unilateral sacroiliac syndrome.

The second objective is to determine the effectiveness of manipulation of the symptomatic sacroiliac joint compared to manipulation of both the asymptomatic and symptomatic sacroiliac joints, in terms of subjective clinical findings, in the treatment of unilateral sacroiliac syndrome.

CHAPTER TWO: REVIEW OF THE RELATED LITERATURE

2.1. Introduction.

The review of the related literature will describe: the incidence of sacroiliac joint syndrome in relation to low back pain; the definition and diagnosis of sacroiliac joint syndrome; the anatomy and biomechanics of the sacroiliac joint and the mechanism of sacroiliac joint dysfunction.

2.2. Incidence of sacroiliac joint syndrome.

Low back pain (LBP) is a significant public health problem that has had a marked impact on quality of life and on health care costs (Weiner, et al. 2000:450).

Mechanical low back pain is a major health problem among general populations in Western, industrial countries and a significant cause of medical expenses, absenteeism and disablement (Van Tulder, Koes and Bouter, 1997:2128).

In a study done in Southern Africa, Zeleke Worku (2000) analysed the incidence of low back pain in a random sample of 4001 mothers from the Maseru district in Lesotho. A total of 405 (10.12%) of the 4001 mothers in the study had severe low back pain at the time of data collection, 513 (12.82%) had moderate low back pain, and 1422 (35.54%) had mild low back pain. The lifetime incidence of low back pain in Indian and Coloured communities in South Africa was found to be 78.2% and 76.6% respectively (Docrat, 1999), whilst in the formal black settlement of Chesterville the prevalence of low back pain was found to be 53.1% (Van der Meulen, 1997). The p values for the three studies above were set at a 0.05 confidence interval.

People who have low back pain and associated conditions experience significant restrictions on their activities (Weiner, et al. 2000:450).

In a cross-sectional analytical study, Schwarzer, April and Bogduk, (1995:31-37) established the sacroiliac joint to be a significant source of pain in patients with chronic low back pain (13 out of 43 patients with a p value of 0,004). The sacroiliac joint was considered to be the source of pain if the patients exhibited a 75% reduction in pain after the intra-articular administration of 2% lignocaine (diagnostic block). Only patients with unilateral pain were considered for this analysis and the side of referred pain had to coincide with the side of injection.

Toussaint, et al. (1999:134) confirmed that the prevalence of sacroiliac joint dysfunction in the population has been noted in the medical literature to be between 19.3% and 47.9%, depending on the variables (age, sex, level of physical fitness, employment and degree of education in the study group).

Gemmel and Jacobson (1990:63-66) conducted a study to determine the incidence of sacroiliac joint dysfunction in fit college students in the United States. Their results showed that 26.5% indicated a history of low back pain with 19.3% being shown to have unilateral or bilateral sacroiliac joint dysfunction (p value of 0.05). Females had a higher incidence of low back pain than males and white students had a higher incidence than black students. Cibulka and Koldehoff (1999:92) reported a predominance of sacroiliac syndrome in females when compared to males, with a ratio of 3:1. This was in contrast to a comparative, randomised, controlled trial on sacroiliac syndrome done by Sawyer (2001:82) in which she found no trend favouring a male or female distribution of patients.

Although no epidemiological study exists to show definitively the prevalence of sacroiliac syndrome within the population of South Africa, with such a high prevalence of low back pain in this country, as in the rest of the world, it would seem a fair assumption (based on the studies in other countries above) that sacroiliac joint syndrome contributes significantly to these numbers and hence further research into the effective management of this condition is required.

2.3. The sacroiliac joint syndrome.

Sacroiliac joint syndrome or dysfunction is a collection of signs and symptoms that is thought to result from a mechanical derangement of the sacroiliac joint (Burton and Cassidy, 1992:418). Generally pain from the sacroiliac joint can be referred to the buttock, groin, anterior and posterior proximal thigh (DeFranca, 1996:91).

Daum (1995:475) defined sacroiliac dysfunction as "...an acquired mechanical instability, with no history of major trauma, which leads to fixed subluxation or hypermobility of the joint." He went on further to state that certain activities such as stair climbing and cycling may aggravate the pain of sacroiliac syndrome, and that a symptomatic patient frequently shows sitting intolerance, favouring the uninvolved side.

2.4. Diagnosis of sacroiliac joint syndrome.

Hertling (1997:707) described five typical characteristics of patients presenting with sacroiliac syndrome which included: unilateral sacroiliac joint pain, local to the joint itself, but possibly referring down the leg (posterolaterally); the absence of lumbar articular signs or symptoms; a short period of morning stiffness that eases with movement and weight bearing; increased pain with prolonged postures (sitting or standing); and pain aggravated by walking, rolling over in bed and climbing stairs.

McCulloch and Transfeldt (1997:180) proposed a similar set of clinical findings that they found were typical of sacroiliac joint syndrome presentation, including: pain over the sacroiliac joint which is tender to palpation and aggravated by provocation tests; referral of pain to the groin, trochanter and buttock; an idiopathic nature as to the cause of the pain; and clinical evidence of increased movement or asymmetry of the sacroiliac joints.

The diagnosis is usually confirmed by stressing the joint using the Patrick Faber test, Gaenslen's test, Yeoman's test (Kirkaldy-Willis, 1992:123-124) and the posterior shear test (Laslett and Williams, 1994).

1) Posterior shear or "thigh thrust test"

The patient is positioned supine. The examiner is positioned on the left side for a suspected right sacroiliac syndrome. The right hip and knee is flexed and slightly adducted. The examiner places the left hand under the right sacroiliac joint while exerting a posterior shearing force downward on the right knee through the femur, while feeling for joint motion with the opposite hand. A positive test is recorded if this position elicits pain over the region of the right sacroiliac joint (Laslett and Williams, 1994:1244).

2) Gaenslen's test

The patient is positioned supine. The examiner flexes the patient's left knee and hip, while pressing downward over the right thigh to hyperextend the right hip. A positive test is recorded if this position elicits pain over the region of the right sacroiliac joint (Kirkaldy-Willis, 1992:125)

Laslett and Williams (1994:1246) evaluated the interexaminer reliability of Gaenslen's and the Posterior shear test (Thigh Thrust test) and found an 88.2% and 94.1% reliability of these tests respectively. Hendler, et al. (1995:173) reported that Gaenslen's test was frequently positive on examination of a patient with sacro-iliac joint dysfunction.

3) Patrick Faber test

The patient is positioned supine. The right leg, near the ankle is placed above the knee on the left thigh. The examiner places his right hand over the patient's left iliac crest, while the examiners left hand pushes downward on the medial aspect of the right knee. A positive test is recorded if this position elicits pain over the region of the right sacroiliac joint (Kirkaldy-Willis, 1992:125).

The Posterior shear and Patrick Faber tests were evaluated by Broadhurst and Bond (1998:341-345) to determine their specificity for sacroiliac joint dysfunction. The conclusion of this double-blind trial was that these tests exhibit a high degree of sensitivity (77%) and specificity (100%) in the diagnosis of sacroiliac joint dysfunction. In their opinion the use of other pain provocation tests in conjunction with the two tested would "add to the physicians diagnostic capabilities".

4) Yeoman's (Erickson's) test

The patient is positioned prone. The examiner places one hand under the right thigh above the knee on the affected side, to extend the right hip. The examiners other hand presses downward over the crest of the right ilium. A positive test is recorded if this position elicits pain over the region of the right sacroiliac joint (Kirkaldy-Willis, 1992:125).

Panzer and Gatterman (1995:460) described a high degree of reliability when using Yeoman's test to diagnose sacroiliac joint dysfunction. Van der Wurff, Hagmeijer and Meyne (2000:30-36) conducted a methodological review concerning the reliability of eleven clinical tests of the sacroiliac joint. The authors concluded that there was no evidence to support the use of mobility tests for the diagnosis of sacroiliac syndrome, but accepted the reliability of both Gaenslens and Erickson's (Yeoman's) tests to demonstrate provocation of sacroiliac joint pain.

Two of the most common methods used by chiropractors to diagnose sacroiliac joint dysfunction, namely the Gonstead Listing System (a static radiographic listing system) and motion palpation, have been excluded from this study.

Laslett (1997:288) felt that pain provocation tests (that mechanically stress the sacroiliac joint), had a better potential, than motion palpation tests, when diagnosing sacroiliac syndrome, since the symptoms that led the patient to seek treatment were being used to indicate positivity or negativity of the tests.

Dorman and Vleeming (1995:416) stated that "manual palpation has not yet yielded inter-observer consistency in measurements that are satisfactory for statistical analysis". Motion palpation is performed with the purpose of identifying asymmetrical motion. Harrison, Harrison and Troyanovich (1997:613) however contend that "even if asymmetrical motion could be determined solely from palpatory methods (which is unlikely), there is evidence to suggest that this may actually be a normal finding because of anatomical form differences from the left to right joint in the same individual". In the same literature review, these authors go on to also question the validity of the Gonstead Listing System. In a randomised clinical trial, Moorcroft (1997:41) found that the use of x-rays and the Gonstead Listing System for determining sacroiliac dysfunction held no reliability and was not recommended.

Gillet's test (also called the standing hip flexion test) has been used frequently by chiropractors to analyze sacroiliac joint mobility. Stureson, Uden and Vleeming (2000:364) analyzed twenty-two patients, considered to have sacroiliac pain, with radiostereometric (flourescopic examination of Tantalum balls inserted into each ilium and the sacrum) analysis when standing and when performing Gillet's test on the right and left sides. Their results showed that movements in the sacroiliac joint during Gillet's test were so negligible, 1.1° around the x-axis, that external detection by manual methods was virtually impossible.

2.5. Anatomy of the sacroiliac joints.

2.5.1. Introduction.

The two auricular shaped sacroiliac joints are formed by articulations between the right and left articular portions of the sacrum and the right and left iliac bones. The two sacroiliac joints make up an integral part of and add stability to the pelvic ring (Giles and Singer, 1997:411).

The sacroiliac joint is a true diarthrodial joint because it contains synovial fluid and matching articular surfaces. It is formed by the articulation between the sacrum and the anteromedial aspect of the ilium. The bony elements of the joint include specifically the posterolateral aspect of the sacral ala at the level of the first and second sacral segments and the anteromedial surface of the ilium adjacent to the posterior inferior iliac spine (Mior, Ro and Lawrence, 1999:209).

The sacroiliac joint is unique in that hyaline articular cartilage faces and moves against "fibrocartilage". On the sacral side the collagen fibres of the hyaline cartilage are aligned parallel to the joint only in the most superficial layer. This is consistent with the other articular surfaces in the body. On the side of the iliac cartilage, which is thinner, the chondrocytes are arranged in palisades and clumped together between bundles of collagen fibres that are all orientated perpendicular to the joint surface. Although this collagen is type II, typical of hyaline cartilage, it gives the appearance of fibrocartilage (Mooney, 1997:37).

2.5.2. Developmental anatomy.

The developmental anatomy of the sacroiliac joint is unique and offers an explanation for some of the unique characteristics of this joint. Walker (1986:326) found that cavitation (initial formation of a true joint space) of the sacroiliac joint occurs in the tenth week of intrauterine life and is not well

established until the second trimester. Most human joints cavitate by eight weeks of gestation. Normally, opposing surfaces of synovial joints develop between two cartilage anlagens (primary growth centers). As the joint matures these cartilage growth models ossify, forming the primary centres of ossification, and leaving a gap to form the articular surfaces of the joint (Bernard, 1997:73). However, in the sacroiliac joint, the adjacent ilium has already ossified by the time the sacroiliac joint has cavitated (10th week), so the newly formed sacroiliac joint develops between a hyaline cartilage model and the newly ossified ilium. According to Cassidy (1994:24) this is significant in that it allows for unequal chondrogenesis and may explain the differences in the appearance of the cartilagenous surfaces of the sacroiliac joint.

Throughout this initial developmental period to the age of approximately eighteen years, the sacral vertebrae and pelvic bones remain separated by cartilagenous regions which gradually ossify. Gotz (1993:132) established that synostosis occurs after the age of eighteen and is completed by the twenty-fifth year, at which time the sacroiliac joint has completely acquired adult morphology.

Marginal ankylosis may begin after the fourth decade once the cartilagenous elements of the joint become thinned (Mior, Ro and Lawrence, 1999:214). In most individuals mobility in the sacroiliac joint is lost by the eighth decade as a result of bony ankylosis.

2.5.3. Surface texture.

In a detailed study of sacroiliac joint surfaces in 200 cadavers, Ruch (1997:324) established that the surfaces showed irregularities, that variations existed between cadavers and that side to side differences in the same specimen were present. The surface irregularities were found to always be reciprocal in form; i.e. an elevation of the sacrum fits a depression on the ilia and vice versa. Based on a literature review, Harrison, Harrison and Troyanovich (1997:608) stated that these ridges and depressions varied in height, were numerous and were orientated in different directions. They went on further to conclude that these ridges were "a nonpathological adaptation to

increased stress at the joints that restrict mobility and increase the stability of the joint in transmitting weight from the spine to the lower limbs."

The articular surfaces of the female sacroiliac joints are smaller, flatter and smoother than that in the male (Vleeming et al, 1990:130). They concluded that these differences were linked to function, specifically, parturition in women.

2.5.4. Ligamentous anatomy.

Mior, Ro and Lawrence (1999:214), and Harrison, Harrison and Troyanovich (1997:609), described the ligaments serving the sacroiliac joint as follows: "They are some of the largest in the body and may be broken down into intrinsic and extrinsic ligaments."

The fibrous capsule of the sacroiliac joint is strengthened anteriorly and posteriorly by the intrinsic capsular ligaments:

- a) The anterior sacroiliac ligament is an anterior inferior thickening of the joint capsule. Its fibers, which are thin superiorly and become progressively thickened inferiorly, attach horizontally across the joint. This ligament opposes translation of the sacrum up or down and separation of the joint surfaces.
- b) The posterior sacroiliac ligament covers the interosseous ligament and may branch into a long and short posterior sacroiliac ligament. This ligament attaches medially to the sacral tuberosity, runs laterally and attaches superiorly to the posterior superior iliac spine. This ligament functions to counteract gravitational forces and prevent distraction of the sacroiliac joint.
- c) The interosseous sacroiliac ligament is a thick ligament filling the irregular spaces posterior and superior to the joint. This is the largest syndesmosis in the body and the strongest connection in this region. This ligament strongly resists joint separation and translations along the vertical and anteroposterior planes.

