THE RELATIVE EFFECTIVENESS OF MANUAL MANIPULATION VERSUS MANIPULATION USING THE "ACTIVATOR ADJUSTING INSTRUMENT" IN THE MANAGEMENT OF ACUTE ON CHRONIC SACROILIAC SYNDROME

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I, Kirstin Anne Shearar do declare that this dissertation is representative of my own work.

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DEDICATION

To Jonathan Silcock. This is for you! Thank you for being my dad, for teaching me to trust God with all my heart even when I don't understand. You have left a legacy that will last beyond my lifetime. Your belief in me – that I was the best – has given me the courage to dream big dreams.
I am so sorry you could not see this dream come to completion, but I know that you saw it long before it ever happened.
I love you and I miss you terribly.

Party on in Heaven!

To my King – Lord Jesus. My only prayer is that I would become all you've destined me to be.

You are my life-source.

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ABSTRACT

Low back pain is a significant health problem that has had a major impact on quality of life and on health care costs (Weiner, et al. 2000:450). Schwarzer, et al. (1995) established the sacroiliac joint to be a significant source of pain in patients with chronic low back pain. Bernard and Kirkaldy-Willis (1987:2107-2130) established the sacroiliac joint to be the primary source of low back pain in 22.5% of 1293 patients presenting with back pain.

According to a review article by Hendler, et al. (1995:169), "manipulation provides dramatic relief" in cases of sacroiliac syndrome. Little research, however, has been done regarding instrument manipulation and it's effect on acute, chronic or acute on chronic sacroiliac syndrome. Osterbauer and De Boer, et al. (1993) found a significant decrease in Visual Analogue Scale and Oswestry scores following treatment using instrument manipulation for sacroiliac joint syndrome. They also noted a reduction in the number of pain provocation tests applied to the research subjects.

"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" (Walker 1992:914).

The study design was a randomised, comparative clinical trial. Sixty voluntary subjects were accepted onto the trial; each diagnosed as having acute on chronic sacroiliac joint syndrome, and divided into two groups of thirty subjects. Each subject received five treatments within a three-week period. The subjects in group one received manipulation using the Diversified Technique of manipulation and those in group two received instrument manipulation using the "Activator Adjusting Instrument".

The response of the subjects to the Numerical Pain Rating Scale-101 and the Revised Oswestry Low Back Pain Disability Questionnaire was analysed statistically in terms of subjective measures. Additionally, the objective data was gathered from algometer measurements and the Orthopaedic Rating

Scale, and analysed statistically. This data was collected at the beginning of the first, third and final consultations.

Statistical analysis of the subjective and objective data showed equal improvement for both groups with regards to acute on chronic sacroiliac syndrome. Inter-group analysis showed that there was a slight difference between the two groups, favouring instrument manipulation (group two), however these observations were not statistically significant for all the outcome measures.

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DEFINITION OF TERMS

Adjustment

A manual manoeuvre 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 anatomic structure; force 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).

Chiropractic

Chiropractic is the discipline within the healing arts especially concerned with the aetiology, pathogenesis, diagnostics, therapeutics and prophylaxis of functional disturbances, pathomechanical states, pain syndromes and other neurophysiologic effects related to the statics and dynamics of the neuromusculoskeletal system, particularly those related to the spine and pelvis. (Schafer and Faye, 1990).

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 immobilisation 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 manoeuvre 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 or 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).

Motion palpation

Palpation of the human spine in the diagnosis of muscular, discal or articular mechanical changes used by some schools of osteopathy, chiropractic and occasionally medicine. (Robert Alley, 1983:97).

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

1.1 Introduction

Low back pain is a significant health problem that has had a major impact on quality of life and on health care costs (Weiner, et al.2000:450). It's estimated effect on the world's population is such that 60-90% suffer from pain sometime during their lives, while its incidence is as much as 20-30% (Cassidy and Burton, 1992:3).

Sacroiliac syndrome has been described as pain and decreased mobility of the sacroiliac joint resulting from the mechanical derangement of the sacroiliac joint (Cassidy and Burton, 1992:418). A study done by Bernard and Kirkaldy-Willis (1987:2107-2130) showed that the sacroiliac joint was the primary source of low back pain in 22.5% of 1293 patients presenting with back pain. Despite this high incidence, the sacroiliac joint is still commonly viewed as an "enigma" by medical practitioners (McCulloch and Transfeldt, 1997:180).

Sacroiliac syndrome is a well-researched condition. Numerous studies have found spinal manipulation to be more effective than other referenced treatments and, confirm that it provides dramatic relief (in the form of decreased pain and improved range of motion) in sacroiliac syndrome (Mohseni-Bondpei et al. 1998:185-194, Hendler et al. 1995:169, Osterbauer et al. 1993:82-90).

In a review of literature relating to various treatment methods for low back pain, Gatterman et al. (2001) found 10 studies that made use of instrument adjusting. This was relatively little information in comparison with the articles describing side posture, manual manipulation.

A review of literature by Osterbauer et al. (1992) found that the use of instrument manipulation for low back pain produced favourable results.

1.2 The Problem and its Setting

1.2.1 The Problem Statement

The purpose of this investigation was to evaluate the relative effectiveness of manual manipulation versus instrument adjusting in the treatment of acute-on-chronic sacroiliac syndrome.

1.2.2 The Objectives

1.2.2.1 Objective One

The first objective was to evaluate the relative effectiveness of manual manipulation versus instrument adjusting, in terms of subjective clinical findings, in the treatment of acute-on-chronic sacroiliac syndrome.

1.2.2.2 Objective Two

The second objective was to evaluate the relative effectiveness of manual manipulation versus instrument adjusting, in terms of objective clinical findings, in the treatment of acute-on-chronic sacroiliac syndrome.

1.2.2.3 Objective Three

The third objective was to integrate the results of objectives one and two in order to determine whether either of the two treatments was more effective than the other in terms of subjective and objective clinical findings.

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

2.1 Introduction

The following chapter aims to create a clear understanding regarding the incidence, definition, diagnosis and treatment of sacroiliac syndrome, as well as outlining the relevant anatomy and biomechanics of the sacroiliac joint and its dysfunction. Further importance will be dedicated to instrument manipulation and the theories and principles surrounding the use of the "Activator Adjusting Instrument" in treating sacroiliac syndrome.

2.2 Incidence and prevalence of sacroiliac syndrome

Cassidy and Burton (1992) claim that 60-80% of the population will suffer from low back pain at some time in their life, and between 20% and 30% are suffering from low back pain at any given time. Mechanical low back pain is a major health problem among general populations in Western, industrial countries and a major cause of medical expenses, absenteeism and disablement (Van Tulder, Koes and Bouter, 1997:2128).

Frank and De Souza (2001) state that back pain has a worldwide prevalence, but in many industrialised societies disability due to back pain has reached epidemic proportions. An epidemiological study done by Van der Meulen (1997) found that the lifetime incidence of low back pain amongst Indigenous Africans in South Africa was 57,6%. A similar study by Docrat (1999) amongst Indian and coloured communities in South Africa, found that the lifetime incidence of low back pain amongst Indians was 78,2%, and coloureds 76,6%. 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. At the time of data collection, a total of 405

(10.12%) of the 4001 mothers had severe low back pain, 513 (12.82%) had moderate low back pain, and 1422 (35.54%) had mild low back pain.

Schwarzer et al. (1995) established the sacroiliac joint to be a significant source of pain in patients with chronic low back pain. In a medical literature review, Toussaint et al. (1999:134) noted that the prevalence of sacroiliac joint dysfunction in the general population was between 19,3% and 47,9%, depending on the variables in the study group. These variables included age, sex, level of physical fitness, employment, and degree of education.

