The efficacy of a single maintained contact drop piece manipulation technique in the treatment of sacroiliac syndrome.

By

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I, Quentin Martin Botha do declare that this dissertation is representative of my own work.

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DEDICATION

I dedicate this research to my incomparable parents, Martin and Jean,
and my wonderful girlfriend, Marlene.

Thank you for your unending love, support,
encouragement and sacrifices.

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ABSTRACT

Research indicates the sacroiliac joint (prevalence of sacroiliac syndrome ranges from 19.3% and 47.9% (Toussaint et al., 1999)) as being the primary source of low-back pain in 22.5% of patients with back pain (Bernard et al., 1987:2107-2130).

Treatment options that are available for the treatment of low-back pain include allopathic (Hellman and Stone, 2000), and manual therapies such as hydrotherapy and traction (Cull and Will, 1995). It has been found that allopathic interventions have been less effective than spinal manipulative therapy, even with spinal manipulative therapy having various modes of application (e.g. side posture and drop piece manipulations) (Gatterman et al., 2001).

Drop table thrusting techniques were found to be effective for patients with neuromuskuloskeletal problems such as facet syndrome (Haldeman et al., 1993), however, it is still not known which specific drop piece technique is the most appropriate for sacroiliac syndrome. Thus it is important to ascertain the clinical effectiveness of the technique as certain conditions prevent the patient from being positioned in the conventional side posture for treatment of sacroiliac syndrome (White, 2003; Pooke, 2003; Hyde, 2003; Pretorius, 2003; Haldeman, 2003; Cramer, 2003; Engelbrecht, 2003).

Therefore this study aims at determining the efficacy of a maintained contact drop piece manipulation technique.

This study included a total of eighty subjects divided into two groups of thirty and one of twenty. The method was that of non-probable convenience sampling in order to have a more accurate representation of the entire population.

Each subject that met the inclusion and exclusion criteria was asked to draw a piece of paper out of an envelope on which an “A”, “B” or “C” was printed. Group

A included those that received treatment, group B included those that received placebo and group C included those in the control group.

Treatment included a maintained contact drop piece manipulation to the symptomatic sacroiliac joint. The placebo group received a sham drop piece manipulation and the control group received a sham drop piece manipulation with no patient contact.

Subjects underwent two consultations – one treatment and one follow-up. The follow -up was within 24 hours after the treatment. Data collection took place pre and post treatment, at 1 hour and then within 24 hours.

SPSS version 11.5 (SPSS Inc, Chicago, Ill, USA) was used to analyse the data. STATA version 7 (STATA Corp, USA) was used to generate GEE models for categorical outcomes. A p value of <0.05 was considered as statistically significant.

Statistical analysis of the subjective and objective data showed an improvement in group A and no improvement in groups B and C with regards to a single maintained contact drop piece manipulation to the symptomatic sacroiliac joint.

This implies that a single maintained contact drop piece manipulation is effective for the treatment of sacroiliac syndrome in terms of objective and subjective findings for immediate and short-term measures.

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Chapter 1:

1) Introduction

Research indicates the sacroiliac joint (prevalence of sacroiliac syndrome ranges from 19.3% and 47.9% (Toussaint et al., 1999)) as being the primary source of low-back pain in 22.5% of patients with back pain (Bernard et al., 1987:2107-2130). Studies in South Africa indicate a high incidence of low-back pain in the Indian, Coloured and Black communities (Worku (2000:147-154); Docrat, 1999; Van der Meulen, 1997). With the incidence of low-back pain in South Africa being comparable to the global norm (based predominantly on Western research), it could be assumed that the sacroiliac joint is the primary cause of low-back pain in the South African community when considering the prevalence of sacroiliac syndrome.

Treatment options that are available for the treatment of low back pain include allopathic (Hellman and Stone, 2000), and manual therapies such as hydrotherapy and traction (Cull and Will, 1995). It has been found that allopathic interventions have been less effective than spinal manipulative therapy, even with spinal manipulative therapy having various modes of application (e.g. side posture and drop piece manipulations) (Gatterman et al., 2001).

In this respect drop table thrusting techniques were found to be effective for patients with neuromusculoskeletal problems such as facet syndrome (Haldeman et al., 1993 as cited by Gatterman et al., 2001), however, it is still not known which specific drop piece technique is the most appropriate for sacroiliac syndrome. The two types of drop table techniques used widely by chiropractors are toggle recoil manipulations (the contact hand is quickly withdrawn from the contact point immediately after the thrust is given) and a maintained contact manipulation (the contact is maintained throughout the manipulation). Hence, this research is aimed at determining the efficacy of a maintained contact drop piece manipulation technique for immediate outcome improvement in the treatment of sacroiliac syndrome in terms of objective and subjective findings.

1.1) Aims and Objectives

1.1.1) The Aim

There is no literature based on clinical studies available on a drop table thrusting technique that makes use of a maintained contact, whereby the contact point of the thrusting hand is not quickly withdrawn (toggled), therefore this research is aimed at determining the efficacy of a maintained contact drop piece manipulation technique for immediate outcome improvement in the treatment of sacroiliac syndrome in terms of objective and subjective findings.

1.1.2) The Objectives

The first objective is to determine the efficacy of a maintained contact drop piece manipulation technique versus placebo intervention for immediate outcome improvement in the treatment of sacroiliac syndrome in terms of objective and subjective findings.

> Hypothesis one: Patients receiving the maintained contact drop piece manipulation will improve significantly in terms of subjective and objective findings when compared to the placebo group for immediate outcome improvement in the treatment of sacroiliac syndrome.

The second objective is to determine the efficacy of a maintained contact drop piece manipulation technique versus control placebo intervention for immediate outcome improvement in the treatment of sacroiliac syndrome in terms of objective and subjective findings.

> Hypothesis two: Patients receiving the maintained contact drop piece manipulation will improve significantly in terms of subjective and objective findings when compared to the control placebo group for immediate outcome improvement in the treatment of sacroiliac syndrome.

The third objective is to compare a control placebo intervention and a placebo intervention for immediate outcome improvement in the treatment of sacroiliac syndrome in terms of objective and subjective findings.

Hypothesis three: Patients receiving the placebo and control placebo intervention will show no significant improvement, nor will there be a difference between the two groups in terms of objective and subjective findings for the immediate outcome improvement in the treatment of sacroiliac syndrome

The fourth objective is to determine if there is a psychosocial touch effect in the treatment of sacroiliac syndrome in terms of objective and subjective findings.

Hypothesis four: There will be no psychosocial touch effect in the treatment of sacroiliac syndrome in terms of objective and subjective findings.

1.2) The Rationale

The best techniques for manipulating patients with certain conditions need to be taken into account. These conditions include age, gender, physique, general physical condition, area of complaint, flexibility, chronicity, location of subluxation and contraindications. (Gatterman, 1995)

Certain conditions prevent the patient from being positioned in the conventional side posture for treatment of sacroiliac syndrome, hence the need for the most effective drop piece technique (White, 2003; Pooke, 2003; Hyde, 2003; Pretorius, 2003; Haldeman, 2003; Cramer, 2003; Engelbrecht, 2003). For example, anterior catching of the hip capsule or decreased flexibility makes side posture manipulation more difficult and unpleasant / painful for the patient.

The need for alternative treatment options increases the practitioner's ability to adapt to patient treatment requirements within the clinical setting to optimise and facilitate patient improvement, however, Cooperstein et al. (2001) stated that it is still unknown which specific chiropractic treatment methods are the most appropriate for specific clinical conditions and that it is important that outcomes for the treatment of specific conditions are researched.

Drop table thrusting techniques were rated as being effective for the care of patients with neuromusculoskeletal problems (Haldeman et al., 1993) as cited by Gatterman et al., (2001), however, it is still unknown which specific drop piece technique is the most appropriate for sacroiliac syndrome.

Techniques that use a lower force / velocity should be used first before high velocity thrusts (Gatterman, 1995), therefore drop piece techniques should be employed before side-posture techniques. This may be beneficial to patients who have contraindications to torsioning such as Abdominal Aortic Aneurysm, and who may benefit from low force thrusting techniques. (Gatterman, 1995).

Chapter 2

2) Literature Review

2.1) Introduction

The review of the literature aims to create an understanding of the incidence of sacroiliac syndrome in relation to low-back pain; the definition, diagnosis and treatment of sacroiliac syndrome; the anatomy and biomechanics of the sacroiliac joint as well as the mechanism of sacroiliac joint dysfunction, and the possibility of psychophysical touch effects in chiropractic treatment and its hypothesised effects on treatment outcome.

2.2) Anatomy of the Sacroiliac joints

2.2.1) Introduction

The sacroiliac joints are formed by articulations between the sacrum and the ilium. The sacroiliac joints have an auricular shape and form an essential part of and add stability to the pelvic ring (Giles and Singer, 1997:411).

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

The iliac surface is covered by cartilage, which has chondrocytes arranged in palisades, clumped together between bundles of collagen fibres, all of which are positioned perpendicular to the joint surface. The collagen fibres are of a hyaline nature on the sacral side, which are aligned parallel to the joint in the most superficial layers; the deeper layers are more haphazard. This arrangement is consistent with other articular surfaces in the body. Although this cartilage is typical of hyaline cartilage (Type II), it gives the appearance of fibrocartilage (Mooney, 1997:37).