The iliolumbar, sacrotuberous, sacrospinous and pubic symphysis ligaments are extrinsic to the fibrous capsule of the sacroiliac joint, however they do assist in stabilizing the joint:

- a) The iliolumbar ligaments run from the transverse processes and body of the fifth lumbar vertebra to attach along the superior border of the iliac crest. It functions to limit all motions between the distal lumbar spine and sacrum.
- b) The sacrotuberous ligament fibers attach to the anterolateral border of the sacrum and run laterally and anteriorly to reach the ischial spine. This ligament functions to resist sacral flexion rotation.
- c) The sacrospinous ligament is a thin triangular ligament which also counteracts sacral flexion rotation.
- d) The pubic symphysis is composed of three ligaments, namely: the superior pubic, arcuate pubic and interpubic. It resists shear stresses, anterior sacral rotation and joint separation.

Willard (1995:340) states that " this complicated ligamentous structure plays a key role in the self-bracing mechanism of the pelvis, a mechanism that maintains the integrity of the low back and pelvis during transfer of energy from the spine to the lower extremity."

2.5.5. Muscles of the sacroiliac joint.

Bernard and Cassidy (1991:2115) note that anatomically the sacroiliac joint is surrounded by "...some of the largest and most powerful muscles of the body, but these have no direct influence on joint motion." Because the sacroiliac joint has no intrinsic muscle of its own, its movement occurs through various mechanisms: The sacrum moves when the spinal column changes position, and the ilium moves when the lower extremities change position. Bernard and Cassidy (1991:2117) concluded that although displaying no "direct influence", muscles do indeed play an important role in sacroiliac joint motion.

Mior, Ro and Lawrence (1999:216) assessed that the sacroiliac joint movements were created by three basic groups of muscles:

- a) The muscles that flex, extend, or rotate the vertebral column, moving the sacrum.
- b) The muscles that flex, extend, abduct, adduct, supinate and pronate the thigh, moving the ilium.
- c) The muscles that tilt the pelvis anteriorly, posteriorly moving the sacrum, and tilt right or left laterally, moving the ilium.

Included amongst these muscle groups are the erector spinae, multifidus, iliopsoas, gluteus maximus, piriformis, hamstrings, sartorius and the rectus abdominus muscles.

2.5.6. Innervation of the sacroiliac joint.

Innervation of the sacroiliac joint is highly variable from person to person and even from side to side in the same individual (Solonen, 1957:160). According to Mooney (1997:41), the synovial capsule of the sacroiliac joint and overlying ligaments have many unmyelinated free nerve endings that transmit pain and temperature sensation.

The sacroiliac joint capsule is also innervated by complex nerves providing pressure and position sense to the central nervous system. Posteriorly, the capsule and ligaments are innervated by articular branches of the posterior primary rami from S1 and S2, and anteriorly articular branches of the anterior primary rami from L3 to S2 are involved (Ombregt, et al. 1995:691).

Maitland, et al. (2001:384) described the sacroiliac joint as having a diverse and extensive innervation from L2 to S4. They went on to conclude that this may partly account for the inconsistency and variability in suggested sacroiliac joint pain patterns.

According to Hilton's law, any nerve crossing a joint gives a branch to that joint (Hollinshead, 1982:210). Bernard and Cassidy (1991:2111) summarized that two types of articular nerves existed: a specific type reaching the joint capsule as independent branches of peripheral nerves and nonspecific articular branches that are derived from muscles overlying a particular joint. They stated that "...these articular nerves are thought to have a unique feedback mechanism on the overlying muscles, which receive the same

innervation. This arthrokinetic reflex exists because articular mechanoreceptors regulate muscle tone."

Recently this theory has gained substantial support by the publication of a study by Indahl et al. (1999:325-330) in which they described the regulatory function of the sacroiliac joint on reflex muscle activation. Ten domesticated pigs were used to demonstrate how stimulation of nerves in the ventral sacroiliac joint activated contractions in the gluteus medius and quadratus lumborum muscles, while stimulation of the dorsal sacroiliac joint capsule activated contractions in the multifidus muscle fibres nearest the joint.

2.6. Biomechanics and functions of the sacroiliac joint.

The biomechanics of the sacroiliac joint are difficult to study due to direct palpation and access being impossible and its variable shape and symmetry making modeling complicated (Zheng, YongKing and Watson, 1996).

2.6.1. Kinematics.

Ombregt, Bisschop and Ter Veer (1995:692) conceded that there was a general lack of agreement on movements of the sacroiliac joint. They elaborated that these movements "... are small and vary according to the subject. The precise nature of motion in the normal joint is still unclear, and joints such as the sacroiliac joint with extensive ridges and depressions, can be expected to have a very limited amount of mobility."

Harrison and Troyanovich (1997:607) stated that the wedged structure of the sacrum, coarse surface textures, symmetrical ridges and depressions, and several of the strongest ligaments in the body all added to the stability and limited mobility of the sacroiliac joint. They suggested that the above mentioned individual components should be considered a complex integrated system that provides stability while allowing limited mobility.

Both *in vivo* and *in vitro* kinematic studies have demonstrated various types of minor motions in the sacroiliac joints, such as gliding, rotation, tilting, nodding and translation (Ombregt, Bisschop and Ter Veer, 1995:692). Panzer and Gatterman (1995:453-465) described between three and five degrees of motion having been demonstrated in both cadaver specimens and living subjects. They considered translation and rotation as normal movements within the sacroiliac joint and surmised that these extra movements enhanced the shock absorbing quality of the joint.

According to Stureson (1997:174), roentgen stereophotogrammetric analysis (RSA), a computerised system for the exact radiographic localisation of landmarks in the human body, has "... taken the role as the gold standard in

determining mobility in orthopaedic research concerning growth, small movements in joints, and micromotion of arthroplasties." In a study done on twenty-five patients with sacroiliac joint disorders, he used RSA to demonstrate mobility in the sacroiliac joints. The RSA results revealed the following:

- a) Sacroiliac joint motions were very small, with average rotations of 2.5° and translation of 0.7mm.
- b) Sacroiliac joint mobility in men was on average 30-40% less than in women.
- c) Small differences occurred between patients with unilateral and patients with bilateral pain.

Wang and Dumas (1998:293-299) examined the mechanical behaviour of the sacroiliac joints in female cadavers. Lateral rotation and nutation rotation were found to be the predominant motion, limited to 1.2°, while translation was recorded up to 0.9mm.

Schaefer and Faye (1990:95), described sacroiliac joint motion in terms of upper and lower articulations. The lower section allows a slight sliding motion antero-inferiorly and postero-superiorly, as well as a rotating action, while the upper section offers relief to the relatively weak antero-superior sacroiliac ligaments. The upper articulation is at the level of the first sacral segment and the lower one is level with the third sacral segments. Schafer and Faye considered this important because, when functioning optimally these two articulations would act reciprocally. They stated that, "... if one joint becomes partially fixated, the contralateral side will only be able pivot around the abnormal axis of the fixated joint, with obvious biomechanical alterations."

2.6.2. Kinetics.

According to Mior, Ro and Lawrence (1999:221), the sacroiliac joint's position as a link in the kinetic chain between the spine and legs, makes it imperative that it has stability and mobility and yet be able to withstand the considerable forces affecting it. The sacroiliac joint's strategic location makes it susceptible to large downward shear loads ranging from 300 to 1750 N during daily activities (Miller, Schultz and Anderson, 1987:92). In a study done on cadaveric specimens, Gunterberg, Romanus and Stener (1976:635) reported that the sacroiliac joints had a mean downward shear strength of 4865 N. The flat orientation of the joint surfaces enables the sacroiliac joint to transfer great moments of force but it is extremely vulnerable from loads occurring in a direction parallel to the joint surface (Snijders, Vleeming and Stockhart, 1993:287). This vulnerability to shear forces may predispose the joint to subluxate superiorly; however this is prevented by the self-locking mechanism of the sacroiliac joint.

The self-locking mechanism of the sacroiliac joint, according to Mior, Ro and Lawrence (1999:221) is accomplished as a result of several unique characteristics of the sacroiliac joint and surrounding structures:

- a) The arch-like architecture of the pelvis complements easy locking.
- b) The joint's longitudinal dimension is twice that of the transverse, thus providing favourable resistance against bending moments along this plane.
- c) Grooves and ridges of the joint surfaces form a resistance to sliding.
- d) The higher friction coefficients in the joint, due to the rough-textured surfaces, resist movement.
- e) The corkscrew appearance of the joint created by different wedge angles in transverse sections at the cranial and caudal ends of the joint.
- f) The muscles and ligaments.

Mens et al. (1997:69) explained that according to the self-locking mechanism, resistance against shear results from the specific properties of the articular

surfaces of the sacroiliac joint (form closure) and from compression produced by body weight, muscle action and ligament force (force closure).

2.7. Mechanism of sacroiliac syndrome.

Tabar (1997:185) stated that controversy on the mechanism of dysfunction of the sacroiliac joint was evident and each system or author provided an explanation based on his own or adopted conceptual model. According to Dreyfuss, et al. (1994:1138) sacroiliac joint dysfunction can be either symptomatic or asymptomatic and the factor(s) that cause a dysfunctional joint to become painful remain elusive. Toussaint, et al. (1999:134) noted that the reasons why there are symptomatic and asymptomatic sacroiliac dysfunctions has yet to be sufficiently explained and consequently warrants further research into improved treatment protocols.

Vleeming, et al. (1990:130) have stated that: "abnormal loading conditions could theoretically force the sacroiliac joint in a new position where ridges and depressions are no longer complementary. Such an abnormal joint position could be regarded as a blocked joint." Hendler, et al. (1995:171) described the development of sacroiliac joint syndrome as a "wedging" of an irregular prominence of one articular surface upon the prominence of the opposed articular surface. They agreed with Vleeming and went on to state that because the ridges and depressions of the opposing surfaces were normally so congruent even a small abnormal load could lead to incongruency. They explained that the local ligaments then become taut, reflex muscle spasm occurs and thus the pain may become severe and continuous.

Hesch (1997:535) expanded this theory by stating that if the sacroiliac joint was hypomobile it would not effectively absorb stress from the activities of daily living and other structures would be over-stressed, thus contributing to musculoskeletal pain and dysfunction.

Gatterman (1990:114) described the sacroiliac joint like a typical vertebral-motion-segment, in which dysfunction may take the form of simple joint locking or simple joint locking with compensatory hypermobility in adjacent articulations. This compensatory hypermobility proposed by Gatterman would result in the contralateral sacroiliac joint, being subject to increased motion demands and possibly more prone to overload and subsequent inflammation and pain.

Based on the clinical practice of local chiropractors and a review of related literature, Hesch (1997:535) suggested that the sacroiliac joint was part of an integrated system and hence did not function in an isolated fashion. He elaborated further that it may be that mobility was evaluated and treated manually as part of the integrated system of the spine, pelvis and hip. Thus the absence of sacroiliac dysfunction relies heavily on optimal functioning of both sacroiliac joints as part of an integrated system and kinematic chain.

Osterbauer et al. (1993:82) claimed that movements in the sacroiliac joints were very small and that there was no difference in sacroiliac joint movement between the presumably "affected" versus the "normal" side. According to Vleeming, et al. (1995:753-758) pain in the area of the sacroiliac joints was not necessary a local problem, it could be symptomatic of a failed load transfer system between the spine and lower extremities. This load transfer system is made up of both sacroiliac joints, intervening soft tissues and the sacrum and pelvis.

2.8. Treatment of sacroiliac joint syndrome.

According to Hellmann and Stone (2000:819), the allopathic management of mechanical low back pain relies on two basic key elements: analgesia and education. They established that there is limited evidence to support the use of muscle relaxants such as diazepam, cyclobenzapine, corisprodol and methacarbamol and stated that corticosteroid injections into the facet joints are ineffective for chronic low back pain.

Cull and Will (1995:867) stated that chiropractic manipulation was superior to hydrotherapy and traction in patients with chronic low back pain. They elaborated that no controlled clinical trials existed to show that treatment with short wave diathermy, ultrasound, acupuncture or transcutaneous nerve stimulation had "...anything more than a placebo effect." Cull and Will (1995:867) also stated that surgery was required in less than 1% of patients with low back pain.

Daum (1995:478) reported on the inconsistent results of surgery in cases of sacroiliac syndrome and concluded that it should only be considered after all other conservative therapeutic modalities had failed. These therapies included sacroiliac belts (to provide added bracing for the sacroiliac joint), activity modification (to reduce forces acting on the sacroiliac joint), prescription of non-steroidal anti-inflammatory drugs (not recommended due to their common adverse side-effects), injection of local anesthetics or steroids (minimal usage is advocated only in extreme cases of a highly acute nature) and chiropractic manipulation.

In a critical review of the available randomized clinical trials, spinal manipulation was found to be more effective than other referenced treatments for acute and chronic low back pain (Mohseni-Bandpei, Richardson and Ali, 1998:185-194).

Van Toulde, Koes and Bouter (1997:2128-2138) assessed the effectiveness of the various interventions for the treatment of acute and chronic low back pain using a rating system for the strength of the scientific evidence. Five investigators of The Intercollegiate Panel of Advisors to the American Chiropractic Association's Council on Technique were asked to identify common chiropractic technique procedures used in the treatment of low back pain. Each panel member rated ten treatment procedures for eight low back conditions – rating for quality of literature and clinical effectiveness on a scale of 0 to 10. "Strong" evidence (scores of 7 out of 10 or higher) was found for the effectiveness of muscle relaxants for acute low back pain and for the

effectiveness of non steroidal anti-inflammatories for uncomplicated acute low back pain.

Regarding the treatment of chronic low back pain, "strong" evidence was found for the effectiveness of manipulation, back schools and exercise therapy.