2.3 The sacroiliac joint syndrome

2.3.1 Symptoms

Kirkaldy-Willis (1992:124), believes the symptoms of sacroiliac syndrome include pain over the posterior aspect of the sacroiliac joint that varies in its degree of severity; referred pain to the groin, over the greater trochanter, down the back of the thigh to the knee, and occasionally down the lateral or posterior calf to the ankle, foot and toes.

2.3.2 Associated clinical signs

Restricted joint movement and associated tenderness over the posterior superior iliac spine (Urli and Till, 1995).

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. Daum

(1995:475) stated 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.

A similar set of clinical findings, typical of sacroiliac joint syndrome were proposed by McCulloch and Transfeldt (1997:180), including: pain and palpable tenderness over the sacroiliac joint, aggravated by provocation tests; pain referral to the groin, trochanter and buttock; an idiopathic nature as to the cause of the pain; and clinical asymmetry as to the movement of the sacroiliac joints.

The following provocation tests are used to confirm the diagnosis:

1) Posterior shear (POSH) or "thigh thrust test" (Laslett and Williams, 1994:1244).
❖ Patient's position: supine.
❖ Examiner's position: standing on the side opposite to the suspected sacroiliac syndrome (i.e. on the left for a suspected right sacroiliac syndrome).
❖ Method: The patient's right knee and hip are flexed and slightly adducted. The examiner places the left hand under the right sacroiliac joint and applies a downward, or posterior, shearing force 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.

2) Gaenslen's test (Kirkaldy-Willis, 1992:125).
❖ Patient's position: Supine.
❖ Examiner's position: standing on the same side as the suspected sacroiliac syndrome (i.e. on the right for a suspected right sacroiliac syndrome).
❖ Method: The patient's left knee and hip is flexed, while the examiner presses downward over the right thigh to hyperextend the hip. A positive

test is recorded if this position elicits pain over the region of the right sacroiliac joint.

The interexaminer reliability of both Gaenslen's and the Posterior shear tests was found to be 88.2% and 94.1% respectively (Laslett and Williams, 1994:1246). Furthermore, Hendler, et al. (1995:173) found that Gaenslen's was frequently positive on examination of a patient with sacroiliac joint dysfunction.

3) Patrick Faber test (Kirkaldy-Willis, 1992:125).
❖ Patient's position: Supine.
❖ Examiner's position: standing on the same side as the suspected sacroiliac syndrome (i.e. on the right for a suspected right sacroiliac syndrome).
❖ Method: The patient's right knee and hip are flexed. The hip is then externally rotated. The examiner places his right hand over the patient's left iliac crest and his 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.

Broadhurst and Bond (1998:341-345) evaluated both the Posterior shear and Patrick Faber tests to determine their specificity for sacroiliac joint dysfunction. This double-blinded trial concluded that these tests delivered a high degree of sensitivity (77%) and specificity (100%) in the diagnosis of sacroiliac joint dysfunction. They stated further that the addition of other pain provocation tests in conjunction with the two tested would only "add to the physicians diagnostic capabilities".

4) Yeoman's (Erichson's) test (Kirkaldy-Willis, 1992:125).
❖ Patient's position: Prone
❖ Examiner's position: standing on the same side as the suspected sacroiliac syndrome (i.e. on the right for a suspected right sacroiliac syndrome).

- ❖ Method: The examiner places one hand under the right thigh above the knee, in order to extend the hip. The examiner's other hand presses downward over the crest of the right ilium, while the right hip is extended. A positive test is recorded if this position elicits pain over the region of the right sacroiliac joint.

Two of the most common tests used by chiropractors in the diagnosis of sacroiliac syndrome have been excluded from this study for the following reasons:

Harrison, Harrison and Troyanovich (1997:613) believe that motion palpation, used for the purpose of identifying asymmetry in motion, may not be valid due to the assumption 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". These same authors also question the validity of the Gonstead Listing System. Moorcroft (1997:41) found, during a randomised clinical trial, that the use of x-rays and the Gonstead Listing System held no reliability and was not recommended for use in diagnosing sacroiliac syndrome.

Gillet's (or standing hip flexion) test is frequently used by chiropractors to assess sacroiliac joint mobility. Sturesson, Uden and Vleeming (2000:364) examined 22 patients with sacroiliac pain using radiostereometric analysis. This analysis was used while performing Gillets test on the right and left sides. The results showed no more than about 1.1° sacroiliac movement around the x-axis. External detection of joint movement by manual methods was deemed virtually impossible.

The above stated lends a greater validity to Laslett (1997:288), who felt that pain provocation tests (that mechanically stress the joint), had a far better potential than motion palpation tests in the diagnosis of sacroiliac syndrome. This is because the symptoms that motivated the patient to seek treatment were also being used to indicate positivity or negativity of the tests.

2.5 Anatomy of the sacroiliac joints

2.5.1 Introduction

The sacroiliac joint is formed by the articulation between the sacrum and the ilium. It is a synovial joint, the iliac surface composed of thin fibro-cartilage and the articular surface of the sacrum composed of hyaline cartilage (Kirkaldy-Willis, 1992:71).

The collagen fibres of the hyaline cartilage on the sacral side are aligned parallel to the joint only in the most superficial layer, which is consistent with the other articular surfaces of the body. The iliac cartilage has chondrocytes arranged in palisades and clumped together between bundles of collagen fibres, all positioned perpendicular to the joint surface. Although this collagen is a type II, typical of hyaline cartilage, it gives the appearance of fibrocartilage (Mooney, 1997:37).

The two sacroiliac joints make up an integral part of and add stability to the pelvic ring (Giles and Singer, 1997:411). Sacroiliac joint surfaces have been demonstrated to have complimentary, cartilage covered ridges and depressions on the auricular surfaces. This not only restricts movement but also contributes to the strength of the joint as weight is transferred from the vertebral column to the lower extremities (Giles and Singer 1997:174).

2.5.2 Developmental anatomy

Most human joints cavitate (initially form a true joint space) in the eighth week of gestation. Cavitation of the sacroiliac joint occurs in the tenth week of intrauterine life. It is not well established until the second trimester (Walker, 1986:326). Normally, opposing surfaces of synovial joints develop between two cartilage analagens (primary growth centres). Maturation of the joint leads to ossification of the cartilage growth models, forming primary centres of ossification, and leaving behind a cap to form the articular surfaces of the joint (Bernard, 1997:73). The sacroiliac joint is different in that it has already

ossified by the time cavitation takes place. This means that the newly formed joint develops between a hyaline cartilage model and the newly ossified ilium. Cassidy (1994:24) believes that this is significant for the reason that it allows for unequal chondrogenesis and may well explain the variation in the cartilage surfaces between the two joints.

The sacral vertebrae and pelvic bones remain separated by cartilaginous regions, which gradually ossify throughout the initial developmental period until about eighteen years of age. Synostosis occurs after the age of eighteen and is completed by about the twenty-fifth year. By this time the sacroiliac joint would have acquired complete adult morphology (Gotz, 1993:132). After the fourth decade, following the thinning of the cartilaginous elements of the joint, marginal ankylosis may begin (Mior, Ro and Lawrenece, 1999:214). Most individuals lose sacroiliac joint mobility by the eighth decade due to complete bony ankylosis.

2.5.3 Surface texture

Ruch (1997:324) studied the sacroiliac joint surfaces of 200 cadavers in detail. He established that there were vast surface irregularities and variations between cadavers, and side-to-side differences in the same specimen were present. The surface irregularities were always found to be reciprocal in form; i.e. an elevation of the sacral surface fits a depression of the iliac surface and vice versa. The ridges and depressions varied in height and number, and were orientated in differing directions (Harrison, Harrison and Troyanovich, 1997:608). These authors further concluded that the 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 lower limbs".

Vleeming, et al. (1990:130) found the articular surfaces of the female sacroiliac joints to be smaller, flatter and smoother that those of the male. This was linked to function, and more specifically parturition in women.