2.2.2) Surface Texture

Ruch (1997:324) studied 200 cadaver sacroiliac joint surfaces in detail and established that the surfaces of the joints showed vast irregularities and variations between cadavers and that side-to-side differences were also present within the same specimen. The surface irregularities were always found to be reciprocal (i.e. an elevation of the iliac surface fits a depression of the sacral surface and vice versa). These elevations and depressions can be seen in a review of the literature, where Harrison, Harrison and Tryanovich (1997:608) stated that the elevations and depressions varied in height, were numerous, and orientated in different directions. They further concluded that these irregularities were "a non-pathological adaptation to increased stress at the joints that restrict mobility and increase the stability of the joint in transmitting weight from the spine to the lower limbs".

This, however, complicates the body's response to abnormal or unbalanced loading conditions, which forces the sacroiliac joint into a position where the ridges and depressions no longer complement each other (Vleeming, et al, 1990:130). This can be regarded as a segmental dysfunction, resulting in (Leach, 1994: 43-44):

- point tenderness or altered pain threshold to pressure in adjacent musculature,
- loss of normal motion, and
- contraction or tension in the adjacent musculature.

When such dysfunction is present, the effects are not only on the joint surfaces, but also the surrounding muscles, ligaments and associated soft tissues.

2.2.3) Ligamentous anatomy

The sacroiliac ligaments are among the largest in the body and may be broken down into intrinsic and extrinsic ligaments (Mior, Ro and Lawrence, 1999:214 and Harrison, Harrison and Tryanovich, 1997:609).

The extrinsic ligaments include, the iliolumbar, sacrotuberous, sacrospinous and pubic symphysis ligaments, which are outside of the fibrous capsule of the joint and assist in stabilising the joint (Mior, Ro and Lawrence, 1999:214 and Harrison, Harrison and Tryanovich, 1997:609). These can be described as follows:

a. The iliolumbar ligaments run from the transverse processes and the body of the fifth lumbar vertebra and attach along the superior border of the iliac crest. They limit all motion between the distal lumbar spine and the sacrum.
b. The sacrotuberous ligament attaches to the anterolateral border of the sacrum and runs anterolaterally to the ischial spine. It resists sacral flexion rotation.
c. The sacrospinous ligament is a thin triangular ligament, which also counteracts sacral flexion rotation.
d. The pubic symphysis is composed of three ligaments, viz: the interpubic, arcuate pubic and the superior pubic. It resists shear stresses, anterior sacral rotation and joint separation.

The intrinsic ligaments strengthen the fibrous capsule anteriorly and posteriorly (Mior, Ro and Lawrence, 1999:214 and Harrison, Harrison and Tryanovich, 1997:609), and include the following:

a. The anterior sacroiliac ligament is an anterior inferior thickening of the joint capsule that is thin superiorly and becomes thickened inferiorly and attaches horizontally across the joint. It opposes translation of the sacrum up or down as well as separation of the joint surfaces.
b. The posterior sacroiliac ligament covers the interosseous ligament and may branch into a long and short posterior sacroiliac ligament. It attaches medially to the sacral tuberosity, runs laterally and attaches superiorly to the posterior superior iliac spine. It counteracts gravity and prevents distraction of the sacroiliac joint.

c. The interosseous sacroiliac ligament is a thick ligament filling the irregular spaces posterior and superior to the joint. It is the largest syndesmosis in the body. It strongly resists joint separation and translations along the vertical and anteroposterior planes.

In respect of this study, it is important to understand that these ligaments play a vital role with respect to the movements of the sacroiliac joint. This role is facilitated by the presence of various neurological receptors that are associated with the ligaments. These receptors include mechanoreceptors (Wyke types I – III) of which the Type A beta afferents are most commonly found within the joint capsule and surrounding ligaments. These receptors are sensitive to stretch and intra-articular pressure changes, and assist the body in determining movement and position within the sacroiliac joint (Leach, 1994:90). In addition to this, nociceptors are also present (Wyke type IV). These are free nerve endings and are found in articular capsule, blood vessels, synovial membrane and ligaments (Leach, 1994:102).

The functions of these ligament receptors are enhanced or aided by the presence of the receptors within the muscles around the sacroiliac joint. However, before we discuss these receptors, a discussion of the muscles will follow.

2.2.4) Muscles of the sacroiliac joint

Sacroiliac joint motion is not directly affected by muscles that surround the joint (Bernard and Cassidy, 1991:2115), but rather through various other mechanisms:

- the sacrum moves when the spinal column changes position,
- the ilium moves when the lower extremities change position.

It is further concluded that although the muscles do not directly influence joint motion, they do play an important role in sacroiliac stability (Harrison et al., 1997). These muscles play a key role, especially since they are expected to create stability for effective load transfer during movement (Harrison et al., 1997: 610).

There are three major muscle groups that affect sacroiliac joint motion in this manner (Mior, Ro and Lawrence, 1999:216):

a. Muscles that flex, extend, or rotate the vertebral column, moving the sacrum. (erector spinae, rectus abdominus, multifidus, iliopsoas).
b. Muscles that flex, extend, abduct, adduct, supinate and pronate the thigh, moving the ilium. (iliopsoas, hamstrings, sartorius, piriformis, gluteus maximus).
c. Muscles that tilt the pelvis anteriorly or posteriorly moving the sacrum, and tilting the pelvis laterally moving the ilium. (gluteus maximus, sartorius, rectus abdominus, iliopsoas).

These various muscle groups are governed by muscle receptors, which include muscle spindle receptors, Golgi tendon organs, pressure receptors (these first three would be classified as Wyke types I – III), and unmyelinated pain receptors (Wyke type IV) (Leach, 1994, 91). These receptors play important functions in (Leach, 1994, 92-93):

- Reflex contraction, called the stretch reflex;
- Nociceptive and thermal detection; and
- Detection of rapid mechanical deformation.
-

2.2.5) Innervation of the sacroiliac joint

The complexity of the neurological interaction can be seen if one applies the concept of Hilton's law to the sacroiliac joint. This law states that any nerve crossing and supplying a joint gives a branch to that joint, the muscles controlling the joint and the stabilising ligaments, as well as the overlying skin (Hollinshead, 1982:210), which would imply that the muscles, ligaments, tendons and the capsule of the joint would have similar levels of innervation.

The nerves that innervate the muscles and ligaments around the sacroiliac joint have a diverse and extensive innervation from L2 to S4, which may partly account for the inconsistency and variability in the presentation of sacroiliac joint syndrome pain patterns.

If this is viewed in the context of Hilton's law, the sacroiliac joint capsule is also innervated by complex nerves that provide pressure and position sense. The posterior capsule and ligaments are innervated by articular branches of the posterior primary rami from S1 and S2, and anteriorly, articular branches of the anterior primary rami from L3 to S2 are involved (Ombregt, et al,. 1995:691).

Furthermore, Bernard and Cassidy (1991:2111) state that there are two types of articular nerves. The first is a specific type reaching the joint capsule as independent branches of peripheral nerves, and the second type comprises non-specific articular branches that are derived from muscles overlying a particular joint. These overlying muscles receive the same innervation and a unique feedback mechanism on these muscles is thought to be caused by these articular nerves, which regulate muscle tone, forming an arthrokinetic reflex.

In congruence with the specificity indicated by Bernard and Cassidy (1991:2111), the sacroiliac joint and adjacent tissues also contain mechanosensitive afferent units according to Sakamoto et al. (2001). Most of these units are nociceptive receptors (Cassidy and Mierau, 1992: 211-212; Sakamoto et al., 2001), which could explain why small changes within the joint lead easily to complex pain patterns within the presentation of sacroiliac syndrome. As a result of these complex patterns, the effect of different types of treatments and the frequency of treatments, has only been hypothesised in an effort to address and break the influence of the negative neurological feedback cycles that occur within the sacroiliac syndrome.

2.3) Biomechanics and function of the sacroiliac joint

2.3.1) Normal movement

2.3.1.2) Kinematics

Ombregt, et al., (1995:692) determined that there is a general lack of agreement on the movements of the sacroiliac joint. Movements that do occur are small and vary according to each individual.

However, several facts need to be taken into consideration when assessing this disparity. One of these is the structure of the joint, which lends itself to very limited mobility (viz: the wedged structure of the sacrum, surface irregularities, symmetrical elevations and depressions and several ligaments) (Harrison and Troyanovich, 1997:607) and therefore lends credence to the literature which indicates there is very little or no movement (Gatterman, 1990:453).

This is further supported by a study of twenty-five patients with sacroiliac joint disorders where roentgen stereophotogrammetric analysis (RSA) was used to demonstrate mobility in the sacroiliac joints and the following was revealed (Sturesson, 1997:174):

a. Sacroiliac joint motions were very small, with average rotations of 2,5° and translation of 0,7mm.
b. Sacroiliac joint mobility in men was on average 30-40% less than in women.
c. Small differences occurred between patients with unilateral and those with bilateral pain.

Nutation is the process of the sacral base moving in the anterior and inferior direction, as the ilium or ilia move in the opposite posterior-inferior direction, with the PSIS as the point of reference. Counternutation is the process of the sacral base moving in the posterior-superior direction, as the ilium or ilia move in the anterior-superior direction. (J. Kurnik, 2000).

Thus it can be argued that the movement within the sacroiliac joint is limited and therefore the effect of decreased motion within the joint has a very small effect;

however, this complements the function of the sacroiliac joint as a stabiliser of the lower back and pelvis (Mior, Ro and Lawrence, 1999:221).

2.3.1.3) Kinetics

According to Mior, Ro and Lawrence (1999:221) it is imperative that the sacroiliac joint has stability and mobility, yet must withstand considerable forces affecting it as it functions as a link in the kinetic chain between the spine and legs.