They concluded by recommending the implementation of a multidisciplinary approach to the treatment of low back pain.

Hellmann and Stone (2000:819) went so far as to state that: "back manipulation for benign, mechanical low back pain appears safe and as effective as therapies provided by physicians."

2.9. Chiropractic manipulation in sacroiliac joint syndrome

Gatterman (1990:410), describes chiropractic manipulation as "...a passive manual manoeuver in which specifically directed manual forces are applied to vertebral and extra-vertebral articulations of the body, with the object of restoring mobility to restricted areas."

Herzog, Conway and Willcox (1991:104-109) compared the effects of spinal manipulative therapy (SMT) given by a chiropractor, to back school therapy (BST) given by a physiotherapist, on gait symmetry for patients with sacroiliac joint pain. The results of this study showed that BST was a better treatment in terms of subjective measures, however objective measures (gait analysis) showed that the SMT group had better results. A possible explanation for these results was that the subjects receiving BST underwent a longer treatment period which may have influenced the responses of the subjects in the BST group to the Oswestry and pain questionnaires. This study questions the reliability of the pain questionnaires in studies of a short duration.

According to a review article by Hendler, et al. (1995:169) "manipulation provides dramatic relief" in cases of sacroiliac syndrome. In a descriptive case

series with a 1 week baseline and 1 year follow-up, Osterbauer, et al. (1993:89) reported that pain decreased from a mean baseline value of 25 to 12 ($p < 0.05$) after unilateral manipulation of the sacroiliac joint in patients with sacroiliac dysfunction. They also stated that neither palpation for traditional sacroiliac joint fixations nor biomechanical analysis of gait or sway data (degree of pelvic tilt) proved helpful in identifying the manipulable lesion thereby possibly justifying manipulation of the traditionally "non-fixated" joint.

According to Shakelle (1994: 858-861), manipulation is performed to restore joint play to dysfunctional joints. He stated that it is thought to work by 1) releasing entrapped synovial folds or plica; 2) relaxing hypertonic muscles; and 3) disrupting articular or periarticular adhesions. Joint mechanoreceptors are thought to be stimulated during manipulation and this in turn creates reflexogenic muscle tone changes in the muscles that serve the joint (DeFranca 1996:295).

Vincenzino, et al. (1998:583) reported that spinal manipulation may produce hypoalgesia by activation of a central control mechanism, whilst Indahl, et al. (1997:2834-2840) postulated that spinal manipulation may produce a stretch reflex from joint capsules that may lead to inhibition of muscle spasm.

Dishman and Bulbulian (2000:2519-2525) evaluated the effect of lumbosacral spinal manipulation with thrust and spinal mobilization without thrust on the excitability of the alpha motoneuronal pool in 17 human subjects without low back pain. Their results showed that both spinal manipulation with thrust and mobilization without thrust significantly ($p < 0.05$) attenuated alpha motoneuronal activity, as measured by the amplitude of the gastrocnemius Hoffmann reflex. These findings tend to support the theory that manual spinal therapy procedures may lead to short-term inhibitory effects on the human motor system. These results also place doubt as to the importance of the specific contact point of chiropractic manipulation for the sacroiliac joints.

Anecdotal evidence would seem to indicate that the direction of the chiropractic manipulation is immaterial to clinical improvement (Till, 1994).

Bilateral manipulation of the symptomatic and asymptomatic joints has been used in clinical practice in an attempt to increase the efficacy of chiropractic management for unilateral sacroiliac joint syndrome (Till, 1994, Lewis, 2001 and Nook, 2000).

Walker (1992:914) was of the opinion that "Unless reliability and validity of assessments and effectiveness of treatment procedures can be demonstrated, clinicians should temper their claims of measurement of, and direct effects on, the sacroiliac joint."

In a recent review of the medical literature Cooperstein, et al. (2001:410) established that many studies, comprehensive reviews of literature and authoritative opinions existed that supported chiropractic care as safe, appropriate, clinically useful and cost effective compared with alternative treatments such as surgery, drug therapy, bed rest, physical therapy and patient instruction. They however concluded that "what we still do not know is which specific chiropractic treatment methods are most appropriate for specific clinical conditions."

Gattermann, et al. (2000:449-456) undertook a study to rate specific chiropractic technique procedures used in the treatment of common low back conditions. A panel of chiropractors rated these procedures for their effectiveness, based on the quality of supporting evidence after literature reviews and expert clinical opinion. They concluded that "much more evidence is necessary for chiropractors to understand which procedures maximally benefit patients for which conditions".

This study will serve to establish the efficacy of bilateral sacroiliac joint manipulation in the treatment of sacroiliac syndrome and help shed more light on the possible pathogenesis of this condition.

CHAPTER THREE: MATERIALS AND METHODS

3.1. Introduction.

This chapter gives a detailed description of the design, primary and secondary data, the subjects and interventions utilized. An overview of each questionnaire is discussed as well as the methods of statistical analysis and the process of evaluation of the data. The study design chosen was a randomized, comparative, clinical trial. This involved two treatment groups, one group receiving unilateral sacroiliac joint manipulation of the symptomatic sacroiliac joint, and the other bilateral sacroiliac joint manipulation of the symptomatic and asymptomatic sacroiliac joints. .

3.2. The Data.

The data consisted of primary and secondary data.

3.2.1. The primary data.

1. Patient's response to the Numerical Pain Rating Scale-101 (Appendix A) on their perception of change in the level of pain.
2. Patient's response to the Revised Oswestry Low Back Disability Questionnaire (Appendix B) on their perception of change of their disability.
3. Clinical observation of change in their condition as observed through objective measurement using the digital algometer pain/pressure meter (Appendix C).
4. Clinical observation using an Orthopaedic Rating Scale (Appendix C), involving a point system allocated to various orthopaedic stress tests, in order to assess the objective change in their condition.

3.2.2. The secondary data.

The secondary data consists of data obtained from various sources, including journal articles, books, medline and the internet, using the relevant search engines.

3.3. The Subjects.

Subjects were recruited from the greater Durban area by means of advertisements placed at local sports clubs, local schools, gyms and tertiary institutions, as well as advertising in local newspapers and newsletters. Sixty subjects were selected from those who responded, using convenience sampling (Willemse, 1990:14). No stratification of the subjects took place and they were accepted regardless of gender, occupation, race, severity or chronicity of the condition.

An initial telephonic interview was conducted and patients were only excluded from the study at this stage if they did not fit the age criteria or had undergone recent lumbar spinal surgery. All subjects were evaluated by means of a case history (Appendix D), the relevant physical examination (Appendix E), low back regional examination (Appendix F) and orthopaedic sacroiliac joint tests. A letter of information (Appendix G) was provided and a letter of informed consent was signed (Appendix H).

3.4. Inclusion and exclusion criteria.

- a) Only patients between the ages of 18 and 59 years of age were included in this study to avoid parental consent and the possibility of the development of fibrous ankylosis in the sacroiliac joint after the sixth decade (Kirkaldy-Willis and Burton, 1992:418), respectively.

- b) Any mechanical conditions associated with, but secondary to, sacroiliac syndrome (e.g. latent myofascial involvement, facet syndrome) were assessed and noted in the lower back regional examination, but no treatment for these conditions was administered.
- c) Subjects presenting with conditions that were contra-indicated to manipulation as stated by Kirkaldy-Willis and Burton (1992:291) i.e. destructive lesions of spine, ribs and pelvis, healing fracture or dislocation, gross instability, cauda equina syndrome, large abdominal aneurysm or visceral referred pain, were excluded from the study. These were excluded on the grounds of clinical history and examination, and no further investigations were performed (e.g. radiographs or scans).
- d) Patients presenting with lumbar spine facet syndrome as the primary causative factor, with the emphasis on the objective and subjective clinical signs in the lumbar spine, were not accepted into the trial.
- e) Previous lumbar surgery and pregnant females (due to hormone-induced ligamentous laxity and possible resultant instability of the sacroiliac joint occurring during pregnancy [Vleeming et al. 1990:131]) were excluded from the study.
- f) Patients presenting with bilateral sacroiliac joint syndrome were excluded.
- g) Patients receiving workers compensation or disability insurance for low back pain were excluded.
- h) Patients already taking anti-inflammatory or analgesic medication (Myprodol, Mobic, Voltaren, Cataflam D, etc.) for longer than 5 days were required not to alter the dosage in any way.

- i) Patients were required not to change their lifestyle or activity levels during the research period to avoid biasing the results. Failure to comply, to these instructions resulted in exclusion from the trial.
- j) Patients that received any other treatment for sacroiliac syndrome or low back pain during the research period were excluded.

3.5. Ethical considerations.

- The rights and welfare of the subject were protected.
- Informed consent was obtained (Appendix I).
- The subject was not coerced into participating in the study.
- Information was given to the subject in an understandable language where possible .
- The research involved no more than minimal risk.
- Confidentiality was maintained.
- Participation was voluntary and did not involve financial benefit.
- The subject was free to withdraw from the study at any time (Pak and Adams 1994:34).

3.6. The Sample Group.

The sample population consisted of sixty patients, selected for the study according to the criteria defined above. Patients were randomly allocated into one of two groups without the use of stratification, depending on whether they chose a piece of paper out of a box with the number one or two on it, until each group had thirty patients.

Group one was the control group and received chiropractic manipulation of the symptomatic sacroiliac joint only.

Group two was the experimental group and patients in the group received chiropractic manipulation of both the symptomatic and the asymptomatic sacroiliac joints.

3.7. Measurements.

3.7.1. Subjective measurements.

Subjective measurements were recorded from two questionnaires completed by the patients in writing. The questionnaires used were the Numerical Pain Rating Scale-101 (Jenson, Karoly and Braver, 1986:117) and the Revised Oswestry Low Back Pain Disability Questionnaire (Hsieh, et al. 1992:25; Haas and Jacobs 1995:79). The Numerical Pain Rating Scale-101 and the Revised Oswestry Low Back Pain Disability Questionnaires were completed before the first, third and after the fourth treatment.

3.7.1.1. Numerical Pain Rating Scale-101.

Subjective pain is still considered one of the most important measurements available to both researchers and clinicians (Jenson, Karoly and Braver, 1986:117). The Numerical Pain Rating Scale-101 is a questionnaire used to measure the intensity of pain experienced by the subject. The subject was required prior to treatment, to indicate the intensity of pain by means of a percentage from 0 to 100, where 0 represents 'no pain' and 100 represents 'pain as bad as it could be'. The two values recorded were firstly the pain intensity when it is at it's worst and secondly the pain intensity when it is at it's least. The average between these two figures is an indication of the subject's pain level.

Jenson, Karoly and Braver (1986:117-126) conducted a study where six methods of evaluating pain intensity were compared according to five criteria:

- Ease of administration of the scoring,

- Relative rate of incorrect responding,
- Sensitivity with regard to questions,
- Sensitivity of statistical analysis,
- Relationship to a combination of pain intensity indices.

The results of this study concluded that the Numerical Pain Rating Scale-101 was superior to the other measures due to its simple and practical method of administering and scoring, which may be in written or verbal form and its results did not seem to be dependent on age.

A more recent study by Bolton and Wilkinson (1998:1-7) on seventy-nine chiropractic patients compared three pain scales, including the Visual Analogue Scale, the Verbal Rating Scale and the Numerical Pain Rating Scale-101. The authors found the Numerical Pain Rating Scale-101 to be the most responsive and recommended this questionnaire for most types of outcome studies.

3.7.1.2. The Revised Oswestry Low Back Disability Index.

The Revised Oswestry Low Back Pain Disability Questionnaire (ROLBPQ), has been validated by the chiropractic research studies of Hsieh, et al. (1992:4-9) and Haas, et al. (1995:79-87). Fairbank and Pynsent (2000:2949) concluded that the ROLBPQ was a "valid and vigorous measure of condition-specific disability."

The ROLBPQ has ten sections of six statements, including pain intensity, personal care, lifting, walking, sitting, standing, sleeping, social life, traveling and changing degree of pain.

For each section of six statements the total score was 5; if the first statement was marked the score = 0; if the last statement was marked, the score = 5. Intervening statements were scored according to rank. The final results were scored thus:

Total scored out of 50 total possible points multiplied by 100 to form a percentage (Fairbank and Pynsent, 2000:2944).

The overall goal of assessment was to measure change in the subject's condition over time.

3.7.2. Objective measurements.

Objective measurements were recorded from the results of algometer readings and the Orthopaedic Rating Scale, which comprised of orthopaedic tests specific for sacroiliac joint syndrome, each of which were assigned points according to their specificity or accuracy. These measurements were recorded before the first, third and fifth consultations.

3.7.2.1. The Algometer.

The algometer used in this trial was the Wagner FDK20 Force Dial (Wagner Instruments, P.O. Box 1217, Greenwich, CT, 06836 USA, tel. 2038699861). Fischer (1987:122) described the algometer pressure/pain threshold readings as the minimum pressure or force that induces pain or discomfort.

The algometer readings were taken over the most painful area of the symptomatic sacroiliac joint. This position sometimes changed between visits, however the readings were taken in the corresponding area of the asymptomatic sacroiliac joint for each visit. Measurements were taken by applying the force dial, to the most painful area of either one of the sacroiliac joints. The force readings were measured in kilograms per square centimeter. The higher the reading the less tenderness was felt, indicating a higher tolerance to pain.

Fischer (1987:122) defines pressure threshold as the maximum pressure inducing pain or discomfort. The algometer can be used to quantify response to treatment such as manipulation and provides a means of measuring the patient's improvement (Fischer 1986:837).

The dial was set to zero before each reading, by pressing the reset button. The rubber disc was placed over the tenderest point of the sacroiliac joint. The patient was instructed to say 'now' at the point when they first felt the sensation of pressure, change to a feeling of pain. The pressure was gradually increased at a rate of 1 kg/second (Fischer 1986:836) until the point of pain. The pressure was released and the reading was taken.

3.7.2.2. Orthopaedic Rating Scale.

Specific orthopaedic tests were performed to determine the presence of sacroiliac joint syndrome. The specific tests included: Posterior shear or "thigh thrust test" (Laslett and Williams 1994:342), Patrick Faber test (Magee 1992:343), Gaenslen's test (Magee 1992:319) and Yeoman's test (Schafer and Faye 1990:271). A full description of these tests and their validity may be found in chapter two.