2.5.4 Ligamentous anatomy

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." The sacroiliac ligaments are among the largest in the body (Mior, Ro and Lawrence, 1999:214); (Harrison, Harrison and Troyanovich, 1997:609). They may have been broken down into intrinsic and extrinsic ligaments.

The intrinsic capsular ligaments strengthen both the anterior and posterior portion of the fibrous capsule of the sacroiliac joint:

❖ Interosseous sacroiliac ligament: This is the largest syndesmosis in the body and the largest connection in this region. The interosseous sacroiliac ligament is a thick ligament filling the irregular spaces posterior and superior to the joint. It functions to strongly resist joint separation and translations along the vertical and anteroposterior planes.

❖ Anterior sacroiliac ligament: This is a thickening if the joint capsule anteriorly and inferiorly. Its fibres are thin superiorly and become progressively thickened inferiorly. They attach horizontally across the joint. The function of this ligament is to oppose translation of the sacrum up or down, and oppose separation of the joint surfaces.

❖ Posterior sacroiliac ligament: This ligament attaches to the sacral tuberosity medially and runs laterally to attach to superiorly to the posterior superior sacroiliac spine. Its function is to counteract the gravitational forces and prevent distraction of the joint. The posterior sacroiliac ligament covers the interosseous ligament. It may branch into a long and short posterior sacroiliac ligament.

The extrinsic ligaments, although external to the fibrous capsule of the sacroiliac joint, do assist in stabilising the joint:

❖ The iliolumbar ligaments: These run from the transverse processes and body of the fifth lumbar vertebra, and attach along the superior border of

the iliac crest. They function to limit all motions between the distal lumbar spine and sacrum.

❖ The sacrotuberous ligament: the fibres of this ligament attach to the anterolateral border of the sacrum and run laterally and anteriorly to attach to the ischial spine. It functions to resist sacral flexion rotation.

❖ The sacrospinous ligament: This thin triangular ligament also counteracts sacral flexion rotation.

❖ The pubic symphysis: The three ligaments composing the pubis symphysis include the superior pubic, arcuate pubic and interpubic. The complex serves to resist shear stresses, anterior sacral rotation and joint separation.

2.5.5 Muscles of the sacroiliac joint

The muscles surrounding the sacroiliac joint do not directly affect joint motion. They are, however amongst the most powerful and strongest muscles in the body (Bernard and Cassidy, 1991:2115). Movement of the sacroiliac joint occurs not through the contraction of intrinsic muscles, but by various other 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) assure that, although having no direct influence on joint motion, muscles do indeed play an important role in the movement of the sacroiliac joint.

Mior, Ro and Lawrence (1999:216) claim that there are three major muscle groups that affect sacroiliac joint motion:

❖ Muscles that flex, extend, or rotate the vertebral column, resulting in sacral motion.

❖ Muscles that flex, extend, abduct, adduct, supinate, or pronate the thigh, resulting in iliac movement.

❖ Muscles that tilt the pelvis anteriorly or poseriorly, resulting in sacral movement, and tilt the pelvis laterally left or right, resulting in iliac movement.

These muscle groups include erector spinae, multifidus, iliopsoas, gluteus maximus, piriformis, hamstrings, sartorius and rectus abdominus muscles.

2.5.6 Innervation of the sacroiliac joint

According to Hilton's law, any nerve crossing a joint gives a branch to that joint (Hollinshead, 1982:210).

The posterior aspect of the sacroiliac joint is innervated by both posterior rami of L5-S2 spinal nerves, and the anterior aspect is innervated by both posterior branches from the L3-S2 nerve roots and the superior gluteal nerve L5-S2. The articular branches of these joints are derived from the superior gluteal nerves, the sacral plexus, and the dorsal rami of S1 and S2 nerves (Moore, 1992:251).

Apart from the innervation of numerous unmyelinated free nerve endings that transmit pain and temperature sensation (Mooney, 1997:41), the sacroiliac joint and capsule have a complex innervation, providing pressure and position sense to the central nervous system (Ombregt, et al., 1995:691).

Two types of articular nerves exist: a specific type reaching the joint capsule as independent branches of peripheral nerves, and then non-specific articular branches that are derived from muscles overlying a particular joint. The overlying muscles receive the same innervation, and these articular nerves are thought to have a unique feedback mechanism on these muscles. The articular mechanoreceptors regulate muscle tone, forming an arthrokinetic reflex (Bernard and Cassidy, 1991:2111).

Maitland, et al. (2001:384) described the sacroiliac joint as having a diverse and very extensive innervation from L2 to S4. They further concluded that this would likely account for the inconsistent and variable presentation in suggested sacroiliac joint patterns

2.6 Biomechanics and function of the sacroiliac joint

2.6.1 Kinematics

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).

Movements of the sacroiliac joint are small and vary according to each individual. There is a general lack of agreement on the movements of the sacroiliac joint, and the precise nature of motion in the normal joint is unclear. The structure of the joint (extensive ridges and depressions) lends itself to very limited mobility (Ombregt, Bisschop and Ter Veer, 1995:692).

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 (Harrison and Troyanovich, 1997:607). They suggested that the above-mentioned individual components should be considered a complex integrated system that provides stability while allowing limited mobility.

Schaefer and Faye (1990:95) described sacroiliac joint motion in terms of upper and lower articulations. The lower section allows a slight sliding motion anteriorly-inferiorly and posteriorly-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."

Sturesson (1997:174) used roentgen stereophotogrammetric analysis (RSA) to demonstrate mobility in the sacroiliac joints of twenty-five patients with

sacroiliac joint disorders. This system of analysis has "… taken the role as the gold standard in determining mobility in orthopaedic research concerning growth, small movements in joints, and micromotion of arthroplasties." The RSA results revealed the following:

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

2.6.2 Kinetics

The position of the sacroiliac joints as a link in the kinetic chain between the spine and legs, makes it imperative that it have stability and mobility and yet be able to withstand the considerable forces affecting it (Mior, Ro and Lawrence, 1999:221).

Miller, Schultz and Anderson (1987:92) claim that the sacroiliac joint's strategic location makes it susceptible to large downward shear loads ranging from 300 to 1750 N during daily activities. A study done on cadaver specimens showed that the sacroiliac joints had a mean downward shear strength of 4865 N (Gunterberg, Romanus and Stener, 1976:635). 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. 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 (Snijders, Vleeming and Stockhart, 1993:287).

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).

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

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

2.7 Mechanism of sacroiliac joint syndrome

Toussaint, et al. (1999:134) noted that the reasons why there are symptomatic and assymptomatic sacroiliac dysfunctions has yet to be sufficiently explained and consequently warrants further research into improved treatment protocols.

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. This was later confirmed by Hesch (1997:535), who suggested that the sacroiliac joint was part of an integrated system and,

presumably, did not function in an isolated fashion. He elaborated further that it might 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.

Theoretically speaking, abnormal or unbalanced loading conditions could force the sacroiliac joint into a position where the ridges and depressions no longer compliment each other. This abnormality in joint position could be regarded as a blocked joint (Vleeming, et al., 1990:130). Hendler, et al. (1995:171), agreed with Vleeming, et al., and went on to state that, because the ridges and depressions of the opposing joint surfaces were normally so congruent, even a small abnormal load could lead to incongruency. This incongruency resulted in the local ligaments becoming taut, reflex muscle spasm occurring, and finally pain that may be severe and continuous.

This theory was further expanded by Hesch (1997:535) in claiming that hypomobility of the sacroiliac joint would result in the joint not effectively absorbing the stress from daily activities. This would result in over-stress of the other related structures, contributing to musculoskeletal pain and dysfunction.

An alternative, but complementary, theory was proposed by Gatterman (1990:114) in which he described the sacroiliac joint to be like a typical vertebral motion-segment. Dysfunction may take the form of simple joint locking, or simple joint locking with compensatory hypermobility in adjacent articulations. This compensatory hypermobility would result in the contralateral sacroiliac joint being subject to increased motion demands, with the possibility of overload and subsequent pain and inflammation.