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 parallel direction to the joint surfaces which may predispose the joint to subluxate superiorly; however, this is prevented by the self-locking mechanism of the sacroiliac joint (Snijders, et al, 1993:287).

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

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

2.4) Effect of altered kinematics and kinetics

Thus, with respect to the normal kinematics and kinetics, an abnormality in joint position could be regarded as a blocked joint, which could theoretically be due to abnormal or unbalanced loading conditions that force the sacroiliac joint into a position where the ridges and depressions no longer complement each other (Vleeming, et al, 1990:130). Hendler, et al. (1995:171), later agreed with Vleeming, et al. (1990:130), and stated that because the ridges and depressions of the opposing joint surfaces were normally very congruent, even a small abnormal load could lead to incongruency. In this position, any additional loading or movement can cause damage to the joint surfaces, with resultant inflammation and the formation of a syndrome termed sacroiliac syndrome (Gatterman, 1990:454).

Kurnik also stated that during the dynamics of the integrated motion of nutation and counternutation, the ilia can become fixated in the anterior-superior direction (AS fixation), or they can become fixated in the posterior-inferior direction (PI fixation). (J. Kurnik, 2000).

Hesch (1997:535) later expanded this theory by claiming that stress from daily activities would not be effectively absorbed by a hypomobile sacroiliac joint, resulting in over-stress of the other related structures, contributing to myofascial pain and dysfunction (Travel and Simmons, 1997).

Gatterman (1990:114) proposed a complementary, but alternative theory. He described the sacroiliac joint to be like a typical vertebral motion-segment in which dysfunction could take the form of simple joint locking, or with concurrent compensatory hypermobility in adjacent articulations.

This incongruency and compensatory theories have been hypothesised to result in the local ligaments becoming taut, reflex muscle spasms, and finally pain that may be severe and continuous.

The pain in the area of the sacroiliac joints could be symptomatic of a failed load transfer system between the lower extremities and the spine, which is made up of both sacroiliac joints, intervening soft tissues, the sacrum and pelvis (Vleeming, et al, 1995: 753-758). Compensatory hypermobility of the contralateral sacroiliac joint would result in the sacroiliac joint being subjected to increased motion demands with the possibility of overload and subsequent pain and inflammation (Gatterman, 1990:114) in the contralateral joint in addition to the localised symptoms of the affected joint.

These suggestions in the literature support Hesch's (1997:535) suggestions that the sacroiliac joint is part of an integrated system and does not function in isolation.

Within this context sacroiliac syndrome has effects that extend beyond the confines of the joint and include the following hypothesised effects:

2.4.1) Neurological and muscular changes

With changes in joint motion the effect of the gamma-motor system, which controls the intrafusal muscle fibres, is that of deranged receptor input; resetting and resultant increased or decreased firing as pertinent to the causative factor.

This often occurs when there is a sudden shortening of the muscle that accompanies the sudden approximation of the joint surfaces due to an unbalanced load (Korr 1975 in Leach 1994). The sudden approximation of the two poles of the muscle results in a decrease in length of the extrafusal muscle fibers, silencing the annulospiral and flowerspray endings which are responsible for maintaining a set homoeostatic ration between the extrafusal and intrafusal muscles fibers (Korr 1975). In response to this silencing of the these receptors (annulospiral and flowerspray endings) the reflex effect on the gamma motor and alpha motor neurons results in their stimulation, which increases primary and secondary muscle spindle neural output that causes muscle contraction. This reflex control of muscle tone (defined as stiffness or resistance to stretch) has led to proposals of gamma involvement in chronic pain syndromes (Knutson, 2000).

Knutson (2000) further stated that Johansson and Sloka hypothesised that slow conducting muscle afferents (group III and IV), which include mechanoreceptors, chemoreceptors and nociceptors, also have a powerful influence on gamma neurons. Activation of these afferents may establish a positive feedback loop through the gamma muscle spindle system leading to chronic muscle hypertonicity and pain causing disturbances in proprioception and motor control of and around the joint (in this case the sacroiliac joint). It is further proposed that these feedback loops can create muscular hypertonicity, sensitivity to pressure and altered ranges of motion that are all characteristics of joint subluxation. It must be noted, however, that this is still just a theory (Knutson (2000).

Thus when there is segmental dysfunction (as in sacroiliac syndrome) with concomitant increased muscle tone and decreased motion, segmental facilitation may occur if the initiating stimulus is sufficient or lasts long enough, even after the initial stimulus is removed (Patterson and Steinmetz, 1986 in Leach, 1994: 101). Once this facilitation occurs, despite the removal of the afferent source of stimulation, the abnormal segmental reflex circuit itself participates in maintaining the symptoms (Leach, 1994:101 and Patterson and Steinmetz, 1986).

Patterson and Steinmetz (1986) further state that spinal manipulation may be effective in restoring normal limb / joint position based on a theory by Korr (1975) as found in Leach (1994:98), which states the following mechanisms:

a. A sudden increase in the facilitation of the segment causes the supraspinal structures to reset their sensitivity (via resetting “gamma gain” effect as described above) as the supraspinal structures receive a sudden barrage of impulses post the manipulation.
b. This resetting allows for the normalization of the joint structures through mechanical replacement as well as for the normalization of the firing patterns of the different receptors including those of proprioception, with resultant normalization of the posture / joint position sense of the patient / subject.

2.4.2) Cellular

From the dysfunction, the reflex effects as described above and the abnormal mechanical loading and joint surface locking, it stands to reason that there will be injury to the joint surfaces with reactive inflammation and swelling to protect the area (Gatterman, 1995:166). In this respect several inflammatory theories predict that segmental dysfunction (as in sacroiliac syndrome) might evoke inflammatory changes to a local adaptation syndrome Leach (1994:102).

Dvorak, in Leach (1994:102), proposed that segmental dysfunction (SDF) creates the mechanical and chemical stimulation necessary for activation of nociceptors and spinothalamic tract (pain, temperature, touch and pressure, (Crossman and Neary, 2000:81)) activity, which include the following key components:

- SDF creates both articular pain and reflex muscular changes.
- SDF causes increased muscle spindle activity resulting in postcontraction sensory discharge via increased firing of alpha motorneurons, triggering further contraction of the same muscle and may change the spindle distribution.
- Shortening of the muscles is also associated with histochemical changes that may help maintain the postcontraction sensory discharge.
- Relative hypoxemia and muscular dysfunction causing disturbed joint movement are consequences of these changes.

Based on these hypotheses the following discussion will be defined by discussing the sacroiliac syndrome as presented in the literature and in the context of these changes discussed above.

2.5) The sacroiliac joint syndrome defined

Several authors have described sacroiliac syndrome as pain over one or both sacroiliac joints as a result of joint dysfunction or sustained muscle contraction. The pain may be referred to the groin, trochanter and buttock unilaterally. The joint is tender to palpation and clinical tests can be applied to the joint to reproduce the pain. There must be no other apparent cause of joint pain, e.g. infection. (Gardner, 2000; McCulloch, 1997; Souza, 1997)

2.6) Incidence and prevalence of sacroiliac syndrome

Chronic low back pain is a common characteristic of patients who visit and receive treatment from chiropractors (French et al., 2000). In Western society, low-back pain is the single largest cause of disability, with estimates predicting that in some point in time, 50%-80% of the population will experience low-back pain (McGregor et al., 1998). A study in Lesotho by Worku (2000:147-154) was conducted on 4001 mothers. At the time of the study the incidence of severe low back pain was found to be 10.12%, moderate low-back pain was 12.82% and mild low-back pain was 35.54% (incidence = 58.84 %). The lifetime incidence of low-back pain in Indian and Coloured communities in South Africa was found to be 78.2% and 76.6% respectively (Docrat, 1999). In the formal black settlement of Chesterville, the prevalence of low-back pain was found to be 53.1% (Van der Meulen, 1997).

In a study of the literature, Toussaint et al., (1999) noted that depending on the study group, the prevalence of sacroiliac syndrome is between 19.3% and 47.9%. Various factors can be involved and would depend on various circumstances such as demographics, genetics, lifestyle, occupation etc. (Giles and Singer, 1997:18).

It has been found that the sacroiliac joint was identified as a primary source of low-back pain in 22.5% of 1293 patients presenting with back pain as determined in a study by Bernard and Kirkaldy-Willis (1987:2107-2130), which was confirmed by Schwarzer, Aprill and Bogduk (1995:31-37). This tends to indicate that with such a high incidence and prevalence of low-back pain in the Indian, Coloured and Black communities in this country (which is comparable to the globally-based predominantly Western research studies) it would be a fair assumption that the

South African population would also have a high percentage of low-back pain resulting from sacroiliac syndrome.

2.7) Diagnosis of sacroiliac syndrome

The diagnosis of the syndrome is related to five typical characteristics of patients presenting with sacroiliac syndrome, which have been described by Hertling (1997:707) and include:

- unilateral sacroiliac joint pain, local to the joint itself, but possibly referring down the posterolateral aspect of the ipsilateral leg;
- 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 sitting or standing; and
- pain aggravated by walking, climbing stairs and rolling over in bed.

In addition, the syndrome may present with joint dysfunction of the sacroiliac joint that has been described as hypomobility in the joint. This is measured as per the Gillet-Liekens method of motion detection within the sacroiliac joint as discussed by Leach (1994).