The tests were put together into a scale based on the principle that when a diagnosis is based on combinations of many tests, the specificity of the diagnosis is improved (Griner, et al. 1981:559). Each of the above tests were allocated a score on production of a positive result in order to establish an orthopaedic rating scale as an objective measure that may be statistically analyzed. The posterior shear test is the more sensitive test according to Laslett and Williams (1994:1246) therefore it received a score of 4 when positive, while Patrick Faber test, Gaenslen's test and Yeoman's test each received a score of 2 when positive.

An orthopaedic assessment rating out of 10 was determined. Only subject's with a rating of 6 out of 10 or higher were included in the trial ensuring that at least two orthopaedic tests were positive for a diagnosis to be made. A change in the score gave an indication as to whether there was a difference in the patient's sacroiliac syndrome.

3.7.2.3. Orthopaedic tests.

The same tests were used to assess the patient's initial presentation and progress throughout the treatment period. The tests were performed bilaterally and scored a possible maximum of ten points. Points were recorded before the first and third treatments and during the fifth consultation.

A negative result was recorded as zero points when the patient reported 'no pain'.

3.8. Interventions.

Each subject who was accepted for the trial attended five consultations over a two-week period. Group A received unilateral manipulation of the symptomatic sacroiliac joint. Group B received manipulation of the symptomatic and asymptomatic sacroiliac joints. If a patient became asymptomatic, in terms of subjective clinical findings, before the sixth treatment, the patient continued to be evaluated for the remainder of the treatment period, but received no further treatment.

3.8.1. Spinal manipulative therapy.

Both groups received spinal manipulative therapy, once the diagnosis of sacroiliac joint syndrome was confirmed using the Orthopaedic Rating Scale (as discussed in section 3.6.2.2).

3.8.2. Manipulation.

The involved area was manipulated according to the Diversified Technique (Schaefer and Faye 1989:241-269). The applicable side posture adjustment with the patient in the lateral recumbent position, with a thenar or hypothenar contact, was delivered to the right or left (or both) sacroiliac joint.

3.9. Statistical Analysis.

Statistical analysis was conducted on the subjective and objective data using the SPSS version 9.0 statistical software programme (manufactured by SPSS Inc., 444N. Michigan Ave, Chicago, Illinois, 60611, USA) and was presented in the form of graphs and tables. The statistical evaluation was aimed at measuring any significant changes occurring between the initial and third consultation, the initial and fifth consultation, as well as the third and fifth consultations between the different study groups.

3.9.1. Comparison between Independent Samples.

The Mann-Whitney U-Test was used to determine whether any significant difference occurred between the two groups at the time of the final consultations. The subjective data tested was the NRS-101 and Oswestry Low Back Pain Disability Index. The objective data tested was the Algometer readings and Orthopaedic Rating Scale score.

3.9.2. Comparison between related samples.

The Friedman's T-test was used to determine whether any significant change occurred between: The initial, third and fifth consultations, within each study group. The subjective variables listed were the NRS-101, and Oswestry Low Back Pain Disability Index. The objective data tested were the Algometer readings and Orthopaedic Rating Scale score.

3.9.3. Hypothesis testing and the decision rule.

The null hypothesis (H_0) stated that there was no improvement between treatments. The alternative hypothesis (H_1) stated that there was an improvement between the treatments.

$\alpha = 0.05$ = level of significance

For a one tailed test,

Reject H_0 if $P < \alpha = 0.05$

Accept H_0 if $P \geq \alpha = 0.05$ where:

$P = (\text{reported } p\text{-value}) / 2$ if H_1 is of form $<$ and z is negative

H_1 is of form $>$ and z is positive

$P = 1 - (\text{reported } p\text{-value} / 2)$ if H_1 is of form $<$ and z is positive

H_1 is of form $>$ and z is negative

If the null hypothesis H_0 is rejected for Friedman's T-test, then the multiple comparison procedure (Dunn's procedure) will have to be applied to determine which of the treatments are significantly different.

Summary statistics including the mean, standard deviation and relevant p values were obtained to support the data from the various tests.

The results of these tests were used to discuss and draw conclusions as to the efficacy of bilateral sacroiliac joint manipulation as compared to unilateral sacroiliac joint manipulation.

CHAPTER FOUR: THE RESULTS

4.1. Introduction.

This chapter deals with the results obtained after statistical analysis of the data from the measurement criteria, which were as follows:

- Revised Oswestry Low Back Pain Disability Questionnaire
- Numerical Pain Rating Scale
- Algometer
- Orthopaedic Rating Scale
- Age, gender, and race distribution.
- Exclusions and drop outs from the study.

This study consisted of 60 subjects, with 30 in group 1 and 30 in group 2. The results from the inter and intra-group analysis were represented in tables. The tabulated statistical results included the level of significance (p-value). The descriptive data was represented in pie and bar graphs. The P-value was compared to the level of significance, which is set at $\alpha = 0.05$ for all the tests.

The null hypothesis stated that there was no improvement between the two samples being compared at the $\alpha = 0.05$ level of significance. The alternative hypothesis stated that there was a difference between the groups being compared (Fisher and Van Belle 1993: 315-319).

THE DUNN'S PROCEDURE (MULTIPLE COMPARISON TEST)

Dunn's procedure was performed after Friedman's T-test if the null hypothesis was rejected. This was done to determine the significance of improvement of each treatment.

Dunn's procedure states:

Let R_j and $R_{j'}$ be the j th and j' th consultation rank totals.

Let α be the experiment-wise error rate. $\alpha = 0.10$

(Experimentwise error rate is usually higher than α and it depends on the sample size.)

Decision Rule:

$$|R_j - R_{j'}| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

In the above formula:

b = the number of blocks

k = the number of consultations

z = value in the inverse normal distribution corresponding to $\{1 - [\alpha/k(k-1)]\}$

In order to compute the consultation rank totals, the values in each block were ranked and then the sum of the ranks for each consultation was computed.

In this case $k = 3$, $\alpha = 0.10$, $z = 2.12$, $b = 30$

4.2. Inter-group analysis of the subjective measurements.

4.2.1. Analysis of the Oswestry scores.

Table 1. Comparison of the Oswestry (OSW) scores of the final visit of groups one and two using the Mann-Whitney U-Test.

Group	Mean rank	Mann-Whitney	P-Value
1	30.10	438.000	0.859
2	30.90		

Table 1 shows that there was no significant difference between groups 1 and 2 after the final visit at the 5% significance level. The null hypothesis was therefore accepted.

4.2.2. Analysis of the NRS scores.

Table 2. Comparison of the NRS scores, of the final visits, of groups one and two using the Mann-Whitney U-Test.

Group	Mean rank	Mann-Whitney	P-Value
1	31.12	431.500	0.784
2	29.88		

Table 2 shows that there was no significant difference between groups 1 and 2 after the final visit at the 5% significance level. The null hypothesis was therefore accepted.

4.3. Inter-group analysis of the objective data

4.3.1. Analysis of the Orthopaedic Rating Scale (ORS) scores.

Table 3. Comparison of the ORS scores, of the final visits, of groups one and two using the Mann-Whitney U-Test.

Group	Mean rank	Mann-Whitney	P-Value
1	36.73	263.000	0.04
2	24.27		

Table 3 shows that there was a difference between groups 1 and 2 after the final visit at the 5% significance level. The null hypothesis was therefore rejected.

4.3.2. Analysis of the Algometer readings.

Table 4. Comparison of the algometer readings of the symptomatic side between groups after the final visit using the Mann-Whitney U-Test,

Group	Mean rank	Mann-Whitney	P-Value
1	29.08	407.500	0.530
2	31.92		

Table 5. Comparison of the algometer readings of the asymptomatic side between groups after the final visit using the Mann-Whitney U-Test,

Group	Mean rank	Mann-Whitney	P-Value
1	32.40	393.00	0.399
2	28.60		

Tables 4 and 5 show that there was no significant difference between groups 1 and 2 after the final visit at the 5% significance level. The null hypothesis was therefore accepted.

4.4. Intra-group analysis of the subjective data for group 1.

4.4.1. Analysis of the NRS scores.

Table 6. Comparison of NRS means between the initial, third and final visits.

Group 1	Mean	S.D.
NRS 1	43.7333	12.6653
NRS 3	32.3667	14.0160
NRS 5	27.9667	17.3354

Table 7. Comparison of the NRS scores between the initial, third and final visits, using Friedman's T-test.

Group 1	Mean Rank	Rank Scores	P-value
NRS 1	2.67	80.1	0.00 (<0.001)
NRS 3	1.92	57.6	
NRS 5	1.42	42.6	

Tables 6 and 7 give an indication of the response to treatment within group 1. The null hypothesis was rejected and one can conclude that at the 5% significance level, there was an improvement between consultations one, three and five.

Dunn's procedure:

$$|R1 - R3| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$22.5 \geq 16.42$$

- for $j = 1$ and $j' = 3$, the above inequality is true, hence the result is declared significant, which indicates improvement between consultations one and three.

$$|R1 - R3| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$37.5 \geq 16.42$$

- for $j = 1$ and $j' = 5$, the above inequality is true, hence the result is declared significant, indicating improvement between consultations one and five.

$$|R1 - R5| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$15 \geq 16.42$$

- for $j = 3$ and $j' = 5$, the above inequality is not true, hence the result is declared insignificant, which indicates no improvement between consultations three and five.

4.4.2. Analysis of the Oswestry scores.

Table 8. Comparison of Oswestry means between the initial, third and final visits.

Group 1	Mean	S.D.
OSW 1	35.9667	15.8103
OSW 3	26.0000	16.3496
OSW 5	22.5667	18.8695

Table 9. Comparison of the Oswestry scores between the initial, third and final visits using Friedman's T-test.

Group 1	Mean Rank	Rank scores	P -Value
OSW 1	2.63	78.9	0.000 (<0.001)
OSW 3	1.93	57.9	
OSW 5	1.43	42.9	

Tables 8 and 9 give an indication of the response to treatment within group 1. The null hypothesis was rejected and one can conclude that at the 5% significance level, there was an improvement between consultations one, three and five.

Dunn's procedure:

$$|R1 - R3| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$21 \geq 16.42$$

- for $j = 1$ and $j' = 3$, the above inequality is true, hence the result is declared significant, which indicates improvement between consultations one and three.

$$|R1 - R5| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$36 \geq 16.42$$

- for $j = 1$ and $j' = 5$, the above inequality is true, hence the result is declared significant, indicating improvement between consultations one and five.

$$|R3 - R5| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$15 \geq 16.42$$

- for $j = 3$ and $j' = 5$, the above inequality is not true, hence the result is declared insignificant, which indicates no improvement between consultations three and five.

4.5. Intra-group analysis of the subjective data for group 2.

4.5.1. Analysis of the NRS scores.

Table 10. Comparison of NRS means between the initial, third and final visits.

Group 2	Mean	S.D.
NRS 1	49.7667	16.5022
NRS 3	37.7667	15.2104
NRS 5	26.9000	17.2114

Table 11. Comparison of the NRS scores between the initial, third and final visits, using Friedman's T-test.

Group 2	Mean Rank	Rank Scores	P-Value
NRS 1	2.63	78.9	0.000 (<0.001)
NRS 3	2.05	61.5	
NRS 5	1.32	39.6	

Tables 10 and 11 give an indication of the response to treatment within group 2. The null hypothesis was rejected and one can conclude that at the 5% significance level, there was an improvement between consultations one, three and five.

Dunn's procedure:

$$|R1 - R3| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$17.4 \geq 16.42$$

- for $j = 1$ and $j' = 3$, the above inequality is true, hence the result is declared significant, which indicates improvement between consultations one and three.

$$|R1 - R5| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$39.3 \geq 16.42$$

- for $j = 1$ and $j' = 5$, the above inequality is true, hence the result is declared significant, indicating improvement between consultations one and five.

$$|R3 - R5| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$21.9 \geq 16.42$$

- for $j = 3$ and $j' = 5$, the above inequality is true, hence the result is declared significant, indicating improvement between consultations three and five.

4.5.2. Analysis of the Oswestry scores.

Table 12. Comparison of Oswestry means between the initial, third and final visits.

Group 2	Mean	S.D.
OSW 1	40.9000	15.6433
OSW 3	29.3333	12.3437
OSW 5	21.7667	12.8806

Table 13. Comparison of the Oswestry scores between the initial, third and final visits using Friedman's T-test.

Group 2	Mean Rank	Rank Scores	P -Value
OSW 1	2.85	85.5	0.000 (<0.001)
OSW 3	1.95	58.5	
OSW 5	1.20	36	

Tables 12 and 13 give an indication of the response to treatment within group 2. The null hypothesis was rejected and one can conclude that at the 5% significance level, there was an improvement between consultations one, three and five.

Dunn's procedure:

$$|R1 - R3| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$27 \geq 16.42$$

- for $j = 1$ and $j' = 3$, the above inequality is true, hence the result is declared significant, which indicates improvement between consultations one and three.

$$|R1 - R5| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$49.5 \geq 16.42$$

- for $j = 1$ and $j' = 5$, the above inequality is true, hence the result is declared significant, indicating improvement between consultations one and five.

$$|R3 - R5| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$22.5 \geq 16.42$$

- for $j = 3$ and $j' = 5$, the above inequality is true, hence the result is declared significant, indicating improvement between consultations three and five.

4.6. Intra-group analysis of the objective data for group one.

4.6.1. Analysis of the Orthopaedic Rating Scale (ORS) scores.

Table 14. Comparison of the ORS mean scores of group 1, between the first, third and final visits.

Group 1	Mean	S.D.
ORS 1	7.6667	1.2954
ORS 3	6.3333	1.1842
ORS 5	3.7333	2.3916

Table 15. Comparison of the ORS scores between the initial, third and final visits using Friedman's T-test.

Group 1	Mean Rank	Rank Scores	P-Value
ORS 1	2.77	83.1	0.000 (<0.001)
ORS 3	2.05	61.5	
ORS 5	1.18	35.4	

Tables 14 and 15 gives an indication of the response to treatment within group 1. The null hypothesis was rejected and one can conclude that at the 5% significance level, there was an improvement between consultations one, three and five.