2.8 Treatment of sacroiliac joint syndrome

Chiropractic manipulation was superior to hydrotherapy and traction in patients with chronic low back pain. 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). They also stated that surgery was required in less than 1% of patients with low back pain.

Daum (1995:478) reported that surgery, in cases of sacroiliac syndrome, should only be considered after all other conservative therapeutic modalities had failed, due to its inconsistent results. These conservative 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 anaesthetics or steroids (minimal usage is advocated only in extreme cases of a highly acute nature); and chiropractic manipulation.

In a recent comprehensive review of the medical literature, Cooperstein, et al. (2001:410) established that many studies, 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 did however conclude: "What we still do not know is which specific chiropractic treatment methods are most appropriate for specific clinical conditions."

2.9 Chiropractic manipulation in sacroiliac joint syndrome

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

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).

Manipulation is performed to restore joint play to dysfunctional joints. It is thought to work by 1) releasing entrapped synovial folds or plica; 2) relaxing hypertonic muscles; and 3) disrupting articular or periarticular adhesions (Shakelle 1994: 858-861). The stimulation of joint mechanoreceptors during manipulation is thought to create 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.

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

Calliet (1981:129-130) claims that the possible effects of spinal manipulation to be as follows:

❖ An acute synovial reaction causes immobilisation of the facet joint and adherence of the joint surfaces of the facet takes place. A passive movement, which involves the mobilisation of the spinal motion segment back and forth through its passive range of motion, separates these surfaces.

- ❖ Abrupt movement of the joint in the form of manipulation causes desensitisation of the mechano-receptors, and reflexive protective muscle spasm is removed, allowing the joint to move again.
- ❖ Due to the manipulation, the entrapped menisci are allowed to exit the facet joint.
- ❖ Manipulation allows the capsule (formerly lodged between two adjacent articular surfaces) to be freed.
- ❖ The spindle systems of adjacent muscles are reflexly stimulated by the dynamic thrust of the manipulation and reciprocally relax the extrafusal muscle fibres.
- ❖ The malaligned spinal segments are aligned to conform to the centre of gravity.

Literature therefore indicates that manipulative therapy for sacroiliac joint syndrome is an effective treatment for this condition.

2.10 Instrument manipulation in sacroiliac joint syndrome

The use of instruments to adjust the spine dates back to the origins of the profession (Fuhr et al. 1997). Development of the "Activator Adjusting Instrument" began when Fuhr and Lee found that repetitive use of the thumb toggle technique led to extreme fatigue, muscle strain and frequent elbow injuries. As a result they sought an instrument that would reduce stress on the clinician as well as control the speed, force and direction of thrusts (Osterbauer et al. 1995).

In vivo studies show that the force applied via the activator method results in intervertebral displacement (Nathan and Keller 1994).

In a review of related literature, Osterbauer et al. (1992) noted that the "Activator Adjusting Instrument" has a positive effect in the treatment of low back pain.

In a review of literature relating to various treatment methods for low back pain, Gatterman et al. (2001) found 10 studies that made use of instrument adjusting. This was relatively little information in comparison to the articles describing side posture, manual manipulation.

The review included a case study in which Osterbauer and Fuhr (1992) found that a sciatica patient improved within one month of care, using instrument manipulation, after three failed months of medical care. Another study, this time by Osterbauer and De Boer, et al. (1993) found a significant decrease in Visual Analogue Scale and Oswestry scores following treatment using instrument manipulation for sacroiliac joint syndrome. They also noted a reduction in the number of pain provocation tests applied to the research subjects. When Gemmell and Heng (1987) combined instrument manipulation with low force adjustments, it was found that the experimental subjects showed a greater increase in sacroiliac joint movement than the control group.

No research has been found, to date, comparing manipulation using the Diversified Technique with instrument manipulation for sacroiliac syndrome.

2.11 Conclusion

Taking the afore-mentioned evidence into account, it is seen that sacroiliac syndrome, although poorly researched, is a contributor to low back pain. The treatment methods adopted, effective as they may be, need to be expanded to incorporate more versatile and, possibly more effective, protocols.

Instrument manipulation of the sacroiliac joint is not well documented as a therapy for sacroiliac joint syndrome due to the lack of research in this field. The benefits of instrument manipulation for both the patient and the practitioner are significant enough to motivate further studies in this area.

CHAPTER THREE

3. MATERIALS AND METHODS

3.1 Introduction

This chapter gives detailed description of the methods employed in data collection as well as the statistical methods used for the interpretation of the data. This includes a detailed description of the design, primary and secondary data, the subjects and interventions used. Each questionnaire is discussed as well as the process of data evaluation. The study design was a randomised, comparative, clinical trial. Two treatment groups were prescribed, one group receiving manipulation using the Diversified Technique, and the other receiving instrument manipulation using the "Activator Adjusting Instrument".

3.2 The Data

Both primary and secondary data were used in this study.

3.2.1 The Primary Data

The primary data was obtained directly from the patients and consisted of:

1. Information gathered from the case history (Appendix A), physical examination (Appendix B) and low back regional examination (Appendix C).

2. Specific diagnosis and evaluation of the condition (namely, sacroiliac syndrome) using the Orthopaedic Rating Scale (Appendix F).

3. Clinical observation of the pain sensitivity of the patient, as well as the change in their condition, using an algometer pain/pressure meter (Appendix F).

4. The patient's perception of their disability obtained through the use of the Revised Oswestry Disability Questionnaire (Appendix D).

5. The patient's response to the Numerical Pain Rating Scale-101 (Appendix E) regarding their changing levels of pain.

3.2.2 The Secondary Data

The secondary data was obtained during a search of related literature. This included journal articles, textbooks, medline and the internet (using relevant search engines).

3.3 The Subjects

Subjects were recruited from the greater Durban area by means of advertising placed in local newspapers, pamphlets placed in local sports clubs, gyms and shopping centres, and advertising by word-of-mouth. All respondents were screened telephonically, and subsequently scheduled for an initial consultation provided they met the initial criteria. No stratification of subjects took place, and they were accepted regardless of race, occupation, gender, and severity of their condition. The patients were only included in the study once they had been diagnosed with acute-on-chronic sacroiliac syndrome and it was established that they were not excluded from the study according to the criteria explained below.

3.4 Inclusion and exclusion criteria

Inclusion Criteria:

❖ Patients with a recent history of low back pain longer than 2 weeks duration with a total of more than 4 weeks of low back pain in the preceding year were accepted (acute on chronic episode of low back pain) (Nilsson et al. 2001).

- Only patients between the ages of 18 and 59 years of age were included in this study in order 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.

- Any mechanical conditions associated with but secondary to sacroiliac syndrome (e.g. active myofascial involvement, facet syndrome) were assessed and noted in the lower back regional examination, but no treatment for these conditions was administered.

- Patients already taking anti-inflammatory or analgesic medication (ibuprofen, paracetamol, etc.) were included in the study following a 3-day washout period (Seth, 1999).

Exclusion Criteria:

- 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).

- Previous lumbar surgery and pregnant females (due to hormone-induced ligament laxity and possible resultant instability of the sacroiliac joint occurring during pregnancy [Vleeming et al. 1990:131]) were excluded from the study.

- Patients receiving workers compensation or disability insurance for low back pain were excluded.

❖ Patients were excluded immediately if they had participated in any other research project at the Durban Institute of Technology Chiropractic Day Clinic during the previous three months.

Once included in the research, participants were only excluded if:

❖ They underwent any other form of treatment for low back pain during participation in the research.

❖ They changed their everyday activity levels, or normal lifestyle, as this would bias the results.

3.5 Ethical considerations

❖ The rights and welfare of the subject were protected.