There are also confirmatory orthopaedic tests, which are not part of the diagnostic criteria for sacroiliac syndrome; however, they can be used to confirm the diagnosis (Kirkaldy-Willis et al., 1992:125). These tests are structured to confirm the presence of the syndrome by stressing the sacroiliac joint in various positions. These tests include the Gaenslen’s test, Patrick’s Faber test, Yeoman’s test (Kirkaldy-Willis et al., 1992:123 – 124) and the posterior shear test (Laslett and Williams, 1994).

2.8) Treatment of sacroiliac joint syndrome

Treatment options that are available for the treatment of low-back pain include allopathic (Hellman and Stone, 2000), and manual therapies such as hydrotherapy and traction (Cull and Will, 1995). It has been found that allopathic interventions have been less effective than spinal manipulative therapy, even with spinal manipulative therapy having various modes of application (e.g. side posture and drop piece manipulations) (Gatterman et al., 2001).

Besides the mechanical aspect of manipulation on joint dynamics (kinematics and kinetics, as well as the neuromuscular effects attributed to the manipulation attributed by the theories of Korr; Knutson; Patterson and Steinmetz; and Dvorak), the greatest clinical effects of the manipulation may be due to increasing circulation within the joint itself (Leach, 1994:51). However these assumptions are based on poorly understood biochemical processes, including cavitation and movement of carbon dioxide within the synovium, and inflammatory changes secondary to trauma and thus can only be considered as possibilities and not definitive associations.

Nonetheless, even in the face of the mechanism for improvement not being defined in the literature it is important to recognise which treatments are more clinically effective in order to achieve best practice and present the patient with the best options for treatment available.

In this respect, one of the treatment options cited in the literature is that of “drop table thrusting techniques” which was rated as being effective for the care of patients with neuromusculoskeletal problems (however these assertions seem to be based on a large proportion of anecdotal evidence and clinical experience and not on clinical studies (Haldeman et al., 1993, as cited by Gatterman et al., 2001). In addition to this anecdotal evidence, the various modes of application of “drop table thrusting techniques” make it difficult to ascertain which specific drop piece technique is the most appropriate for sacroiliac syndrome. This is in congruence with Cooperstein et al., (2001:410), who stated that it is still unknown which specific chiropractic treatment methods are the most appropriate for specific clinical conditions and that it is important that outcomes for the treatment of specific conditions need to be researched.

This is particularly important in that certain conditions with which patients present, prevent the patient from being positioned in the conventional side posture for treatment of sacroiliac syndrome, hence the need for the most effective drop piece technique (White, 2003; Pooke, 2003; Hyde, 2003; Pretorius, 2003; Haldeman, 2003; Cramer, 2003; Engelbrecht, 2003). An example in this respect would include a patient that experiences anterior catching of the hip capsule making side posture manipulation more difficult and or unpleasant and painful for the patient, thus reducing the efficacy of the side posture technique.

Thus there is a need for alternative treatment options to be available for the practitioner in that these options increase the practitioner's ability to adapt to patient treatment requirements within the clinical setting and to optimise and facilitate patient improvement. Therefore it has been reported by several Chiropractors that a toggle recoil drop manipulation should be used, while others maintain that the contact point must not be removed during the manipulation (White, 2003; Pooke, 2003; Hyde, 2003; Pretorius, 2003; Haldeman, 2003; Cramer, 2003; Engelbrecht, 2003).

During informal discussions with Chiropractors (White, 2003; Pooke, 2003; Hyde, 2003; Pretorius, 2003; Haldeman, 2003; Cramer, 2003; Engelbrecht, 2003), those who stated that a toggle recoil manipulation should be used felt that the velocity of the patient would cause the joint to gap after the drop section had come to rest while those who felt that the contact should be maintained throughout the manipulation reasoned that it was a more specific manipulation when the contact was not removed and that the force of the thrust was still transmitted through the joint by the Chiropractor after the drop section had come to rest.

With these anecdotal perceptions present amongst the practitioners within the profession, it is important to define the different types of mobilisation and manipulation that can be achieved and how these differ.

Thus in this respect, Grade 5 manipulations are defined as manipulations which cause a sudden separation of the joint articular surfaces with an increase in joint space, a cracking noise and a radiolucent bubble appearance on X-ray as stated by Gatterman (1995). In addition to this, Bergmann (1993) states that a manipulation is a specific form of articular manipulation that is characterised by a dynamic thrust of controlled velocity, amplitude, and direction. Thus manipulation has been defined as a high velocity low amplitude (HVLA) thrust that is characterised by a dynamic thrust with a rapid increase in velocity; is within the boundaries of the joint's anatomic integrity; has a controlled depth and speed and is associated with an audible click and subsequent improved joint mobility. (Bergmann 1993)

In contrast to this, mobilisation has been described as passive joint manipulation that does not employ a rapid thrust and is usually not accompanied by an audible crack associated with joint cavitation. (Bergmann 1993)

From the above definitions it can be assumed that drop table manipulations are grade 5 manipulations as they are described as high velocity low amplitude (HVLA) manipulations (Gatterman et al., 2001), however this has, to date, not been shown conclusively.

2.9) The psychophysical touch effect

In addition to the effect of the manipulation that is applied to the patient and the resultant effects that manipulation has, it must also be considered that the doctor – patient interaction also constitutes a significant amount of skin contact in the region of the sacroiliac joint. It must therefore also be noted that the stimulation of the mechanoreceptors in the skin overlying the sacroiliac joint during the treatment intervention may also have an effect (Melzack, 1999).

This is supported by Ventegodt et al., (2004) stated that when touch is combined with therapeutic work on mind and feelings, holistic healing seems to be facilitated. Further to this, a study of healing by gentle touch, Weze et al., (2005) showed statistically significant improvements in both psychological and physical functioning, especially with regards to stress reduction and pain relief.

However, in a study on Chiropractic treatment on infantile colic, it was found that there was no statistical significance between the treatment and placebo group (Olafsdottir et al, 2001). As there was an improvement of between 60% and 70% in both groups, it may be possible that the placebo group benefited through the possible psychophysical effects of touch, or due to natural spontaneous improvement as a result of increasing age. The results of this study (Olafsdottir et al., 2001) are supported by a review of the literature by Wardell et al., (2004), regarding healing touch, which indicated that no generalized results were apparent.

Thus, in order to account for these variables in the literature with regard to psychophysical touch, it was controlled in this study.

2.10) In conclusion

Theoretically the effect of the maintained contact drop piece manipulation technique should be similar to that of a standard side posture manipulation with the concomitant neurological, muscular and inflammatory benefits. However, this has to date not been tested and because there seems to be varied opinion, anecdotal case studies and very little research, this research is aimed at determining the efficacy of a maintained contact drop piece manipulation technique.

Chapter 3

3) Materials and methods

3.1) Introduction

This chapter gives a detailed description of the methods employed in data collection the subjects and the interventions utilised as well as the methods of statistical analysis and the process of evaluation of the data. The study design was a randomised, comparative, clinical trial. This involved three groups; one group received the maintained contact drop piece manipulation, one group received a placebo drop piece manipulation and one group received a control placebo drop piece manipulation.

3.2) Advertising

Numerous advertisements were placed in local newspapers; on flyers at gyms, schools, sports clubs and companies; intranet advertisements were placed at various companies; flyers were posted in over 1 500 mail boxes and numerous companies were approached in person or by telephone to recruit staff with low-back pain.

3.3) Sampling

3.3.1) Size:

The study included a total of eighty subjects divided into two groups of thirty and one of twenty. This was for optimal statistical analysis within the constraints of my allocated budget. All subjects volunteered as per ethical requirements, none withdrew and all completed the study.

3.3.2) Allocation:

Each subject that met the inclusion and exclusion criteria was asked to draw a piece of paper out of an envelope on which an "A", "B" or "C" was printed.

Group A = Treatment (total of 30)
Group B = Placebo (total of 30)
Group C = Control (total of 20)

3.3.3) Method:

The method was that of non-probable convenience sampling in order to attain a more accurate representation of the entire population.

3.3.3.1) Telephonic screen

Pertinent questions were asked over the telephone to determine whether the patient was a suitable candidate for the research sample, these included;

- Are you between 20 and 55 years of age?
- Do you have a history of trauma/surgery?
- Where is your area of pain?
- Would you rate your pain greater than 5 on a scale of 0 to 10?
- Do you have associated radicular leg pain?
- Do you have any numbness, tingling, pins and needles, muscle weakness etc?

This decreased the chance of unsuitable candidates being called in for an initial consultation and appropriate referral was made at the telephonic screen stage for appropriate care.

At the first consultation and in order to assess whether the patient qualified for the study the following inclusion and exclusion criteria were assessed using a case history (appendix A), physical exam (appendix B), and a lumbar regional exam (appendix C).

3.4) Inclusion criteria

- Patients had to be between the ages of twenty and fifty-five to avoid parent / guardian consent and to reduce the chance of sacroiliac ankylosis. (Giles and Singer, 1997:181)
- Their pain rating scale on the NRS had to be greater than 5. This improved the sample homogeneity (Mouton, 1996:135).
- The patients were required to present with joint dysfunction of the sacroiliac joint, as evidenced by hypomobility in the joint as per Gillet-Liekens method (Leach, 1994)
- Patients had to have joint tenderness on springing of the involved Sacroiliac joint (Bergmann et al, 1993:485).
- Orthopaedic tests are not part of the diagnostic criteria for sacroiliac syndrome, however, they were used to confirm the diagnosis. For the purpose of this research two out of the four orthopaedic tests listed below had to be positive. (Kirkaldy-Willis et al., 1992:125).
  - Posterior shear/"thigh thrust test" (laslett and Williams, 1994).
  - Gaenslen's test (Kirkaldy-Willis et al., 1992:125).
  - Patrick Faber test (Kirkaldy-Willis et al., 1992:125).
  - Yeoman's test (Kirkaldy-Willis et al., 1992:125).