Dunn's procedure:

$$|R1 - R3| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$21.6 \geq 16.42$$

- for $j = 1$ and $j' = 3$, the above inequality is true, hence the result is declared significant, which indicates improvement between consultations one and three.

$$|R1 - R5| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$47.7 \geq 16.42$$

- for $j = 1$ and $j' = 5$, the above inequality is true, hence the result is declared significant, indicating improvement between consultations one and five.

$$|R3 - R5| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$26.1 \geq 16.42$$

- for $j = 3$ and $j' = 5$, the above inequality is true, hence the result is declared significant, indicating improvement between consultations three and five.

4.6.2. Analysis of the Algometer readings.

Table 16. Comparison of the Algometer reading means, of group 1, of the symptomatic side between the first, third and final visits.

Group 1	Mean	S.D.
ALG 1 SYM	36.7233	12.2958
ALG 3 SYM	48.5267	18.0417
ALG 5 SYM	51.4967	19.2341

Table 17. Comparison of the Algometer readings between the initial, third and final visits using Friedman's T-test.

Group 1	Mean Rank	Rank Scores	P-Value
ALG 1 SYM	1.40	42	0.000 (<0.001)
ALG 3 SYM	2.02	60.6	
ALG 5 SYM	2.58	77.4	

Tables 16 and 17 gives an indication of the response to treatment within group 1. The null hypothesis was rejected and one can conclude that at the 5% significance level, there was an improvement between consultations one, three and five.

Dunn's procedure:

$$|R1 - R3| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$18.6 \geq 16.42$$

- for $j = 1$ and $j' = 3$, the above inequality is true, hence the result is declared significant, which indicates improvement between consultations one and three.

$$|R1 - R5| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$35.4 \geq 16.42$$

- for $j = 1$ and $j' = 5$, the above inequality is true, hence the result is declared significant, indicating improvement between consultations one and five.

$$|R3 - R5| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$16.8 \geq 16.42$$

- for $j = 3$ and $j' = 5$, the above inequality is true, hence the result is declared significant, indicating improvement between consultations three and five.

Table 18. Comparison of the Algometer reading means of the asymptomatic side between the first, third and final visits.

Group 1	Mean	S.D.
ALG 1 ASYM	56.2700	19.5481
ALG 3 ASYM	59.2267	18.7801
ALG 5 ASYM	61.8533	19.5189

Table 19. Comparison of the Algometer readings between the initial, third and final visits using Friedman's T-test.

Group 1	Mean Rank	Rank Scores	P-Value
ALG 1 ASYM	1.50	45	0.000 (<0.001)
ALG 3 ASYM	1.95	58.5	
ALG 5 ASYM	2.55	76.5	

Tables 18 and 19 gives an indication of the response to treatment within group 1. The null hypothesis was rejected and one can conclude that at the 5% significance level, there was an improvement between consultations one, three and five.

Dunn's procedure:

$$|R1 - R3| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$13.5 \geq 16.42$$

- for $j=1$ and $j' = 3$, the above inequality is not true, hence the result is declared insignificant, which indicates no improvement between consultations one and three.

$$|R1 - R5| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$31.5 \geq 16.42$$

- for $j = 1$ and $j' = 5$, the above inequality is true, hence the result is declared significant, indicating improvement between consultations one and five.

$$|R3 - R5| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$18 \geq 16.42$$

- for $j = 3$ and $j' = 5$, the above inequality is true, hence the result is declared significant, indicating improvement between consultations three and five.

4.7. Intra-group analysis of the objective data for group two.

4.7.1. Analysis of the Orthopaedic Rating Scale (ORS) scores.

Table 20. Comparison of the ORS mean scores of group 2, between the first, third and final visits.

Group 2	Mean	S.D.
ORS 1	7.8000	1.5177
ORS 3	5.5333	1.6344
ORS 5	2.0000	2.1656

Table 21. Comparison of the ORS scores between the initial, third and final visits using Friedman's T-test.

Group 2	Mean Rank	Rank Scores	P-Value
ORS 1	2.93	87.9	0.000 (<0.001)
ORS 3	2.02	60.6	
ORS 5	1.05	31.5	

Tables 20 and 21 gives an indication of the response to treatment within group 1. The null hypothesis was rejected and one can conclude that at the 5% significance level, there was an improvement between consultations one, three and five.

Dunn's procedure:

$$|R1 - R3| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$27.3 \geq 16.42$$

- for $j = 1$ and $j' = 3$, the above inequality is true, hence the result is declared significant, which indicates improvement between consultations one and three.

$$|R1 - R5| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$56.4 \geq 16.42$$

- for $j = 1$ and $j' = 5$, the above inequality is true, hence the result is declared significant, indicating improvement between consultations one and five.

$$|R3 - R5| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$29.1 \geq 16.42$$

- for $j = 3$ and $j' = 5$, the above inequality is true, hence the result is declared significant, indicating improvement between consultations three and five.

4.7.2. Analysis of the Algometer readings.

Table 22. Comparison of the Algometer reading means, of group 2, of the symptomatic side between the first, third and final visits.

Group 2	Mean	S.D.
ALG 1 SYM	41.1200	15.0649
ALG 3 SYM	43.5623	13.5136
ALG 5 SYM	51.4533	13.4948

Table 23. Comparison of the Algometer readings between the initial, third and final visits using Friedman's T-test.

Group 2	Mean Rank	Rank Scores	P-Value
ALG 1 SYM	1.67	50.1	0.000 (<0.001)
ALG 3 SYM	1.68	50.4	
ALG 5 SYM	2.65	79.5	

Tables 22 and 23 gives an indication of the response to treatment within group 2. The null hypothesis was rejected and one can conclude that at the 5% significance level, there was an improvement between consultations one, three and five.

Dunn's procedure:

$$|R1 - R3| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$0.3 \geq 16.42$$

- for $j = 1$ and $j' = 3$, the above inequality is not true, hence the result is declared insignificant, which indicates no improvement between consultations one and three.

$$|R1 - R5| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$29.4 \geq 16.42$$

- for $j = 1$ and $j' = 5$, the above inequality is true, hence the result is declared significant, indicating improvement between consultations one and five.

$$|R_3 - R_5| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$29.1 \geq 16.42$$

- for $j = 3$ and $j' = 5$, the above inequality is true, hence the result is declared significant, indicating improvement between consultations three and five.

Table 24. Comparison of the Algometer reading means of the asymptomatic side between the first, third and final visits.

Group 2	Mean	S.D.
ALG 1 ASYM	50.3900	17.1021
ALG 3 ASYM	52.0733	14.7504
ALG 5 ASYM	56.5267	14.2113

Table 25. Comparison of the Algometer readings between the initial, third and final visits using Friedman's T-test.

Group 1	Mean Rank	Rank Scores	P-Value
ALG 1 ASYM	1.63	48.9	0.000 (<0.001)
ALG 3 ASYM	1.90	57	
ALG 5 ASYM	2.47	74.1	

Tables 24 and 25 gives an indication of the response to treatment within group 2. The null hypothesis was rejected and one can conclude that at the 5% significance level, there was an improvement between consultations one, three and five.

Dunn's procedure:

$$|R1 - R3| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$8.1 \geq 16.42$$

- for $j=1$ and $j' = 3$, the above inequality is not true, hence the result is declared insignificant, which indicates no improvement between consultations one and three.

$$|R1 - R5| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$25.2 \geq 16.42$$

- for $j = 1$ and $j' = 5$, the above inequality is true, hence the result is declared significant, indicating improvement between consultations one and five.

$$|R3 - R5| \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$20.1 \geq 16.42$$

- for $j = 3$ and $j' = 5$, the above inequality is true, hence the result is declared significant, indicating improvement between consultations three and five.

4.8. Descriptive statistics.

4.8.1. Explanation of recruitment of patients.

One hundred and fifty-one patients, from the greater Durban area, responded to the advertisement for the treatment of low back pain. Patients were screened telephonically to ensure they met the age criteria, and were excluded if they had been experiencing any obvious signs of nerve root entrapment, had bilateral sacroiliac syndrome or had undergone any recent lumbar surgery. Eighty five patients were further assessed at the Technikon Natal Chiropractic Day Clinic of which, sixty-five patients met all the selection criteria and were accepted into the trial. Five patients were excluded during the course of the study due to non-compliance.

Table 26. Patients excluded from the study.

Exclusion criteria	Number	Percentage
Age < 18 Y	3	1.9 %
Age > 59 Y	20	13.2 %
Bilateral SI syndrome	25	16.6 %
Recent Lumbar surgery	5	3.3 %
Cauda Equina syndrome	1	0.7 %
Signs of N.R.E	12	1.9 %
Orthopaedic Test criteria	20	13.2 %

The final criteria refers to the sacroiliac joint stress tests which were applied diagnostically in an orthopaedic rating scale. Patients had to score a minimum of six out of ten to qualify for this study. The percentage of patients excluded from this study due to this criteria has been shown as a percentage of one hundred and fifty-one patients, who responded to the trial. However, only eighty-six were actually physically screened in the clinic. Based on this, 24% of patients were excluded from the trial as a direct result of orthopaedic testing.

4.9. Demographic Data.

Figure 4.1.

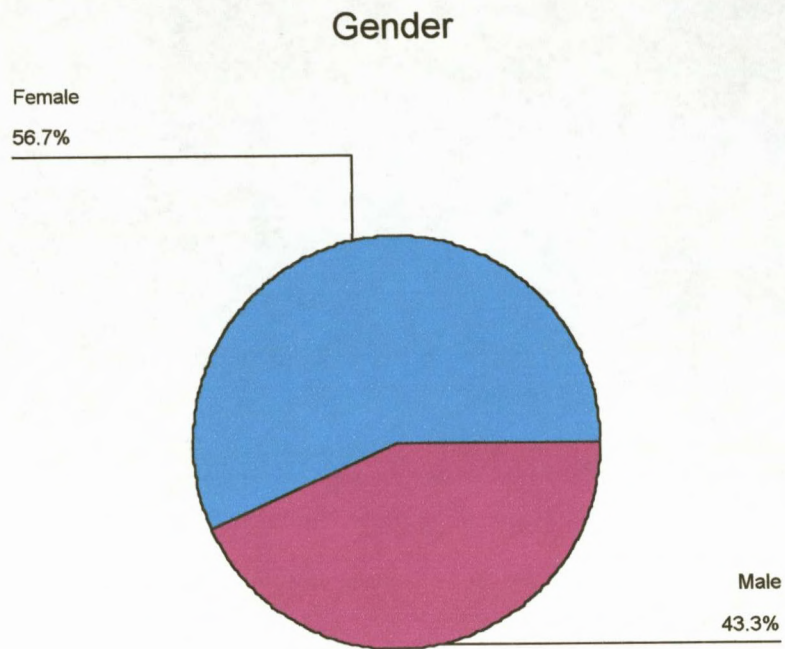


Figure 4.2.

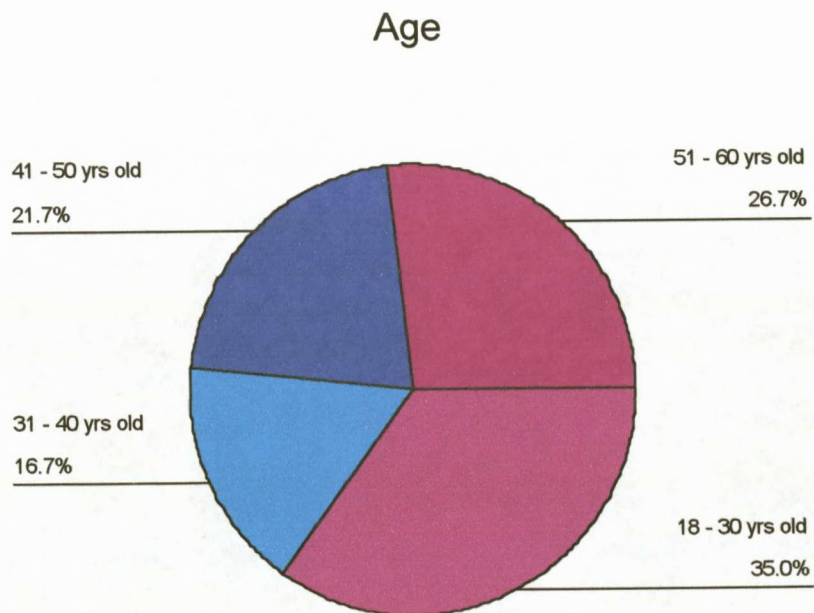


Figure 4.3.

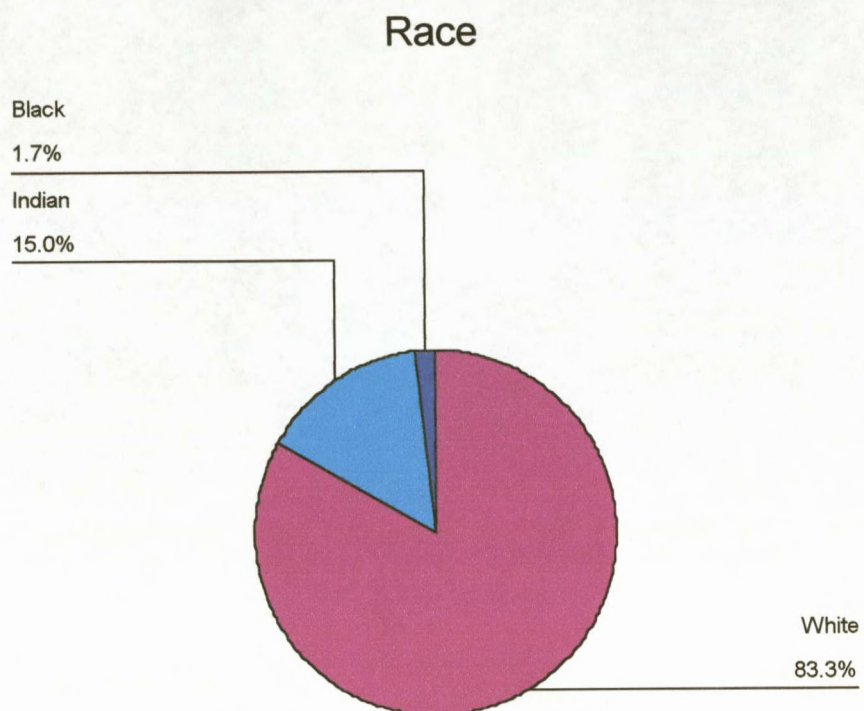


Figure 4.4.