❖ Informed consent was obtained (Appendix H).

❖ The subject was not coerced into participation in the study.

❖ Information was given to the subject in an understandable language.

❖ 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.

3.6 The Sample Group

The sample population consisted of sixty patients, selected for the study according to the aforementioned criteria. Patients were randomly allocated

into one of two groups, without the use of stratification, depending on a number drawn from a box.

Group one was the group receiving side posture manipulation of the symptomatic sacroiliac joint using the Diversified Technique of manipulation (Schafer and Faye, 1990:241-269).

Group two was the group receiving mechanical force, manually assisted instrument manipulation of the symptomatic sacroiliac joint using a hand held instrument, namely the "Activator Adjusting Instrument" (Gemmell and Jacobson, 1995).

3.7 Intervention

At the initial consultation, all prospective participants in the study underwent a full case history (Appendix A), a physical examination (Appendix B), and a regional examination of the lumbar spine and pelvis (Appendix C). Patients were then provided with an Information Sheet (Appendix G), and informed consent (Appendix H) was obtained before inclusion into the study.

Each participant attended four consultations over a two-week period, and then a follow-up consultation within one week following the fourth treatment. Objective and subjective data was collected at the beginning of the first, third, and follow-up consultations. If the patient became asymptomatic, in terms of subjective clinical findings, before the final consultation, the patient continued to be evaluated for the remainder of the treatment period, but received no further treatment.

The most symptomatic joint was identified by motion palpation of the sacroiliac joints (Schafer and Faye, 1990: 211-217). Motion Palpation was used to identify the sacroiliac joints with restricted and/or abnormal motion (Schafer and Faye, 1989: 211-216, 256-259). Motion palpation was also used to determine in which plane the manipulative technique should be administered (for those in Group one), allowing the patient to experience the

least amount of discomfort and to restore maximum joint play to their sacroiliac joints (Schafer and Faye, 1989: 211-216, 256-259).

Motion palpation was used in conjunction with the Orthopedic rating scale (ORS) in order to give an objective rating of the severity of the syndrome, as motion palpation alone will not do this. The ORS also provides an additional objective measure of the relative improvement of the condition.

Patients in Group one received spinal manipulative therapy using the Diversified Technique of manipulation (Schafer and Faye, 1990:241-269). A side-posture adjustment, using either a thenar or hypothenar contact, was applied to the affected sacroiliac joint.

Group two received mechanical force, manually assisted manipulation to the affected sacroiliac joint by means of a hand held instrument. Adjustments were carried out with the patient in a prone position and delivered by means of the "Activator Adjusting Instrument" (Gemmell and Jacobson, 1995).

For the purpose of this study, motion palpation was used to determine the side of fixation (i.e. the symptomatic joint), the level of reduced motion in the joint, and whether the fixation is in flexion or extension (i.e. the plane of fixation) (Schafer and Faye, 1990: 211-17; Schafer and Faye, 1989: 7, 211-16, 256-59). If the sacroiliac joint was found to be fixated in flexion, it was treated as a posterior inferior (PI) ilium subluxation, and an extension fixation was treated as an anterior superior (AS) ilium subluxation.

Instrument manipulation was applied to the symptomatic joint using the method outlined by Fuhr, et al. (1997:183-188), in their book "Activator Methods Chiropractic Technique".

The following contact points were used for a PI ilium subluxation
(Appendix I and J):
　　1) On the same side as the flexion fixation, the tip of the instrument was
　　　　positioned in the soft tissue of the gluteus maximus muscle just medial

to the ischial tuberosity and directed towards the spine of the ilium. The line of drive was superior, lateral, and posterior.

2) On the same side as the flexion fixation, the tip of the instrument was placed in the sciatic notch, under the sacrotuberous ligament. The line of drive was superior, lateral and posterior.

3) On the same side as the flexion fixation, the tip of the instrument was placed in the fossa just lateral to the sacroiliac joint, on the lateral aspect of the ilium. The line of drive was superior and anterior.

The following points were used for a AS ilium subluxation

(Appendix I and J):

1) On the side opposite to the extension fixation, the tip of the instrument was placed on the base of the sacrum, about half an inch lateral to the first sacral tubercle. The line of drive was inferior and anterior.

2) On the side opposite to the extension fixation, the tip of the instrument was placed on the crest of the ilium about one inch superior the posterior superior iliac spine. The line of drive was parallel to the plane line of the sacroiliac joint (medial and inferior).

3) On the side opposite to the extension fixation, the tip of the instrument was placed on the superior aspect of the ischial tuberosity. The line of drive was inferior and anterior.

The use of this technique was in keeping with a study done by Gemmell and Jacobson (1995) in which they applied instrument manipulation to the lumbar spine in the treatment of low back pain. The study made use of the adjusting procedure outline by the Activator Method and not the technique in toto, with its analytical procedure. This means that the study investigated only the relative effectiveness of the adjustive procedure associated with the method and not the "name-brand" technique itself.

3.7.1 Measurements

3.7.1.1 Subjective measurements

3.7.1.1.1 Revised Oswestry Disability Questionnaire

The Revised Oswestry Low Back Pain Disability Questionnaire consists of ten sections encompassing pain intensity; personal care; lifting; walking; sitting; standing; sleeping; social life; traveling; and changing degree of pain.

Each section consists of six statements, each allocated a score from between 0 (indicating no disability) and 5 (indicating maximum disability). If the first section was marked, the allocated score would be 0, and if the last statement was marked, the allocated score would be 5. The intervening statements were scored according to rank. The final score was totaled out of 50, and then converted to a percentage, indicating perceived disability at that time. The overall goal would be to assess the change in the patient's condition over time (Fairbank and Pynsent, 2000:2944).

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

3.7.1.1.2 The Numerical Pain Rating Scale-101

Subjective pain measurement is considered one of the most important measurements available to both researchers and clinicians (Jenson, et al., 1986). The Numerical Pain Rating Scale-101 (NRS) is a questionnaire used to measure the changing intensities of pain experienced by the patient. The questionnaire includes two separate graphs; both ranging from 0 to 100, where 0 indicates "no pain", and 100 indicates "pain as bad as it could be". The subjects were asked to rate their pain firstly according to the pain intensity when it is at its worst, and secondly the pain intensity when the pain is at its least. The average of these two scores is an indication of the patients pain level.

A study by Jenson, Karoly and Braver (1986:117-126), concluded that the NRS was superior to other measures due to its simple, practical method of administering and scoring (which may be in the written or verbal form), and its results did not seem age-dependant.

A more recent study by Bolton and Wilkinson (1998) on seventy-nine patients receiving chiropractic care, compared three different pain scales (namely, the Visual Analogue Scale, the Verbal Rating Scale, and the NRS). It was found that the NRS was the most responsive, and was recommended for use in most types of outcome studies.

3.7.1.2 Objective measurements

3.7.1.2.1 The Orthopedic Rating Scale

Specific 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.

Each of the above tests were allocated a specific score when testing positive, namely, Posterior shear which, according to Laslett and Williams (1994:1246) is a more sensitive test, was allocated four points, and the rest of the three remaining tests were each allocated two points. This scale is based on the principle that the specificity of the diagnosis is improved when based on a combination of diagnostic tests (Griner, et al., 1981:559).

Completion of the tests resulted in an orthopedic assessment rating out of 10. Those scoring 6 or more out of 10 were included in the study. A respective change in the patient's score indicated a change in the condition.

As randomized reliability of the ORS has not yet been established, the ORS was correlated with the RODQ in order to establish concurrent reliability. (Login, 2001).

3.7.1.2.2 The Algometer

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, thus providing a means of quantifying treatment (Fischer 1986:837).

The Wagner FDK20 Force Dial (Wagner Instruments, P.O. Box 1217, Greenwich, CT, 06836 USA, tel. 2038699861) was used for the purposes of this study. This was used to assess the tenderness of the affected joint according to the number of kilograms the patient can withstand before they first perceive pain.