  The points above needed to be positive on the same side, this increased sample homogeneity (Mouton, 1996:135).

- They may not have had any contraindications to manipulation. (Bergmann et al., 1993)
  - Marked osteoporosis
  - Ankylosing Spondylitis
  - The presence of fever, tumours, tuberculosis or any infectious disease.
  - Local inflammation, thrombosis, metal implants or a hip prosthesis.
  - Spinal fusion or spinal surgery.

- Acute disc herniation.
- Abdominal aortic aneurysm.

(Giles and Singer, 1997:352)

- Cancer or other destructive lesions of the spine.
- Severe osteopaenia.
- Active spondyloarthropathies
- Cauda equina syndrome
- Referred pain from visceral disease
- Significant psychological overlay.

3.5) Exclusion criteria

- ➢ Patients must not have had leg pain that was radicular in origin and they may not have suffered from neurological deficits. (Haldeman et al., 1993 In: Gatterman et al., 2001)
- ➢ They may not have been on any medication or other form of treatment, including manual and modality intervention, within 48 hours of research being conducted. (Poul et al., 1993)
- ➢ Patients who failed to sign the informed consent form were excluded by default.
- ➢ Patients who had received low-back surgery were excluded from this study as the source of their pain may have been related to the surgery. (Maroon et al., 1999)
- ➢ Patients that required further investigations (blood tests, X-rays etc.) that were not laid out in this research were excluded so as to maintain a homogenous sample population (Mouton, 1996:135).
- ➢ Patients needed to speak and read English in order for them to have read the subject information sheets that I required feedback on in terms of improvement, (some of these tools have only been validated in the English language). This will have helped to prevent cultural and ethnic misinterpretation of words and their meanings. (Baynham, 1995:190)

There are, however, studies currently underway which are addressing the need for questionnaires in different languages.

- Patients who presented with pain of facet origin on the NRS of 4 or more were excluded from this study as this could have affected the sample homogeneity by having influenced the accuracy of the NRS relating to sacroiliac syndrome (Mouton, 1996:135).
- Patients who have had drop piece manipulations in the last 12 months were excluded from the study, as they would have been aware that the sham manipulation was a placebo treatment if they were placed in the placebo or control group. This would have affected the outcome of the subjective data, as the patient's expectations, based on previous treatment, would have been decreased (Mouton, 1996:135).

Those subjects who did not meet the inclusion criteria were referred to other interns in the Chiropractic day clinic for treatment of their condition.

3.6) Intervention / Treatment Types

3.6.1) Group A

A maintained contact drop piece technique was used to treat Sacroiliac syndrome as described by numerous Chiropractors (Personal communication, White, Pooke, Haldeman, 2003).

As a result of increased gapping between the joint surfaces post manipulation, it has been assumed that drop piece manipulations are grade 5 mobilisations (manipulations). This is based on the fact that increased joint gapping has an effect on the adjusted joint's specific range of motion Gatterman (1995). Thus if specific range of motion of the sacroiliac joint increases after the drop piece manipulation, it will be a grade 5 manipulation as stated by Gatterman (1995).

The drop table thrusting technique is applied as a high velocity, low amplitude (HVLA) thrust, with:

Dr position:	Ipsilateral fencer stance
Pt position:	Prone with ASIS over edge of lumbar drop piece
Contact point on patient:	Ipsilateral sacroiliac joint, medial to PSIS
Contact point on doctor:	Reinforced pisiform
Vector of the thrust:	Posterior to anterior and inferior to superior

Special requirements: The lumbar drop section is raised and the tension in the drop piece is set so that it does not drop with the patient’s body weight, but is able to drop with the addition of minimal force, beyond that of the patient’s weight.

Procedure that is applicable once all the above are in place: Contact is taken and skin slack removed. A high velocity low amplitude with no toggle recoil manipulation will be applied to the symptomatic sacroiliac joint. The manipulations thrust and contact will be maintained through the activation of the drop piece.

Patients received one manipulation.

Table requirements:

The table must have lumbar movable segments (or drop pieces) that are capable of being cocked upward and released downward by the HVLA thrust.

3.6.2) Group B

Control group

As no manipulation thrust was given to the sacroiliac joint, in conjunction with the joint being placed away from the drop table section, it could be assumed that no joint gapping of the sacroiliac joint occurred as described in Group A above.

Dr position:	Ipsilateral fencer stance
Pt position:	Prone with ASIS over edge of lumbar drop piece
Contact point on patient:	Ipsilateral sacroiliac joint, medial to PSIS
Contact point on doctor:	Pisiform
Vector of the thrust:	Posterior to anterior and inferior to superior

Special requirements: The lumbar drop section is raised and the tension in the drop piece is set so that it does not drop with the patient's body weight, but is able to drop with the addition of minimal force, beyond that of the patient's weight.

Procedure that is applicable once all the above are in place:
Contact is taken on the drop section of the table and not on the patient, although the non-thrusting hand is lightly placed over the symptomatic sacroiliac joint. A high velocity low amplitude with no toggle recoil manipulation is applied to the table to activate the drop piece, with no thrust applied to the patient. (Bronfort et al, 2001:371)

Patients received one sham drop manipulation which is recognized as an effective placebo manipulation. (Bronfort et al, 2001:371)

3.6.3) Group C

Placebo group

As no manipulation thrust was given to the sacroiliac joint, in conjunction with the joint being placed away from the drop table section, it could be assumed that no joint gapping of the sacroiliac joint occurred as described in Group A above. With no patient contact during the sham manipulation procedure of this group, the therapeutic touch effect would also be negated.

Dr position:	Ipsilateral fencer stance
Pt position:	Prone with ASIS over edge of lumbar drop piece
Contact point on patient:	None
Contact point on doctor:	Pisiform
Vector of the thrust:	Posterior to anterior and inferior to superior

Special requirements: The lumbar drop section is raised and the tension in the drop piece is set so that it does not drop with the patient's body weight, but is able to drop with the addition of minimal force, beyond that of the patient's weight.

Procedure that is applicable once all the above are in place:
Contact is taken on the drop section of the table and not on the patient; there is no patient contact. A high velocity low amplitude with no toggle recoil manipulation is applied to the table to activate the drop piece, with no thrust applied to the patient (Bronfort et al, 2001:371).

Patients received one sham manipulation.

3.7) Intervention frequency

Subjects underwent two consultations – one treatment and one follow up. The follow up was within 24 hours after the treatment.

3.8) Data Collection

3.8.1) Frequency:

Data collection took place pre and post treatment, at 1 hour and then within 24 hours.

3.8.2) Data Collection Instruments:

3.8.2.1) Objective data:

- An algometer was used to assess tenderness of the piriformis muscle as per definition of sacroiliac syndrome. (Fischer 1987:122). The algometer measures the maximum pain or discomfort pressure that a patient can tolerate and is therefore used to quantify the response to treatment by providing a means of measuring the patient's improvement. (Fischer 1987:122).

  Method: The patient was positioned prone and an imaginary line dropped down from the PSIS. The algometer was placed on the line at the level of the second sacral tubercle.

- Motion palpation as per the Gillet-Liekens method (Leach 1994) was used and the researcher was blinded as a neutral party proficient in the technique took the readings. This was done to determine if there was an increase in joint range of motion post treatment, even though only one thrust in one direction was given irrespective of the fixation found.

Method: The patient was asked to stand whilst holding onto a support for balance.

The examiner stood behind the patient and placed a thumb contact on the patient's posterior superior iliac spine (PSIS) and the second or fourth sacral tubercle (depending on whether the joint restriction was suspected in the upper or lower aspect of the sacroiliac joint respectively).

The patient was then asked to raise the ipsilateral leg to approximately 90 degrees thereby flexing the hip and sacroiliac joint.

With normal movement the examiner's thumbs approximated as the PSIS moved posteriorly and inferiorly relative to the stationery sacral tubercle.

A flexion restriction was suspected when the thumbs did not approximate.

A similar procedure was done to detect an extension restriction, however, raising the contra lateral leg. This induces posterior nodding of the sacral base and sacroiliac extension on the side of palpation. With normal movements the examiner's thumbs move apart as the PSIS moves anteriorly and superiorly away from the sacral tubercle.

Patients were assessed for sacroiliac joint fixations pre, post, at 1 hour and at 24 hours after treatment and the examiner did not know whether the patient received a manipulation or a placebo manipulation. This allowed for a more accurate outcomes measurement.

- Hip range of motion was tested bilaterally with the inclinometer with regards to internal and external rotation both actively and passively as it was found to be affected with sacroiliac manipulations. (Bisset, 2003). This helped determine whether a manipulation of the sacroiliac joint occurred after a drop piece manipulation, as there is no audible joint cavitation with drop table manipulations.

Method: The patient was placed in the prone position, and a strap was placed around the posterior superior iliac spines to prevent pelvic movement.

The assessed hip was placed in 0 degrees abduction while the contra-lateral hip was abducted 30 degrees.

The knee of the hip to be measured was flexed to 90 degrees and the inclinometer was attached just below the ankle.