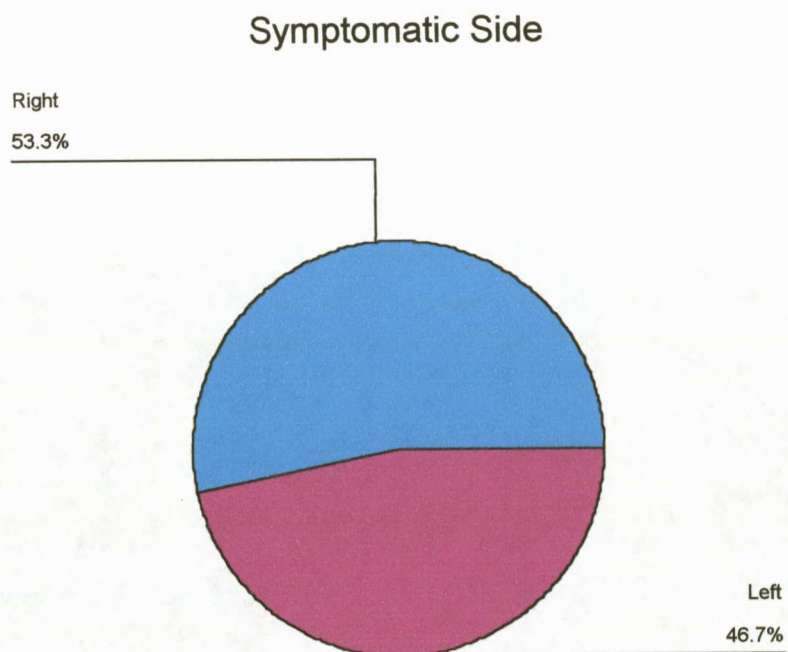


Figure 4.5.

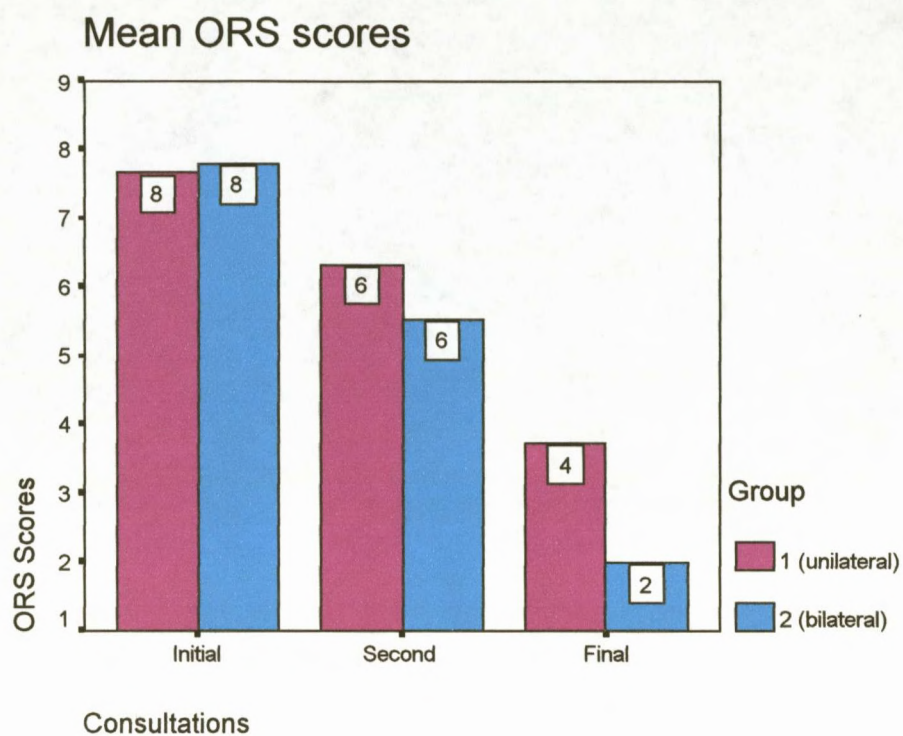


Figure 4.6.

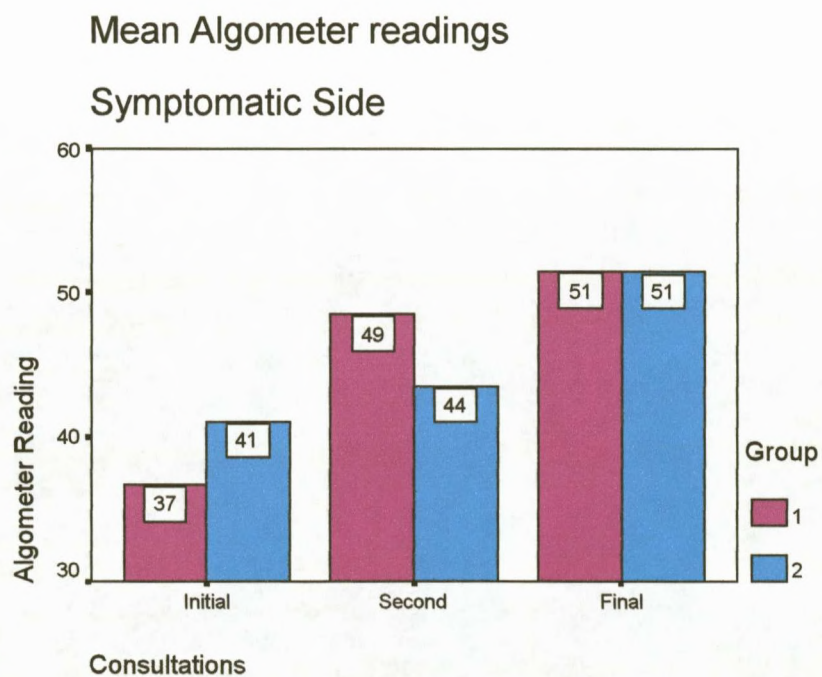


Figure 4.7.

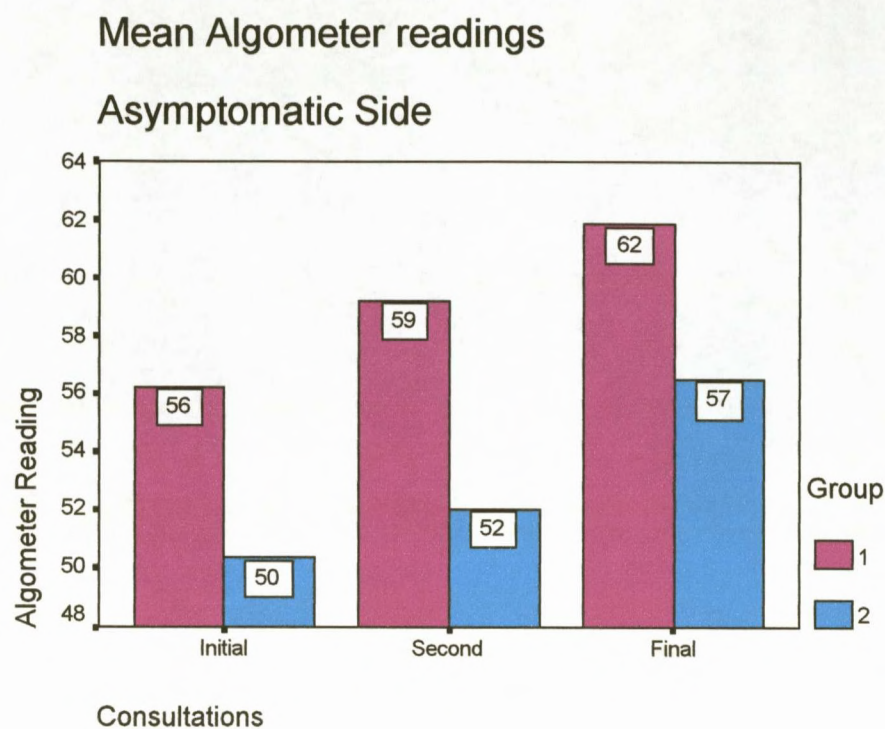


Figure 4.8.

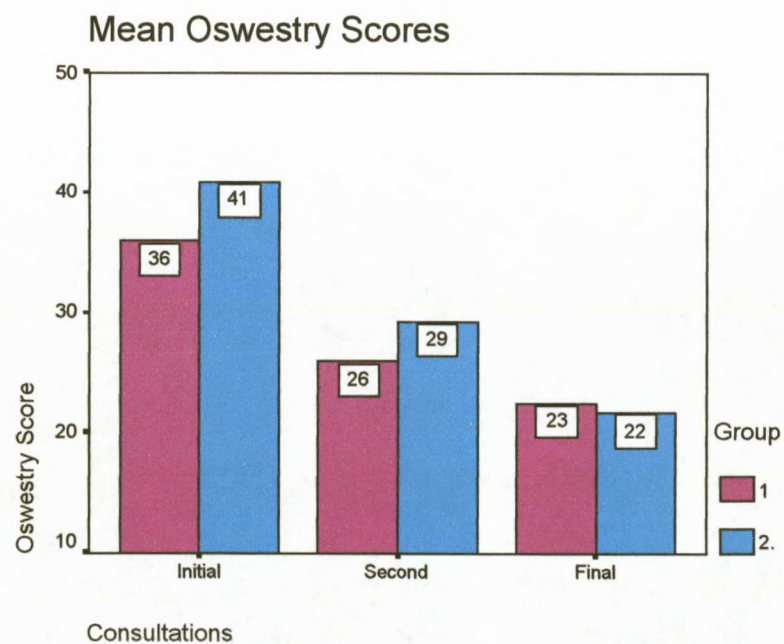


Figure 4.9.

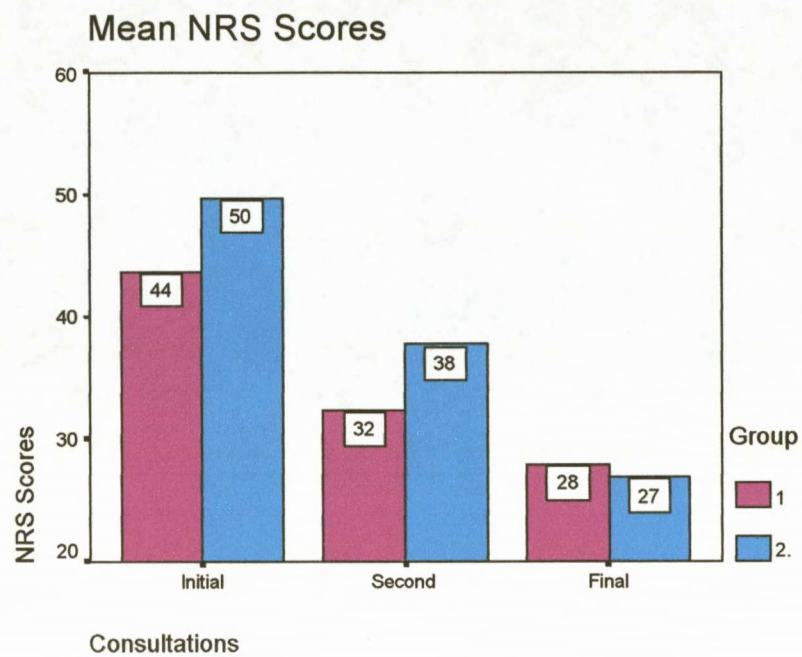


Figure 4.1. shows the gender distribution of the patients in this study. There was no significant trend favouring a male (57%) or female (43%) distribution of patients diagnosed with sacroiliac syndrome. This was consistent with the findings of Sawyer (2000:82) but in contrast with the findings of Cibulka and Koldehoff (1999:84).

Figure 4.2. depicts the age distribution of patients in this study. Patients between the ages of 18 and 30 years old, made up the greatest percentage (35%). This could be attributed to this age group being more physically active than the other age groups.

Figure 4.3. shows the distribution of patients by race. Whites made up by far the greatest percentage of patients (83.3%). This could be attributed to the method of advertisement, for this study, and the areas in which these advertisements took place.

Figure 4.4. depicts which sacroiliac joint was symptomatic within the sample group. There was no significant trend favouring a right (53%) or left (47%) sided presentation.

Figure 4.5. gives a direct comparison between the mean Orthopaedic Rating Scale scores of the two treatment groups. At the initial presentation, both groups had identical mean scores (8). At the time of the final visit, the group receiving bilateral manipulation had a mean score of 2 whilst the group receiving manipulation of the symptomatic joint alone scored a mean of 4.

Figure 4.6. shows the mean algometer readings of the symptomatic sacroiliac joint of both groups throughout the study. Although slight differences occurred initially, at the final visit both groups were identical (51).

Figure 4.7. shows the mean algometer readings of the asymptomatic sacroiliac joint of both groups throughout the study. Slight differences occurred throughout but group 1 had higher readings on the initial presentation and this trend continued throughout the treatment period.

Figure 4.8. depicts a direct comparison of the mean Oswestry scores between the two treatment groups. Group 2 reported a slightly higher score (41) at the first visit. At the time of the final visit both groups scored almost identically.

Figure 4.9. depicts a direct comparison of the mean Numerical Pain Rating Scale-101 scores between the two treatment groups. Group 2 reported a slightly higher score (50) at the first visit. At the time of the final visit both groups scored almost identically.

CHAPTER FIVE: DISCUSSION

5.1. Introduction.

This chapter is concerned with the discussion of the objective and subjective data obtained from the first treatment, third treatment and final treatment.

The subjective data consisted of the Numerical Pain Rating Scale-101 and the Revised Oswestry Low Back Pain Disability Questionnaire.

The objective data consisted of the readings of the Digital Algometer and results of Orthopaedic tests.