The readings were taken over the most painful area of the symptomatic sacroiliac joint. This position may have varied from treatment to treatment, but it was ensured that the respective measurement taken from the asymptomatic joint corresponded in position. Measurements were taken by placing the tip of the algometer to the most painful part of the symptomatic joint (and then the corresponding area of the other sacroiliac joint), and applying a posterior to anterior pressure at a rate of 1 kilogram per square centimeter (kg/cm²) per second until the patient verbally indicated pain. The readings were measured in kilograms per square centimeter (kg/cm²). A higher reading indicated lower pain sensitivity, or higher pain tolerance.

3.8 Treatment of the Objectives

The purpose of this study was to investigate the relative effectiveness of manual manipulation versus instrument adjusting in the treatment of acute on chronic sacroiliac syndrome.

3.8.1 The First Objective

The first objective was to evaluate the relative effectiveness of manual manipulation and instrument adjusting in the treatment of acute on chronic sacroiliac syndrome in terms of subjective clinical findings.

3.8.2 The Second Objective

The second objective was to evaluate the relative effectiveness of manual manipulation and instrument adjusting in the treatment of acute on chronic sacroiliac syndrome in terms of objective clinical findings.

3.9 Statistical Analysis

3.9.1 Treatment of the Data

3.9.1.1 Subjective Data

The subjective data was treated as follows:

- ❖ Questionnaires that the patients filled out were screened to ensure that they had been filled out correctly.

- ❖ Raw data from the questionnaires were converted into percentages where necessary and recorded separately for each group.

- ❖ The data was analysed using a 5% significance level.

3.9.1.2 Objective Data

The objective data was treated as follows:

- ❖ The algometer readings were recorded separately for each group.

- ❖ The results of the orthopaedic tests were recorded separately for each group.

- ❖ The data was analysed using a 5% significance level.

3.10 Statistical Procedure

Following consultation with the Durban Institute of Technology research statistician, 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). The results were presented in the form of graphs and tables. The statistical evaluation was aimed at measuring any significant changes occurring between the initial and third consultations, the initial and fifth consultations, as well as the third and fifth consultations between the different study groups.

Both parametric and non-parametric testing was used in order to analyse the data obtained. Parametric tests were used to analyse the algometer readings, ORS (Percentage analysis), NRS and the RODQ readings. Statistical tests included Mann-Whitney U-Test (for inter-group analysis), and Friedman's T-test (for intra-group analysis). This analysis would determine any significant changes between the initial, third and fifth consultations within each study group.

3.10.1 Procedure 1: Mann-Whitney U-Test (inter-group)

The Mann-Whitney U-Test (for independent samples) was used to determine whether any significant difference occurred between the two groups at the time of the final consultations. In order to validate the difference at the final consultation, the two groups were analysed in the same manner for the initial consultation. The data analysed was the RODQ, NRS, ORS, and algometer readings of both groups.

The null hypothesis (Ho) stated that there was no difference between the two groups. The alternative hypothesis (Hi) stated that there was a difference between the two groups. (Fischer and Van Belle, 1993:315-319).

Therefore the null hypothesis is either accepted or rejected according to the p-value.

Ho: There is no difference between the two groups.
Hi: There is a difference between the two groups.

$\alpha = 0.05$
Decision rule:
If $p < \alpha$, reject Ho.
If $p \geq \alpha$, accept Ho.
Where p is the reported p-value.

3.10.2 Procedure 2: The Friedman's T-test for K-related samples (intra-group)

The Friedman's T-test is a non-parametric test that encompasses three or more related groups (Instat, 2001). If the p-value is small, one can conclude that at least one of the treatments differs from the rest, it is therefore necessary to look at posttests to determine which groups differ from other groups (Instat, 2001). The Friedman's T-test was used between groups to determine if there was any significant difference according to the RODQ,

NRS, ORS, and algometer readings between the first, third and follow-up consultations.

Hypothesis testing:

The null hypothesis (Ho) stated that there was no difference between consultations with regards to the variable of interest. The alternative hypothesis (Hi) stated that there was a difference (improvement) between consultations with regards to the variable of interest.

Ho: The two treatments yield identical results.
Hi: One treatment tends to yield larger results.

α = 0.05 = level of significance of the test.

The decision rule:
For a one-tailed test:

Reject Ho at α level of significance of p $<$ α = 0.05.
Accept Ho at α level of significance of p $\geq$ α = 0.05 where:

p = (reported p-value/2) if   Hi is of form $<$ and z is negative
                                      Hi is of form $>$ and z is positive

p = 1 - (reported p-value/2) if   Hi is of form $<$ and z is positive
                                      Hi is of form $>$ and z is negative

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

3.11 Summary

Sixty patients suffering from low back pain, and diagnosed as having acute in chronic sacroiliac syndrome, were accepted onto the study. These patients were randomly allocated into two groups of thirty patients each. Those in group one received spinal manipulation using the diversified technique, while those in group two received instrument manipulation of the symptomatic sacroiliac joint.

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 manual manipulation as compared with instrument manipulation of the sacroiliac joint.

CHAPTER FIVE

5. DISCUSSION

5.1 Introduction

This chapter aims to discuss the subjective and objective data in a simple and clear manner.

The data was gathered at the first, third, and final (fifth) consultations. The subjective data consisted of the Numerical Pain Rating Scale-101 and the Revised Oswestry Disability Questionnaire. The objective data consisted of algometer readings and the Orthopaedic Rating Scale.

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

5.2 Intra-group results

5.2.1 Subjective data

5.2.1.1 The Revised Oswestry Disability Questionnaire

The RODQ scores were statistically analysed using Friedman's T-Test.

Within group one, there was an improvement between visits 1 and 3, 1 and 5, and therefore 3 and 5 (p=0.000). Tables' 6a and 6b depict these results. Dunn's procedure established that the greatest improvement occurred between treatments 1 and 5. There was equal improvement between treatments 1 and 3, and 3 and 5.

Within group two, improvements occurred between visits 1 and 3, 1 and 5, and therefore 3 and 5 (p=0.000). Tables' 8a and 8b depict these results.

Dunn's procedure established that the greatest improvement occurred between treatments 1 and 5. The next greatest improvement occurred between treatments 1 and 3.

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

5.2.1.2 The Numerical Pain Rating Scale-101

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

Within group one, there was an improvement between visits 1 and 3, 1 and 5, and therefore 3 and 5 (p=0.000). Tables' 7a and 7b depict these results. Dunn's procedure established that the greatest improvement occurred between treatments 1 and 5. The next greatest improvement occurred between treatments 1 and 3.

Within group two, improvements occurred between visits 1 and 3, 1 and 5, and therefore 3 and 5 (p=0.000). Tables' 9a and 9b depict these results. Dunn's procedure established that the greatest improvement occurred between treatments 1 and 5. The next greatest improvement occurred between treatments 1 and 3.

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

5.2.2 Objective data

5.2.2.1 The Orthopaedic Rating Scale

The ORS scores were statistically analysed using Friedman's T-Test.

Within group one, there was an improvement between visits 1 and 3, 1 and 5, and therefore 3 and 5 (p=0.000). Tables' 10a and 10b depict these results.

Dunn's procedure established that the greatest improvement occurred between treatments 1 and 5. The next greatest improvement occurred between treatments 3 and 5.

Within group two, improvements occurred between visits 1 and 3, 1 and 5, and therefore 3 and 5 (p=0.000). Tables' 13a and 13b depict these results. Dunn's procedure established that the greatest improvement occurred between treatments 1 and 5. The next greatest improvement occurred between treatments 1 and 3.

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

5.2.2.2 The Algometer

The algometer readings were statistically analysed using Friedman's T-Test.