The tibia was aligned at 90 degrees, and the sensor zeroed.

The patient actively externally rotated maximally and the angle was recorded.

The patient actively internally rotated maximally and the angle was recorded.

The process was repeated with the examiner moving the limb to assess passive range of motion.

- As mentioned, orthopaedic test were not used to diagnose sacroiliac syndrome, they were however used to confirm the diagnosis (Kirkaldy-Willis et al., 1992:125) and were performed as follows:

3.8.2.1.1) Posterior shear/"thigh thrust test" (Laslett and Williams, 1994).

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

3.8.2.1.2) Gaenslen's test (Kirkaldy-Willis et al., 1992:125).

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

3.8.2.1.3) Patrick's Faber test (Kirkaldy-Willis et al., 1992:125).

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

3.8.2.1.4) Yeoman's test (Kirkaldy-Willis et al., 1992:125)

The patient is positioned prone. The examiner places one hand under the right thigh above the knee on the effected side, to extend the right hip. The examiner's other hand presses downward over the crest of the right iliac. A positive test is recorded if the position elicits pain over the region of the right sacroiliac joint.

3.8.2.2) Subjective data:

- NRS pain rating scale is an effective and reliable tool to evaluate whether pain is reduced with treatment and to what degree. (Bolton and Wilkinson, 1998:1-7) The numerical 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 at its worst'. The subjects were asked to rate their pain firstly to the intensity when it was at its worst, and secondly when the pain was at its least.. The average of the two scores is an indication of the patient's average pain level.

Patients were also asked what their level of pain was at the time of consultation, pre, post, at 1 hour and at 24 hours to determine the immediate effect of treatment on their pain.

- Patient comfort during the manipulation procedure was determined through questioning (Appendix I). This was done in order to elicit subjective patient information that could not be recorded on the restrictive subjective data utilised in this study.

3.9) Description of statistics:

Data was collected from the NRS, algometer, inclinometer and motion palpation (Appendix I). Motion palpation restrictions for sacroiliac syndrome can be described as follows:

Right upper flexion (RUF)
Left upper flexion (LUF)
Right lower flexion (RLF)
Left lower flexion (LLF)
Right upper extension (RUE)
Left upper extension (LUE)
Right lower extension (RLE)
Left lower extension (LLE)

Each restriction was allocated a number for statistical purposes, e.g. RUF=1, LUF=2, RLF=3, LLF=4, RUE=5, LUE=6, RLE=7 and LLE=8.

Orthopaedic tests were used to confirm sacroiliac syndrome and they included Patrick Faber, Gaenslen's, Yeoman's and posterior shear tests. A positive test was allocated a 1 while a negative test was allocated a 0 for statistical purposes. This was done in order to correlate the improvement or lack thereof over time with regards to the initial clinical presentation of the patient in order to determine the positive predictive value of the tests.

Data collection for the above was done pre- and post treatment, at 1 hour and then within 24 hours.

3.10) Statistical Methods

SPSS version 11.5 (SPSS Inc, Chicago, Ill, USA) was used to analyse the data. STATA version 7 (STATA Corp, USA) was used to generate GEE models for categorical outcomes. A p value of <0.05 was considered as statistically significant.

Cross-sectional analysis
Demographic variables were compared between groups using chi square tests for categorical variables and Kruskal-Wallis tests for quantitative variables (non-parametric tests were used due to skewed demographic data). Baseline outcome variables were similarly compared between the three groups in order to check for pre-existing differences between the groups prior to the intervention, except that ANOVA with Bonferroni post hoc tests was used for quantitative outcomes. Intra-group Spearman's correlation between quantitative outcome variables was done to examine relationships between them. Intra-group independent t-tests were done to assess associations between quantitative and binary categorical outcome variables. Chi square tests were done to assess association between two binary categorical outcome variables.

Longitudinal analysis:
Inter-group analysis was by means of repeated measures ANOVA, assessing a time, group and time-group interaction effect. The latter effect was considered as the treatment effect. Profile plots were generated to visually assess the group mean changes over time. Categorical outcomes were assessed for a time by group interaction using generalized estimating equation (GEE) models with robust standard errors adjusted for clustering in patient number.
In addition to the discussion, graphs, plot charts and bar-graphs were presented.

This was done to determine whether there were any significant changes in the data acquired pre and post treatment as well as among the treatment, control and placebo groups.

A comparison of the statistical findings was also done on data from a concurrent peer study on toggle recoil drop piece manipulations to determine the most effective drop piece manipulation technique for sacroiliac syndrome.

Demographic details such as age, occupation etc were also evaluated to determine if trends existed in certain population groups.

Information regarding patient comfort during the manipulation was analysed and compared with the concurrent peer study to determine which technique patients preferred.

Chapter 4

4) Results and Discussion of the results

4.1) Introduction

This chapter aims to statistically analyse the primary data. The data utilised was collected exclusively from participants that fitted the inclusion and exclusion criteria of the study. The analysed data will be discussed with regards to sample description; demographics; quantitative, qualitative and categorical outcomes as well as recommendations.

4.2) Abbreviations

GEE – Generalized estimating equations
SD - standard deviation
MP – Motion palpation
AVE – average

4.3) Definition of groups

Group A = Treatment (total of 30)
Subjects received a maintained contact drop piece manipulation. For a detailed description, refer to chapter 3.

Group B = Placebo (total of 30)
Subjects received a placebo drop piece manipulation. For a detailed description, refer to chapter 3.

Group C = Control (total of 20)

Subjects received a placebo drop piece manipulation without any contact taken on the patient. For a detailed description, refer to chapter 3.

The main objective was to determine the outcome differences between placebo and treatment groups. The study, however, could not overlook the fact of possible psychophysical effects and therefore a smaller control group (Group C) was included in the study as it was hypothesised that no psychophysical effects would be present.

4.4) Readings and time of readings

Subjects underwent two consultations – one treatment and one follow up. The follow up was within 24 hours after the treatment. Data collection took place pre and post treatment, at 1 hour and then within 24 hours.

4.5) Sample description

There were 80 subjects included in this study, 30 in the treatment group (group A), 30 in the placebo 1 group (group B, contact but no thrust) and 20 in placebo 2 group (group C, no contact and no thrust). They ranged in age from 22 to 53, with a mean age of 36.83 years (SD 8.9 yrs).

Most subjects did no physical activity (75%), and the most common occupation was driver 46.3%.

The sample is therefore representative of patients in the general population presenting with low back pain as the results fall within the age ranges suggested by McGregor et al., (1998) as being 44.7 years +/- 13.7 years and Schwarzer, et al., (1995:31-37), who found the average subject age was 32,8 years.

In addition to this, a study by Oleske et al., (2004), confirms that a lack of exercise or physical activities was of prognostic significance in people with low-back pain, which is comparable with our sample population where 75% did no physical activity.

Whole body vibrations due to driving were found to be a significant cause of lower-back pain in a study by Palmer et al., (2003) which was confirmed by Mitsuhiko et al., (2004), which is also comparable to our sample population. Furthermore, Palmer et al., (2003) suggest that occupational lifting was a risk factor in developing low- back pain; this, however, did not appear to be highly correlated in this study. This may have been as a result of patient perception in that patients may not have linked the lifting to their low-back pain as much as the degree of driving. Alternatively, the patients may have contributions from both aspects of their occupation, yet perceptually, link the low back pain to only one.

In support of the above discussion, further analysis was done in order to classify subjects in respect of prolonged sitting irrespective of whether they were drivers (47%) or administrative personnel (26%), those who did not have a sitting job, or whether they had a manual job (26%) or were students (1%). This was compared amongst the groups to assess whether there was any difference in proportion. Pearson's chi-square = 0.102, p = 0.950. There was no difference in proportion of those with prolonged sitting jobs amongst the groups.

TABLE 1: CROSS-TABULATION OF OCCUPATIONS WITH PROLONGED SITTING BY GROUP

			Occupations with prolonged sitting		Total
			no	yes	
Group	A	Count	8	22	30
		% within Group	26.7%	73.3%	100.0%
	B	Count	9	21	30
		% within Group	30.0%	70.0%	100.0%
	C	Count	6	14	20
		% within Group	30.0%	70.0%	100.0%
Total		Count	23	57	80
		% within Group	28.8%	71.3%	100.0%

<u>6) Demographics by group</u>

Demographic variables were compared by group in order to assess whether there was an equal distribution of each variable by group as expected. There was no significant difference in any demographic variable by group. Descriptive statistics and p values are shown in Tables 2 and 3.

TABLE 2: COMPARISON OF PROPORTIONS OF CATEGORICAL DEMOGRAPHIC VARIABLES BY GROUP

		GROUP						p value
		A		B		C		
		Count	Column %	Count	Column %	Count	Column %	
SMOKER	no	23	76.7%	18	60.0%	13	65.0%	0.382
	yes	7	23.3%	12	40.0%	7	35.0%	
ETHNICITY	White	9	30.0%	6	20.0%	7	35.0%	0.220
	Black	15	50.0%	22	73.3%	12	60.0%	
	Indian	6	20.0%	2	6.7%	1	5.0%	

Current cigarette smoking was found to be prognostic in persons suffering from low back pain, Oleske et al., (2004), but was not identified as a causative factor in this study. Reasons for this could have included the fact that the participants were predominantly of indigenous African population, whose culture tends not to support smoking and this could have influenced the sample characteristics. This, however, is conjecture and would require further research for validation.