The results are discussed in two main sections, namely: Intra-group results and Inter-group results.

5.2. Intra-group results.

5.2.1. The Numerical Pain Rating Scale-101 (NRS-101).

The NRS-101 scores were statistically analysed using Friedman's T-test.

Within group 1 improvements occurred between visits 1 and 3, 3 and 5, and hence 1 and 5 ($p = 0.000$). Tables 1 and 2 depict these results. Dunn's procedure established that the greatest improvement occurred between visits 1 and 5.

Within group 2 improvements occurred between visits 1 and 3, 3 and 5, and hence 1 and 5 ($p = 0.000$). Tables 5 and 6 depict these results. Dunn's procedure established that the greatest improvement occurred between visits 1 and 5.

These results indicate a reduction in the level of pain experienced by both groups over the treatment period.

5.2.2. The Revised Oswestry Low Back Pain Disability Index.

The results of the Oswestry questionnaire was statistically analysed using Friedman's T-test.

Within group 1 improvements occurred between visits 1 and 3, and visits 1 and 5 ($p = 0.000$). Dunn's procedure established that no significant improvement occurred between visits 3 and 5. Tables 3 and 4 depict these results.

Within group 2 improvements occurred between visits 1 and 3, 3 and 5, and hence 1 and 5 ($p = 0.000$). Tables 7 and 8 depict these results. Dunn's procedure established that the greatest improvement occurred between visits 1 and 5.

These results indicate a reduction in the level of pain experienced by both groups over the treatment period.

5.2.3. The Orthopaedic Rating Scale Scores.

The scores of the Orthopaedic Rating Scale were statistically analysed using Friedman's T-test.

Within group 1 improvements occurred between visits 1 and 3, 3 and 5, and hence 1 and 5 ($p = 0.000$). Tables 9 and 10 depict these results. Dunn's procedure established that the greatest improvement occurred between visits 1 and 5.

Within group 2 improvements occurred between visits 1 and 3, 3 and 5, and hence 1 and 5 ($p = 0.000$). Tables 15 and 16 depict these results. Dunn's procedure established that the greatest improvement occurred between visits 1 and 5.

These results indicate that both treatment protocols were effective in reducing the amount of inflammation and tenderness associated with sacroiliac joint syndrome.

5.2.4. The Algometer Readings.

The Digital Algometer readings were statistically analysed using Friedman's T-test.

The readings were divided between the symptomatic and asymptomatic sides.

The symptomatic side:

Within group 1 improvements occurred between visits 1 and 3, 3 and 5, and hence 1 and 5 ($p = 0.000$). Tables 11 and 12 depict these results. Dunn's procedure established that the greatest improvement occurred between visits 1 and 5.

Within group 2 improvements occurred between visits 3 and 5, and 1 and 5 ($p = 0.000$). Tables 17 and 18 depict these results. Dunn's procedure established that no significant improvement occurred between visits 1 and 3.

The asymptomatic side:

Within group 1 improvements occurred between visits 3 and 5, and 1 and 5 ($p = 0.000$). Tables 13 and 14 depict these results. Dunn's procedure established that no significant improvement occurred between visits 1 and 3.

Within group 2 improvements occurred between visits 3 and 5, and 1 and 5 ($p = 0.000$). Tables 19 and 20 depict these results. Dunn's procedure established that no significant improvement occurred between visits 1 and 3.

These results indicate that both treatment protocols were effective in reducing the amount of inflammation and tenderness associated with sacroiliac joint

syndrome. The fact that the patients experienced overall relief from the symptomology associated with sacroiliac joint syndrome is highlighted by the increase in algometer readings of both the symptomatic and asymptomatic sides.

5.3. Inter-group results.

5.3.1. The Numerical Pain Rating Scale-101 (NRS-101).

The NRS scores for the final visits of both groups were statistically analysed using the Mann-Whitney U-Test.

There was no difference between the two groups after the final visit at the 5 % significance level (Table 21).

This indicates that in terms of pain intensity, either treatment was equally effective.

5.3.2. The Revised Oswestry Low Back Pain Disability Index.

The Oswestry scores for the final visits of both groups were statistically analysed using the Mann-Whitney U-Test.

There was no difference between the two groups after the final visit at the 5 % significance level (Table 22).

This indicates that in terms of functional disability, either treatment was equally effective.

5.3.3. The Orthopaedic Rating Scale.

The Orthopaedic Rating Scale results for the final visits of both groups were statistically analysed using the Mann-Whitney U-Test.

At the 5 % significance level, group 2 improved more than group 1 (Table 23).

This indicates the greater efficacy of bilateral sacroiliac joint manipulation in terms of decreasing the amount of inflammation and tenderness associated with sacroiliac joint syndrome.

5.3.4. The Digital Algometer Readings.

The Algometer readings for the final visits of both groups were statistically analysed using the Mann-Whitney U-Test.

The symptomatic side:

There was no difference between the two groups after the final visit at the 5 % significance level (Table 24).

The asymptomatic side:

There was no difference between the two groups after the final visit at the 5 % significance level (Table 25).

This indicates that in terms of palpatory tenderness, either treatment was equally effective.

5.4. Comparison of the Results.

Numerous studies exist that support the efficacy of unilateral chiropractic manipulation of the symptomatic sacroiliac joint in sacroiliac syndrome (Herzog, Conway and Willcox [1991:104-109], Hendler et al. [1995:169-174], Sawyer [2000:78] and White [2001:65]). This study corroborated their results and hence further validated the findings.

No studies exist that investigate the use of bilateral sacroiliac joint manipulation and hence no comparisons as to the efficacy of this treatment protocol could be made.

5.5. Summary.

This study found that although differences did occur in favour of bilateral sacroiliac joint manipulation in the treatment of sacroiliac joint syndrome, it was not sufficient to conclude that one treatment was more effective than the other.

CHAPTER SIX: RECOMMENDATIONS AND CONCLUSIONS

6.1. Recommendations.

Homogeneity.

More closely defined parameters with regards to using matched pairs with respect to age, gender, race, occupation and extent of pain and disability, would greatly enhance the strength of the study. It is therefore recommended that future studies include stratification to ensure homogeneity within the two groups. This would improve comparability of baseline patient characteristics.

Epidemiological studies.

Studies involving point prevalence and lifetime incidence around the greater Durban area would enhance the reporting of sacroiliac joint syndrome and allow for stratification of subjects presenting with this condition at the Technikon Natal Chiropractic Day Clinic.

Blinding.

Observer bias could be eliminated by not informing the examiner collecting and collating the data as to which group the patient falls within.

Sample size.

Larger sample sizes increase the validity of any study and minimizes the possibility of a Type II error, which is incorrectly accepting the null hypothesis. Assendfelt et al. (1992:489) recommended that a sample size of 100 be considered a minimum requirement in research of this nature.

Treatment schedules.

The treatments should be uniformly scheduled to ensure consistency and therefore the validity of the treatment. All the treatments should be administered within a specific time frame to allow a direct and accurate comparison of the effect of each treatment and the overall efficacy.

Follow-up consultations.

No long-term follow up evaluation was done which would help to address the cost-effectiveness and general efficacy of the treatment protocols utilized. Follow-up consultations are recommended at one month, and even a six month interval, to evaluate the intermediate and long-term effects of the treatment protocols.

Diagnosis of sacroiliac syndrome.

Until strict, validated, diagnostic criteria are established for sacroiliac joint syndrome, the efficacy of treatments for this syndrome will continue to be questioned.

Use of digital algometer.

Unless the exact point where the algometer is placed is permanently marked, it is impossible to get repeated measurements on exactly the same area. This brings into doubt the validity of this instrument as an objective measure.

Placebo group.

It would also be recommended to add a third group into the study that receives only placebo treatment (sham manipulation), to give an indication of the natural progression of sacroiliac syndrome. Two earlier trials implemented the use of sham manipulations, which seem to have provided useful placebo-control groups to strengthen the trial (Waagen et al. 1986: 63-67), Triano et al. 1995: 948-955).

6.2. Conclusion.

The results of this study suggest that although there was statistically significant improvement for both treatment groups, neither treatment protocol proved to be more effective than the other. An implication of this is that motion palpation of the sacroiliac joint to determine a manipulable lesion, in sacroiliac joint syndrome, is unnecessary if one manipulates both the symptomatic and asymptomatic sacroiliac joints or indeed simply the symptomatic joint alone.

It is the author's contention that research into sacroiliac joint syndrome should concentrate on accurate diagnosis of this condition. Only once specific, accurate and valid diagnostic procedures have been established can research into the treatment of this condition continue.

In conclusion, this study suggests that the use of unilateral manipulation of the symptomatic sacroiliac joint was as effective as manipulation of both the symptomatic and asymptomatic sacroiliac joints, in the treatment of sacroiliac joint syndrome.

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APPENDIX A

NUMERICAL PAIN RATING SCALE-101

NUMERICAL PAIN RATING SCALE-101

Numerical Pain Rating Scale-101

Please indicate on the line below the number between 0 and 100 that best describes the pain of your major problem at this point, when it is at its WORST. A zero (0) would mean "no pain at all" and one hundred (100) would mean "pain as bad as it could be".

Please write only one number:

0 _____ 100

Please indicate on the line below the number between 0 and 100 that best describes the pain of your major problem at this point, when it is at its LEAST. A zero (0) would mean "no pain at all" and one hundred (100) would mean "pain as bad as it could be".

Please write only one number:

0 _____ 100

APPENDIX B

REVISED OSWESTRY LOW BACK DISABILITY QUESTIONNAIRE

Low back pain and Disability Questionnaire (Revised Oswestry)

Patient Name: _____ File no: _____ Date: _____

This questionnaire has been designed to give the doctor information as to how your back pain has affected your ability to manage everyday life. Please answer every section and mark in each section only ONE box as it 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 right now.

Section 1 - Pain Intensity

- ☐ The pain comes and goes and is very mild.
- ☐ The pain is mild and does not vary much.
- ☐ The pain comes and goes and is moderate.
- ☐ The pain is moderate and does not vary much.
- ☐ The pain comes and goes and is very severe.
- ☐ The pain is severe and does not vary much.

Section 6 - Standing

- ☐ I can stand as long as I want without pain.
- ☐ I have some pain on standing but it does not increase with time.
- ☐ I cannot stand for longer than one hour without increasing pain.
- ☐ I cannot stand for longer than ½ hour without increasing pain.
- ☐ I cannot stand for longer than 10 minutes without increasing pain.
- ☐ I avoid standing because it increases the pain straight away..

Section 2 - Personal Care

- ☐ I would not have to change my way of washing or dressing in order to avoid pain.
- ☐ I do not normally change my way of washing or dressing even though it causes some pain.
- ☐ Washing and dressing increase the pain but I manage not to change my way of doing it.
- ☐ Washing and dressing increase the pain and I find it necessary to change my way of doing it.
- ☐ Because of the pain I am unable to do some washing and dressing without help.
- ☐ Because of the pain I am unable to do any washing and dressing without help.

Section 7 - Sleeping

- ☐ I get no pain in bed.
- ☐ I get pain in bed but it does not prevent me from sleeping well.
- ☐ Because of pain my normal night's sleep is reduced by less than ¼
- ☐ Because of pain my normal night's sleep is reduced by less than ½
- ☐ Because of pain my normal night's sleep is reduced by less than ¾
- ☐ Pain prevents me from sleeping at all.

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.
- ☐ Pain prevents me from lifting heavy weights off the floor, but I manage if they are conveniently positioned (e.g. 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 only lift very light weights at the most.

Section 8 - Social life

- ☐ My social life is normal and gives me no 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, e.g. dancing, etc
- ☐ Pain has restricted my social life and I do not go out very often.
- ☐ Pain has restricted my social life to my home.
- ☐ I have hardly any social life because of the pain.

Section 4 - Walking

- ☐ I have no pain on walking.
- ☐ I have some pain on walking but it does not increase with distance.
- ☐ I cannot walk more than one mile without increasing pain.
- ☐ I cannot walk more than ½ mile without increasing pain.
- ☐ I cannot walk more than ¼ mile without increasing pain.
- ☐ I cannot walk at all without increasing pain.

Section 9 - Travelling

- ☐ I get no pain whilst travelling.
- ☐ I get some pain whilst travelling but none of my usual forms of travel make it any worse.
- ☐ I get extra pain whilst travelling but it does not compel me to seek alternative form of travel.
- ☐ I get extra pain whilst travelling which compels me to seek alternative forms of travel.
- ☐ Pain restricts all forms of travel.
- ☐ Pain prevents all forms of travel except that done lying down.

Section 5 - Sitting

- ☐ I can sit in any chair as long as I like.
- ☐ I can only sit in my favorite chair as long as I like.
- ☐ Pain prevents me from sitting more than 1 hour.
- ☐ Pain prevents me from sitting for more than ½ hour.
- ☐ Pain prevents me from sitting for more than 10 minutes.
- ☐ I avoid sitting because it increases pain straight away.

Section 10 - Changing degree of pain

- ☐ My pain is rapidly getting better.
- ☐ My pain fluctuates but overall is definitely getting better.
- ☐ My pain seems to be getting better but improvement is slow at present.
- ☐ My pain is neither getting better nor worse.
- ☐ My pain is gradually worsening.
- ☐ My pain is rapidly worsening.

Pain Severity Scale:

Rate your usual level of pain today by checking one box on the following scale

0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

No pain

Excruciating pain

Adapted from Hsieh et al 1992

APPENDIX C

ALGOMETER READINGS AND ORTHOPAEDIC RATING SCALE

Sacroiliac Orthopaedic Rating Scale

Name: _____

File No: _____ Date: _____

	1 st consultation	3 rd consultation	5 th consultation
Posterior Shear (4)			
Gaenslen's test (2)			
Yeoman's test (2)			
Patrick Faber (2)			
Total			

Algometer Readings

	1 st consultation	3 rd consultation	5 th consultation
Symptomatic			
Asymptomatic			

APPENDIX D

CASE HISTORY

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC
CASE HISTORY

Patient:.....

Date:

File # :

Age :

Sex :

Occupation:.....

Intern :Signature:.....