The readings were recorded on both the symptomatic and assymptomatic side.

The symptomatic side:

Within group one, there was an improvement between visits 1 and 3, 1 and 5, and therefore 3 and 5 (p=0.000). Tables' 11a and 11b depict these results. Dunn's procedure established that the greatest improvement occurred between treatments 1 and 5. The next greatest improvement occurred between treatments 3 and 5. This procedure shows that there was no significant improvement between treatments 1 and 3.

Within group two, improvements occurred between visits 1 and 3, and 1 and 5, and therefore 3 and 5 (p=0.000). Tables' 14a and 14b depict these results. Dunn's procedure established that the greatest improvement occurred between treatments 1 and 5. The next greatest improvement occurred between treatments 1 and 3.

<u>The assymptomatic side.</u>

Within group one, there was an improvement between visits 1 and 3, 1 and 5, and therefore 3 and 5 (p=0.000). Tables' 12a and 12b depict these results. Dunn's procedure established that the greatest improvement occurred between treatments 1 and 5. The next greatest improvement occurred between treatments 3 and 5. This procedure shows that there was no significant improvement between treatments 1 and 3.

Within group two, improvements occurred between visits 1 and 3, 1 and 5, and therefore 3 and 5 (p=0.000). Tables' 15a and 15b depict these results. Dunn's procedure established that the greatest improvement occurred between treatments 1 and 5. This procedure shows that there was no significant improvement between treatments 1 and 3 and treatments 3 and 5.

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

5.3 Inter-group results

5.3.1 Subjective data

5.3.1.1 The Revised Oswestry Disability Questionnaire

The RODQ scores were statistically analysed using the Mann-Whitney U-Test. The scores for both the initial and final consultations were analysed.

There was no difference between the two groups at the initial consultation, at the 5% significance level. This is shown in Table 1a.

There was no difference between the two groups at the final consultation, at the 5% significance level. This is shown in Table 1b.

These results indicate that, in terms of subjective pain intensity and disability, both treatment protocols were equally effective.

Although not statistically significant, group two seemed to show a greater improvement than group one regarding the RODQ scores, especially between treatments 1 and 3.

5.3.1.2 The Numerical Rating Scale-101

The NRS scores were statistically analysed using the Mann-Whitney U-Test. The scores for both the initial and final consultations were analysed.

There was no difference between the two groups at the initial consultation, at the 5% significance level. This is shown in Table 2a.

There was no difference between the two groups at the final consultation, at the 5% significance level. This is shown in Table 2b.

These results indicate that, in terms of subjective pain intensity and disability, both treatment protocols were equally effective.

Although not statistically significant, group two seemed to show a greater improvement than group one regarding the NRS scores, especially between treatments 1 and 3.

These results indicate that, in terms of subjective changing levels of pain intensity, both treatment protocols were equally effective.

5.3.2 Objective data

5.3.2.1 The Orthopaedic Rating Scale

The ORS scores were statistically analysed using the Mann-Whitney U-Test. The scores for both the initial and final consultations were analysed.

There was no difference between the two groups at the initial consultation, at the 5% significance level. This is shown in Table 3a.

There was no difference between the two groups at the final consultation, at the 5% significance level. This is shown in Table 3b.

These results indicate that, in terms of objective findings, both treatment protocols were equally effective.

5.3.2.2 The Algometer

The symptomatic side.

The NRS scores were statistically analysed using the Mann-Whitney U-Test. The scores for both the initial and final consultations were analysed.

There was no difference between the two groups at the initial consultation, at the 5% significance level. This is shown in Table 4a.

There was no difference between the two groups at the final consultation, at the 5% significance level. This is shown in Table 4b.

These results indicate that, in terms of subjective changing levels of pain intensity, both treatment protocols were equally effective.

The assymptomatic side.

The NRS scores were statistically analysed using the Mann-Whitney U-Test. The scores for both the initial and final consultations were analysed.

There was no difference between the two groups at the initial consultation, at the 5% significance level. This is shown in Table 5a.

There was no difference between the two groups at the final consultation, at the 5% significance level. This is shown in Table 5b.

These results indicate that, in terms of subjective changing levels of pain intensity, both treatment protocols were equally effective.

5.4 Comparison of the results

Numerous studies exist that support the use of manual Chiropractic manipulation (using the Diversified Technique) in the treatment of sacroiliac joint syndrome (Mohseni-Bondpei et al. 1998:185-194, Hendler et al. 1995:169, Osterbauer et al. 1993:82-90). This study corroborated their results and thus proved to further validate their findings.

In terms of inter- and intra-group analysis specific to instrument manipulation of the sacroiliac joint, it was found that group two showed a significant decrease in both subjective and objective measures. These results are in line with the only other study found using instrument manipulation in the treatment of sacroiliac syndrome (Osterbauer and De Boer, et al. 1993). This study also showed a decrease in average disability scores as well as a reduction in the number of pain provocation tests.

No studies can be found comparing manual manipulation with instrument manipulation for sacroiliac joint syndrome. This study would therefore act as a base-line study for further research in this field.

5.5 Summary

After statistical analysis and its interpretation regarding the use of instrument manipulation as opposed to manipulation using the Diversified Technique, it was found that some differences did occur, favouring instrument manipulation in most cases. However, these differences where not sufficient to conclude that one treatment was more effective than the other.

CHAPTER SIX

6. 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.

It is in the opinion of the researcher that different population groups may show a tendency to respond favourably to differing treatment protocols. It is recommended that further studies focus on these groups (regarding gender, race and age) and their specific, individual response to each treatment protocol.

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 Durban Institute of Technology Chiropractic Day Clinic.

Blinding

Observer bias could be eliminated by not allowing the examiner to know which group was being assessed, as well as by not allowing the examiner to view the previous treatments readings.

Sample size

Larger sample sizes would increase the validity of the study and minimise the possibility of a Type II error, which is incorrectly accepting the null hypothesis.

Treatment schedules

The treatments should be uniformly scheduled in order to ensure consistency and greater validity of the treatments. All treatments should be administered within a set timeframe to allow a direct and accurate comparison of the effect of each treatment and the overall efficacy.

Follow-up consultations

Long term follow-up consultations (around 1month and then 6 months) should be incorporated into the study. This would assist in addressing cost-effectiveness and general efficacy of the treatment protocols utilised.

Diagnosis of sacroiliac syndrome

Until strict, validated diagnostic criteria are established for sacroiliac joint syndrome, the efficacy of the treatments for this condition will continue to be questioned. This study did not make use of the leg length inequality assessment. This method is used in Activator Methods Chiropractic Technique as a diagnostic tool (this replaces motion palpation as used to determine the fixation listing in Diversified Technique). It was informally noted during the duration of the research that the leg length inequality in each patient was found to be on the same side of the flexion fixation, and on the opposite side of the extension fixation in the sacroiliac joint. It was further observed that the leg length inequality was generally decreased directly following each treatment, and that the inequality got progressively less over the duration of the treatment period. This correction of leg length was seemingly concurrent with decreased symptomology in patients undergoing instrument manipulation for sacroiliac joint syndrome. It is recommended that further studies incorporate the "postural evaluation assessment indirect measures for leg length inequality", as well as "Activator Methods Chiropractic Technique leg testing procedures" as outline by Fuhr et al. (1997), in their book "Activator Methods Chiropractic Technique".

Use of the algometer

Unless the exact point of measurement 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

The natural progression of sacroiliac syndrome would be best observed in a group receiving placebo treatment (sham manipulation). This would greatly enhance the validity of the results of this trial.

Further research

The researcher firmly believes that the use of Activator Methods Chiropractic Technique in its totality would have had further benefit in the treatment of sacroiliac joint syndrome, and it would benefit the profession to incorporate the technique in its entirety into further research projects.