The sample groups have no significant differences in terms of ethnicity. Due to the fact that the sample population is comparable to the normal population, it would be safe to assume that the results obtained in this study would be comparable to the normal population (Mouton, 1996: 135).

TABLE 3: COMPARISON OF MEDIANS OF QUANTITATIVE DEMOGRAPHIC VARIABLES BY GROUP

GROUP		AGE (Years)	WEIGHT (Kg's)	Time since injury (years)
A	Median	35.00	72.00	3.00
	Minimum	22	53	1
	Maximum	53	110	20
B	Median	39.00	81.00	3.00
	Minimum	24	60	1
	Maximum	53	101	22
C	Median	38.50	85.00	2.50
	Minimum	22	52	1
	Maximum	50	104	10
Total	Median	37.50	75.00	3.00
	Minimum	22	52	1
	Maximum	53	110	22
p value		0.460	0.222	0.538

Weight and lower-back pain have been correlated (Kirkaldy-Willis et al., 1992). Therefore, it is significant to note that the groups did not vary significantly in terms of the patients' weights. It must, however, be noted that group A seems to have a smaller average weight when compared to group B and C which tends to indicate that group A seems to have had smaller individuals or predominantly female patients.

4.7) Baseline outcome comparison by group

In order to ensure that the groups were comparable at baseline, initial values for each outcome were compared amongst the groups. There were no significant differences between any of the groups with regard to the outcomes measured. Table 4 shows the means and standard deviations for each quantitative outcome by group, and Table 5 shows the results of the ANOVA tests. Table 6 shows the chi square statistics and p values for the comparison of categorical baseline outcomes by group. Thus there were no statistically significant baseline differences amongst the groups with regard to any outcome.

TABLE 4: DESCRIPTIVE STATISTICS FOR BASELINE QUANTITATIVE OUTCOMES BY GROUP

	GROUP					
	A		B		C	
	Mean	SD	Mean	SD	Mean	SD
Inclinometer active internal left 1	32	10	30	10	32	8
Inclinometer active external left 1	40	8	41	9	40	8
Inclinometer passive internal left 1	38	12	39	11	43	9
Inclinometer passive external left 1	45	9	48	10	49	8
Inclinometer active internal right 1	33	10	29	11	32	9
Inclinometer active external right 1	42	6	41	9	44	7
Inclinometer passive internal right 1	39	11	37	11	41	10
Inclinometer passive external right 1	47	6	49	9	51	8
Ave NRS1	5.1	.7	5.0	.9	4.6	.9
Current NRS 1	5.9	.8	5.7	.8	5.7	.7
Algometer 1	7.28	1.80	7.88	1.21	7.36	1.40

The above table (table 4) shows that the groups are homogenous in terms of baseline measurements for internal and external hip rotation; therefore, the outcomes of the study would not have been influenced by lack of homogeneity amongst the groups in respect of hip internal and external rotation as well as average and current NRS, as well as algometer readings (Mouton, 1996:135).

Furthermore, the homogeneity found amongst the groups indicates that the inclusion and exclusion criteria as employed for this study were rigid enough to ensure that the sample overall was reflected in each of the sample groups.

TABLE 5: ANOVA TABLE FOR COMPARISON OF QUANTITATIVE BASELINE OUTCOMES BETWEEN THE THREE GROUPS

		Sum of Squares	df	Mean Square	F	p value
Inclinometer active internal left 1	Between Groups	107.283	2	53.642	.573	0.566
	Within Groups	7210.667	77	93.645		
	Total	7317.950	79			
Inclinometer active external left 1	Between Groups	21.621	2	10.810	.156	0.856
	Within Groups	5346.367	77	69.433		
	Total	5367.987	79			
Inclinometer passive internal left 1	Between Groups	307.217	2	153.608	1.236	0.296
	Within Groups	9568.333	77	124.264		
	Total	9875.550	79			
Inclinometer passive external left 1	Between Groups	184.988	2	92.494	1.075	0.346
	Within Groups	6622.500	77	86.006		
	Total	6807.488	79			
Inclinometer active internal right 1	Between Groups	270.017	2	135.008	1.297	0.279
	Within Groups	8015.783	77	104.101		
	Total	8285.800	79			
Inclinometer active external right 1	Between Groups	120.033	2	60.017	1.110	0.335
	Within Groups	4161.917	77	54.051		
	Total	4281.950	79			
Inclinometer passive internal right 1	Between Groups	192.021	2	96.010	.802	0.452
	Within Groups	9214.367	77	119.667		
	Total	9406.388	79			
Inclinometer passive external right 1	Between Groups	207.217	2	103.608	1.639	0.201
	Within Groups	4868.983	77	63.234		
	Total	5076.200	79			
Algometer 1	Between Groups	5.974	2	2.987	1.327	0.271
	Within Groups	173.301	77	2.251		
	Total	179.275	79			
Ave NRS1	Between Groups	3.401	2	1.701	2.495	0.089
	Within Groups	52.471	77	.681		
	Total	55.872	79			
Current NRS 1	Between Groups	1.083	2	.542	.836	0.438
	Within Groups	49.917	77	.648		
	Total	51.000	79			

TABLE 6: CHI SQUARE STATISTICS AND P VALUES FOR BASELINE CATEGORICAL OUTCOMES BETWEEN THE THREE GROUPS

Measurement	Chi square value	p value
MP right upper flexion 1	2.761	0.251
MP right lower flexion 1	2.140	0.343
MP right upper extension 1	4.622	0.099
MP right lower extension 1	1.368	0.505
MP left upper flexion 1	1.089	0.580
MP left lower flexion 1	0.000	1.000
MP left upper extension 1	1.688	0.430
MP left lower extension 1	1.688	0.430
Faber 1 Right	0.220	0.896
Faber 1 left	1.022	0.600
Gaenslens 1 Right	5.530	0.063
Gaenslens 1 Left	2.690	0.260
Yeoman 1 Right	1.022	0.600
Yeoman 1 Left	1.217	0.544
Shear 1 Right	5.094	0.078
Shear 1 Left	1.305	0.521

Right upper extension fixations were the most consistent motion palpation finding throughout the groups and showed a high correlation. The possible reasons for this could be that the majority of subjects were drivers, who would have their right legs in a fixed position on the accelerator pedal, or possibly, this could be due to the way that drivers enter and exit their vehicles. Gaenslens and posterior shear orthopaedic tests were also the most consistent throughout the groups. This could be due to the fact that these tests are very specific for right upper extension, which was the most highly correlated fixation. With regards to these findings, it would be recommended that a more in-depth study is done to determine the sensitivity and specificity of these orthopaedic tests with respect to the various sacroiliac fixation positions / listings.

4,8) Longitudinal analysis

4.8.1) Inter-group analysis

4.8.1.1) Inclinometer (Hip internal and external rotation)

Hip range of motion was tested bilaterally with the inclinometer with regards to internal and external rotation both actively and passively as it was found to be affected with sacroiliac manipulations (Bisset, 2003). This helped determine whether manipulation of the sacroiliac joint occurred after a drop piece manipulation, as there is no audible joint cavitation with drop table manipulations.

4.8.1.1.1) Active internal left:

There was a highly significant interaction between time and group (p<0.001). If one examines the profile plot in Figure 1 it can be seen that group A showed an increase in active internal left, while the two placebo groups showed relatively stable levels over time. Thus the treatment was significantly effective for this outcome.

TABLE 7: WITHIN AND BETWEEN SUBJECTS EFFECTS FOR REPEATED MEASURES ANOVA FOR ACTIVE INTERNAL LEFT

Effect	Statistic	p-value
Time	Wilk's lambda 0.613	<0.001
Group	F 2.213	0.116
Time*Group	Wilk's Lambda 0.519	<0.001

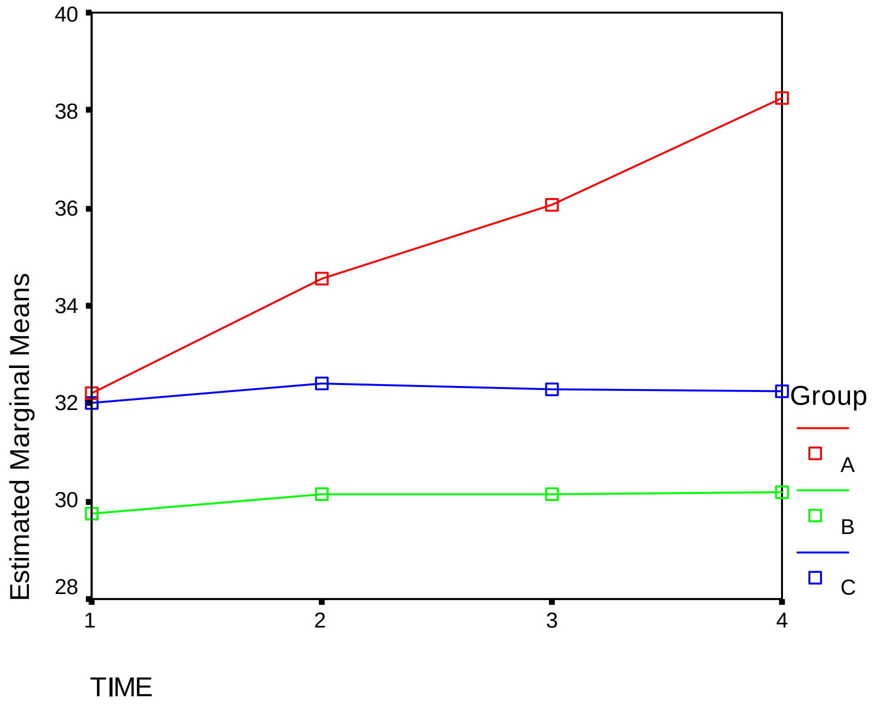


FIGURE 1: PROFILE PLOT OF MEAN ACTIVE INTERNAL LEFT MEASUREMENTS OVER TIME BY GROUP

4.8.1.1.2) Active internal right

There was again a significant treatment effect (p<0.001) for this outcome. In the presence of a significant interaction, the main effects of time and group cannot be interpreted, thus although there was a significant group effect (p=0.049) we cannot say that the group means were different from each other since the difference was time dependent. Thus there was a significant benefit of treatment in group A for this outcome.