FOR CLINICIANS USE ONLY:

Initial visit

Clinician:..... Signature :

Case History:

Examination:

Previous:

Current:

X-Ray Studies:

Previous:

Current:

Clinical Path. lab:

Previous:

Current:

Case Status:

PTT:.....

Signature:..... **Date:**.....

Conditional:

Reason for Conditional:.....

Signature:..... **Date:**.....

All Conditions met in Visit No.:.....

To be signed into PTT:.....

Signature:..... **Date:**.....

Signed off:.....

Intern's Case History:

1. **Source of History:**
2. **Chief Complaint : (patient's own words):**
3. **Present Illness:**

- ▶ Location
- ▶ Onset : Initial:
Recent:
- ▶ Cause:
- ▶ Duration
- ▶ Frequency
- ▶ Pain (Character)
- ▶ Progression
- ▶ Aggravating Factors
- ▶ Relieving Factors
- ▶ Associated S & S
- ▶ Previous Occurrences
- ▶ Past Treatment
- ▶ Outcome:

Complaint 1	Complaint 2

4. **Other Complaints:**
5. **Past Medical 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 incl. xrays

▶ Environmental Hazards (Home, School, Work)

▶ Exercise and Leisure

▶ Sleep Patterns

▶ Diet

▶ Current Medication
Analgesics/week:

▶ Tobacco

▶ Alcohol

▶ Social Drugs

7. Immediate Family Medical History:

▶ Age

▶ Health

▶ Cause of Death

▶ DM

▶ Heart Disease

▶ TB

▶ Stroke

▶ Kidney Disease

▶ CA

▶ Arthritis

▶ Anaemia

▶ Headaches

▶ Thyroid Disease

▶ Epilepsy

▶ Mental Illness

▶ Alcoholism

▶ Drug Addiction

▶ Other

8. Psychosocial history:

- ▷ Home Situation and 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

APPENDIX E

PHYSICAL EXAMINATION

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

Patient: _____ File#: _____ Date: _____
 Clinician: _____ Signature: _____
 Intern: _____ Signature: _____

1. VITALS

Pulse rate:

Respiratory rate:

Blood pressure: R L

Temperature:

Height:

Weight:

2. GENERAL EXAMINATION

General Impression:

Skin:

Jaundice:

Pallor:

Clubbing:

Cyanosis (Central/Peripheral):

Oedema:

Lymph nodes - Head and neck:
 - Axillary:
 - Epitrochlear:
 - Inguinal:

Urinalysis:

3. CARDIOVASCULAR EXAMINATION

- 1) Is this patient in **Cardiac Failure** ?
- 2) Does this patient have signs of **Infective Endocarditis** ?
- 3) Does this patient have **Rheumatic Heart Disease** ?

Inspection - Scars
 - Chest deformity:
 - Precordial bulge:
 - Neck -JVP:

Palpation: - Apex Beat (character + location):
 - Right or left ventricular heave:
 - Epigastric Pulsations:
 - Palpable P2:
 - Palpable A2:

- Pulses:**
- General Impression:
 - Radio-femoral delay:
 - Carotid:
 - Radial:
 - Dorsalis pedis:
 - Posterior tibial:
 - Popliteal:
 - Femoral:
- Percussion:** - borders of heart
- Auscultation:**
- heart valves (mitral, aortic, tricuspid, pulmonary)
 - Murmurs (timing, systolic/diastolic, site, radiation, grade).

4. RESPIRATORY EXAMINATION

1) Is this patient in **Respiratory Distress** ?

- Inspection**
- Barrel chest:
 - Pectus carinatum/cavinatum:
 - Left precordial bulge:
 - Symmetry of movement:
 - Scars:

- Palpation**
- Tracheal symmetry:
 - Tracheal tug:
 - Thyroid Gland:
 - Symmetry of movement (ant + post)
 - Tactile fremitus:

- Percussion**
- Percussion note:
 - Cardiac dullness:
 - Liver dullness:

- Auscultation**
- Normal breath sounds bilat.:
 - Adventitious sounds (crackles, wheezes, crepitations)
 - Pleural frictional rub:
 - Vocal resonance
 - Whispering pectoriloquy:
 - Bronchophony:
 - Egophony:

5. ABDOMINAL EXAMINATION

1) Is this patient in **Liver Failure** ?

- Inspection**
- Shape:
 - Scars:
 - Hernias:

- Palpation**
- Superficial:
 - Deep = Organomegally:

II External examination of eye: - Visual Acuity:
- Visual fields by confrontation:

- Pupillary light reflexes = Direct:
 = Consensual:
- Fundoscopy findings:
- III Ocular Muscles:
 Eye opening strength:
- IV Inferior and Medial movement of eye:
- V a. Sensory - Ophthalmic:
 - Maxillary:
 - Mandibular:
 b. Motor - Masseter:
 - Jaw lateral movement:
 c. Reflexes - Corneal reflex
 - Jaw jerk
- VI Lateral movement of eyes
- VII a. Motor - Raise eyebrows:
 - Frown:
 - Close eyes against resistance:
 - Show teeth:
 - Blow out cheeks:
 b. Taste - Anterior two-thirds of tongue:
- VIII General Hearing:
 Rinnes = L: R:
 Webers lateralisation:
 Vestibular function - Nystagmus:
 - Rombergs:
 - Wallenbergs:
 Otoscope examination:
- IX & Gag reflex:
- X Uvula deviation:
 Speech quality:
- XI Shoulder lift:
 S.C.M. strength:
- XII Inspection of tongue (deviation):

Motor System:

- a. Power
 - Shoulder = Abduction & Adduction:
 = Flexion & Extension:
 - Elbow = Flexion & Extension:
 - Wrist = Flexion & Extension:

- Forearm = Supination & Pronation:
- Fingers = Extension (Interphalangeals & M.C.P's):
- Thumb = Opposition:
- Hip = Flexion & Extension:
- = Adduction & Abduction:
- Knee = Flexion & Extension:
- Foot = Dorsiflexion & Plantar flexion:
- = Inversion & Eversion:
- = Toe (Plantarflexion & Dorsiflexion):

- b. Tone
- Shoulder:
 - Elbow:
 - Wrist:
 - Lower limb - Int. & Ext. rotation:
 - Knee clonus:
 - ankle clonus:

- c. Reflexes
- Biceps:
 - Triceps:
 - Supinator:
 - Knee:
 - Ankle:
 - Abdominal:
 - Plantar:

Sensory System:

- a. Dermatomes
- Light touch:
 - Crude touch:
 - Pain:
 - Temperature:
 - Two point discrimination:
- b. Joint position sense
- Finger:
 - Toe:
- c. Vibration:
- Big toe:
 - Tibial tuberosity:
 - ASIS:
 - Interphalangeal Joint:
 - Sternum:

Cerebellar function:

- Obvious signs of cerebellar dysfunction:
- = Intention Tremor:
 - = Nystagmus:
 - = Truncal Ataxia:

Finger-nose test (Dysmetria):

Rapid alternating movements (Dysdiadochokinesia):

Heel-shin test:

Heel-toe gait:

Reflexes:

Signs of Parkinsons:

8. SPINAL EXAMINATION:(See Regional examination)

Obvious Abnormalities:

Spinous Percussion:

R.O.M:

Other:

9. BREAST EXAMINATION:

Summon female chaperon.

Inspection - Hands rested in lap:
- Hands pressed on hips:
- Arms above head:
- Leaning forward:

Palpation - masses:
- tenderness:
- axillary tail:
- nipple:
- regional lymph nodes:

APPENDIX F

LOW BACK REGIONAL EXAMINATION

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC
REGIONAL EXAMINATION - LUMBAR SPINE AND PELVIS.

PATIENT: _____

FILE #: _____

DATE: _____

INTERN/RESIDENT: _____

SUPERVISING CLINICIAN: _____

STANDING:

Posture
Minor's Sign
Skin
Scars
Discoloration
Muscle Tone
Bony & Soft Tissue Contours

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

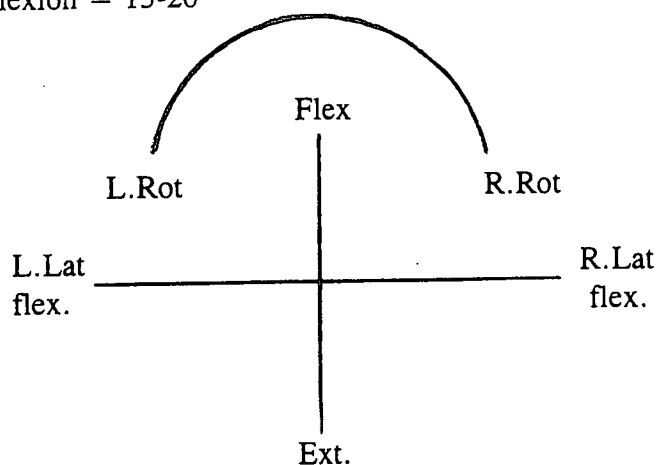
RANGE OF MOTION

Forward Flexion = $40-60^{\circ}$ (15cm from floor)

Extension = $20-35^{\circ}$

L/R Rotation = $3-18^{\circ}$

L/R Lateral Flexion = $15-20^{\circ}$



SUPINE:

Skin
Hair
Nails
Palpate Abdomen/groin
Pulses (abdomen)

Observe abdomen
Fasciculations
Abdominal Reflexes

Pulses (extremities)

SLR

Bowstring

Plantar Reflex

Circumference (thigh, calf)

Leg Length:

actual

apparent

Sciatic Notch

Patrick FABERE

Gaenslen's Test

Gluteus Maximus Stretch

Hip Medial rotation

Psoas Test

Thomas' Test:

hip joint

Rectus Femoris

LATERAL RECUMBENT

S-I Compression

Ober's Test

Femoral Nerve stretch

Myotomes:

QL

Gluteus Medius

NON ORGANIC SIGNS

Pin Point Pain

Axial Compression

Trunk Rotation

Burn's Bench Test

Flip Test

Hoover's Test

Ankle Dorsiflexion Test.

GAIT

Rhythm

On toes (standing)

On Heels (standing)

Half squat on one leg

PRONE

Gluteal skyline

Skin rolling

Iliac crest compression

Facet joint challenge

S-I tenderness

Erichson's Test

Pheasant's Test

Myotome:

Glut. Max

Active MF Trigger Pts:

QL

Glut. Med

Glut. Min

Glut. Max

Piriformis

Hamstrings

TFL

NEUROLOGICAL EXAMINATION

DERMATOMES			MYOTOMES			REFLEXES		
	L	R		L	R		L	R
T12			Hip Flex			Pat.		
L1			Hip int rot			Achil		
L2			Hip ext rot			H/S		
L3			Hip abd					
L4			Hip add					
L5			Knee flex					
S1			Knee ext					
S2			Dorsiflex					
S3			Plantarflex					
			Eversion					
			Ext.hal.long					

Tripod
Kemp's Test

MOTION PALPATION and JOINT PLAY:

LEFT: Upper Thoracics:
 Lumbar Spine:
 Sacroiliac Joint:

RIGHT: Upper Thoracics:
 Lumbar Spine:
 Sacroiliac Joint:

Basic Exam: Hip
Case History:

ROM: Active:
 Passive:
 RIM:
Orthopaedic/Neuro/
Vascular:

Observ/Palpation:

Basic Exam: Thoracic Spine
Case History:

ROM: Motion Palp:
 Active:
 Passive:
Orthopaedic/Neuro/
Vascular:

Observ/Palpation:

APPENDIX G

LETTER OF INFORMATION

LETTER OF INFORMATION

Dear Participant,

The research in which you will participate is entitled "The effectiveness of manipulation of the symptomatic sacroiliac joint compared to manipulation of both the asymptomatic and symptomatic sacroiliac joints in the treatment of unilateral sacroiliac syndrome."

This will be carried out to determine which treatment method is more effective in the treatment of sacroiliac syndrome.

Initially, you will be examined to determine if you are a suitable candidate for the research project. This includes a case history, relevant physical and regional examinations.

You will be randomly assigned to one of two groups. The first group (30 patients) will receive manipulation of the painful sacroiliac (pelvic) joint only. The second group (30 patients) will receive combined manipulation of the painful and non-painful sacroiliac joints. You will be treated with spinal manipulation four times over a three week period, and will be required to attend a follow up visit within seven days of the final treatment. Treatment is free for the duration of the study.

You are please asked not to alter your lifestyle for the duration of this research project. You are also asked not to receive any treatment of any nature for the duration of the research project as it will alter the outcome of your treatment. If you are currently taking any medication you are asked not to alter the dosage in any way for the duration of the study. Although rare, possible side-effects of the treatment you will receive include mild discomfort in the area of treatment, fatigue and mild pain in the groin, buttock and posterior thigh.

All information will be treated as highly confidential and will be retained in the clinic for a period of five years. It will then be shredded.

Participation is voluntary and you are free to leave this study at any time if you so wish and may return at a later stage to continue your treatment.

If you require any additional information or are not happy with any aspect of this trial please feel free to contact me or my supervisor on the numbers listed below.

Thank you for participating in this clinical trial.

Yours in Chiropractic

Norman Marszalek (Chiropractic Student Intern)

Ph: 2042205

Supervisor: Dr. B. Kruger

Ph: 5649091

APPENDIX H

INFORMED CONSENT FORM

LETTER OF INFORMED CONSENT

Date: _____

Title of research project: The effectiveness of manipulation of the symptomatic sacroiliac joint compared to manipulation of the asymptomatic and symptomatic sacroiliac joints, in the treatment of unilateral sacroiliac syndrome.

Name of supervisor: Dr. B. Kruger.

Name of research student: Norman Marszalek

Please circle the appropriate answer:

Yes No

1) Have you read the research information sheet?

Yes No

2) Have you had time 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 the 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?

a) at any time

b) without having to give any reason for withdrawing, and

c) without affecting your future health care?

Yes No

9) Do you agree to voluntarily participate in this study?

Yes No

If you have answered no to any of the above, please obtain the information before signing.

Please print in block letters:

Patient name: _____

Sign: _____

Research Student name: _____

Sign: _____

Witness name: _____

Sign: _____