6.2 Conclusion

The results of this study showed a statistically significant improvement for both treatment groups, in other words, neither protocol was more effective than the other in the treatment of acute on chronic sacroiliac syndrome. This implies that instrument manipulation may be used with equal confidence when treating low back pain caused by sacroiliac syndrome.

The short follow-up period used in this study design prevents any conclusive comment on the long-term effect of either treatment protocol.

It is the author's contention that further research into the sacroiliac joint should concentrate on the ergonomic implications (for the practitioner) of the Diversified Technique of manipulation, and aim to establish the use of more conservative treatment protocols for sacroiliac syndrome.

Therefore, further investigation into this condition and alternative treatment protocols, combined with a better study design would greatly enhance the chiropractic approach to sacroiliac syndrome.

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APPENDIX A

CASE HSTORY

APPENDIX B

PHYSICAL EXAMINATION

APPENDIX C

LOW BACK REGIONAL EXAMINATION

DURBAN INSTITUTE OF TECHNOLOGY CHIROPRACTIC DAY CLINIC
REGIONAL EXAMINATION – *LUMBAR SPINE AND PELVIS*

PATIENT:_____

FILE #:_____   DATE:_____

INTERN/RESIDENT:_____

SUPERVISING CLINICIAN:_____

STANDING:

Posture	Spinous Percussion
Minor's Sign	Schober's Test (6cm)
Skin	Treadmill
Scars	Body Type
Discoloration	Attitude
Muscle Tone	
Bony & Soft Tissue Contours	

RANGE OF MOTION:

Forward Flexion = 40-60° (15cm from floor)
Extension = 20-35°
L/R Rotation = 15-20°

SUPINE:

Skin	Observe Abdomen
Hair	Fasciculations
Nails	Abdominal Reflexes
Palpate Abdomen/Groin	
Pulses (Abdomen)	
Pulses (Extremities)	
SLR	
Bowstring	
Plantar Reflex	
Cicumference (thigh, calf)	
Leg Length: Actual	
Apparent	
Sciatic Notch	
Patrick Fabere	
Gaenslen's	
Gluteus Maximus Stretch	
Hip Medial Rotation	
Psoas Test	
Thomas' Test: Hip Joint	
Rectus Femoris	

LATERAL RECUMBENT:

SI 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
SI Tenderness
Erichson's Test
Pheasant's Test
Myotome: Glut. Max
Active MF Trigger Points:
        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 nit rot			Achil		
L2			Hip ext rot			H/S		
L3			Hip abd					
L4			Hip add					
L5			Knee flex					
S1			Knee ext					
S2			Foot dorsiflex					
S3			Foot plantarflex					
			Eversion					
			Inversion					

Tripod
Kemp's Test

MOTION PALPATION & JOINT PLAY:

LEFT: Upper Thoracics:
      Lumbar Spine:
      Sacroiliac Joint:

RIGHT: Upper Thoracics:
      Lumbar Spine:
      Sacroiliac Joint:

Basic Exam: Hip   **Basic Exam: Thoracic Spine**
Case History   Case History

ROM: Active   ROM: Motion Palp:
   Passive   Active:
   RIM   Passive:
Orthopaedic/Neurovascular: Orthopaedic/Neurovascular:

Observation/Palpation: Observation/Palpation:

APPENDIX D

REVISED OSWESTRY LOW BACK DISABILITY QUESTIONNAIRE

Revised Oswestry
Low back pain and Disability Questionaire

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 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 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 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 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 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 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 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 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 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.

APPENDIX E

NUMERICAL PAIN RATING SCALE-101

APPENDIX F

ORTHOPAEDIC RATING SCALE
AND
ALGOMETER READINGS

APPENDIX G

LETTER OF INFORMATION

<div align="center">

DURBAN INSTITUTE OF TECHNOLOGY
Letter of information.

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Dear Participant,

Welcome to this research study. The title of the study is: The relative effectiveness of manual manipulation versus manipulation using the "Activator Adjusting Instrument" in the treatment of acute on chronic sacroiliac syndrome.

There are two treatment groups, each consisting of 30 participants, and you will be randomly allocated to a specific group. Group 1 will receive manual manipulation of the sacroiliac joint, while Group 2 will receive instrument manipulation using a hand-held instrument called the "Activator Adjusting Instrument". Both groups will undergo a detailed case history, relevant physical examination, and a regional examination.

You will be required to undergo 4 treatments in a two-week period and then a follow-up consultation within one week of the 4th treatment, during which the final measurements will be taken. Your compliance will affect the outcome of the study and attendance at all of the scheduled appointments will be for your own benefit, as well as ensure speedy progression of the study.

During the study you are asked to refrain from any other form of treatment for this condition, chiropractic or other (including the use of drugs such as non-steroidal anti-inflammatories, analgesics, paracetamol and cortisone injections). If you do so, please inform the researcher. You are further asked to refrain from any new or unaccustomed activities.

Although rare, possible side effects may include mild discomfort in the area of treatment, fatigue and mild pain in the buttock, groin and posterior thigh. Your full cooperation in this study will establish a more varied treatment protocol and, possibly, less time consuming treatment for sacroiliac syndrome.

The research will be performed under the supervision of a qualified Chiropractor at the Durban Institute of Technology Chiropractic Day Clinic, and treatment, while on research will be free of charge. Please feel free to ask me or my supervisor questions at any time during the course of your treatment, and know that you are free to withdraw from the study at any time.

The method in which your information is gathered will be ethical and restricted to the purpose of this study. All information will be treated as highly confidential and will be retained in the clinic for a period of five years, during which only those conducting the study and the clinic staff will have access to it. It will then be shredded.

Yours sincerely,

Kirstin Shearar   Dr. H. White
6th year Chiropractic Intern.   Supervisor.
Tel: 031-2042512   Tel: 031-2042244

APPENDIX H

INFORMED CONSENT FORM

DURBAN INSTITUTE OF TECHNOLOGY
INFORMED CONSENT FORM.
(to be completed by patient / subject)

Date:

Title of research project: **The relative effectiveness of manual manipulation versus manipulation using the "Activator Adjusting Instrument" in the treatment of acute on chronic sacroiliac syndrome.**

Name of Supervisor: **Dr. H. White (tel: 031-2042244)**

Name of research student: **Kirstin Shearar (tel: 031-2042512)**

PLEASE CIRCLE THE APPROPRIATE ANSWER:

1. Have you read the research information sheet?	Yes	No
2. Have you had the opportunity to ask questions regarding this study?	Yes	No
3. Have you received satisfactory answers to your questions?	Yes	No
4. Have you had an opportunity to discuss this study?	Yes	No
5. Have you received enough information about this study?	Yes	No

6. Who have you spoken to? _____

7. Do you understand the implications of your involvement in this study?	Yes	No
8. Do you under stand that you are free to withdraw from this study?	Yes	No

  a) At any time
  b) Without having to give any reason for withdrawing, and
  c) Without affecting your future health care.

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 necessary information from the researcher or research supervisor before signing.

Please Print in block letters:

Patient / Subject Name: _____ Signature: _____

Witness Name: _____ Signature: _____

Research Student Name: _____ Signature: _____

APPENDIX I

CONTACT POINTS FOR LEFT
PI AND AS ILIUM

APPENDIX J

CONTACT POINTS FOR RIGHT
PI AND AS ILIUM

Schematic of Pelvis
(in the prone position)

Right Side PD

Contact Points for AS Ilium

1.* Posterior Base of Sacrum
½" lateral to 1st Sacral Tubercle
LOD: Ant-Inf

2.* Crest of Ilium
LOD: Inf-Med

3.* Ischial Tuberosity
LOD: Ant-Inf

Contact Points for PI Ilium

1. Spine of Ischium
LOD: Post-Sup-Lat

2. Under Sacrotuberous Ligament
toward S.I. Joint
LOD: Post-Sup-Lat

3. Iliac Fossa
LOD: Ant-Sup