TABLE 8: WITHIN AND BETWEEN SUBJECTS EFFECTS FOR REPEATED MEASURES ANOVA FOR ACTIVE INTERNAL RIGHT

Effect	Statistic	p-value
Time	Wilk's lambda 0.590	<0.001
Group	F 3.128	0.049
Time*Group	Wilk's Lambda 0.562	<0.001

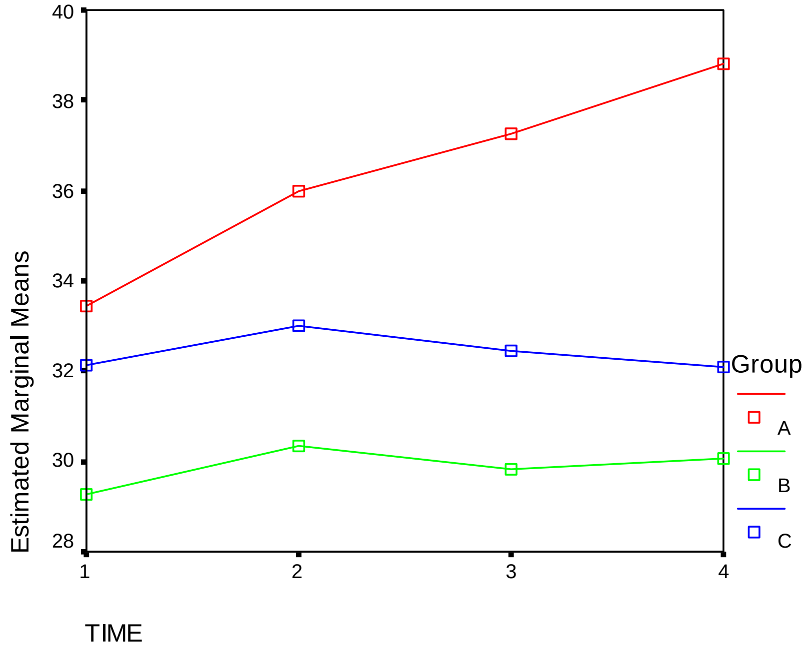


FIGURE 2: PROFILE PLOT OF MEAN ACTIVE INTERNAL RIGHT MEASUREMENTS OVER TIME BY GROUP

4.8.1.1.3) Active external left

There was a significant treatment effect for active external left (p<0.001). Figure 3 shows that the subjects in Group A experienced a steeper rise in this outcome than the other groups.

TABLE 9: WITHIN AND BETWEEN SUBJECTS EFFECTS FOR REPEATED MEASURES ANOVA FOR ACTIVE EXTERNAL LEFT

Effect	Statistic	p-value
Time	Wilk's lambda 0.626	<0.001
Group	F 0.120	0.887
Time*Group	Wilk's Lambda 0.718	<0.001

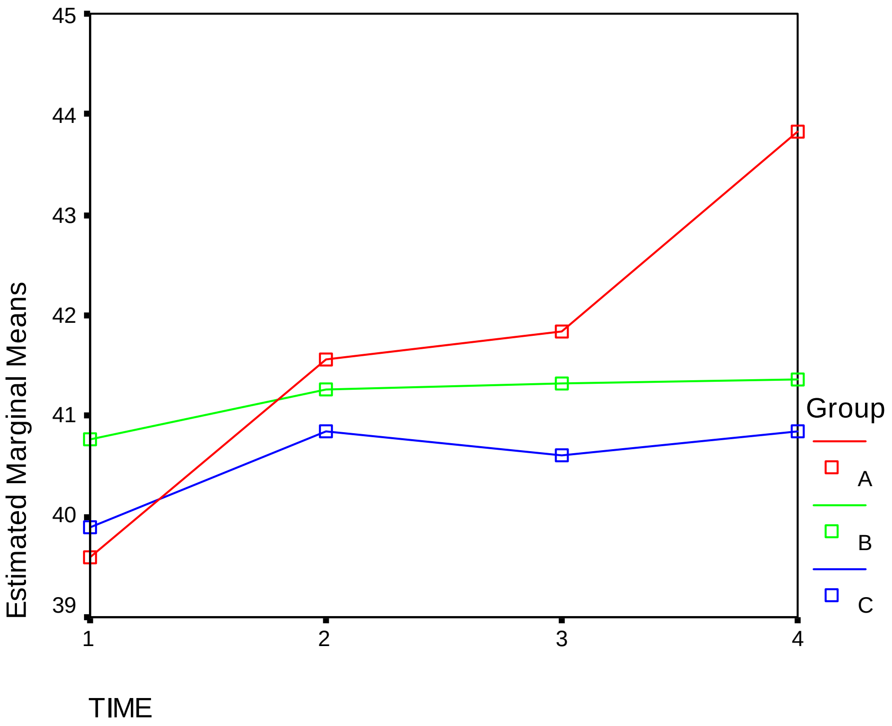


FIGURE 3: PROFILE PLOT OF MEAN ACTIVE EXTERNAL LEFT MEASUREMENTS OVER TIME BY GROUP

4.8.1.1.4) Active external right

There was a highly significant treatment effect (p<0.001). Subjects in Group A improved at a faster rate than in the other two groups (See Figure 4).

TABLE 10: WITHIN AND BETWEEN SUBJECTS EFFECTS FOR REPEATED MEASURES ANOVA FOR ACTIVE EXTERNAL RIGHT

Effect	Statistic	p-value
Time	Wilk's lambda 0.694	<0.001
Group	F 1.281	0.284
Time*Group	Wilk's Lambda 0.699	<0.001

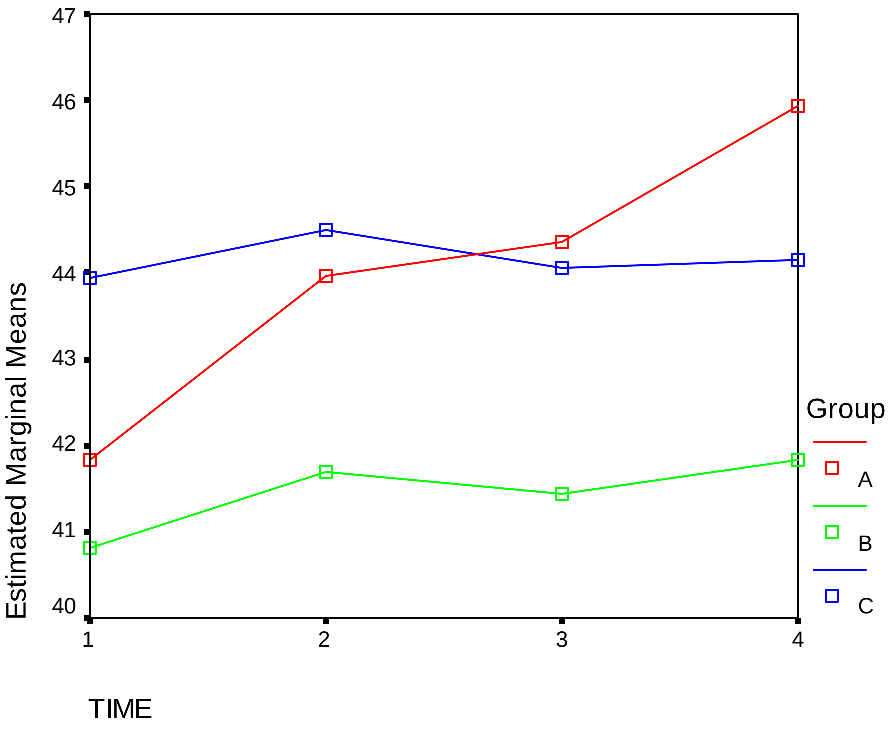


FIGURE 4: PROFILE PLOT OF MEAN ACTIVE EXTERNAL RIGHT MEASUREMENTS OVER TIME BY GROUP

Because the active range of motion of group A (treatment group) increased significantly when compared with groups B and C (placebo groups), it would be reasonable to assume that the sacroiliac joint was adjusted using the maintained contact drop table technique.

With regards to the above results, it can be argued that the treatment group improved significantly more than the placebo groups because of the following:

a. The relaxation of all tissues that were previously irritated by the hyper excited state of the neural system during the inflammatory period. The manipulation would have facilitated normalisation of the pathological neural pathways due to depolarisation of the hyperpolarised segments of the spinal cord (Mense, Gatterman and Goe – Leach 1994: 103 - 104).

b. The possibility that manipulation stimulated the large mechanoreceptor fibres (Wyke type I, II and III), which would override the smaller type C nociceptor fibres thereby inducing a gait control effect (Melzack and Wall, 1965). This effect would have reduced the pain and increased muscle relaxation, and a return to normal of the mechanics of the joint by aligning the depressions and ridges returning the joint to its normal position allowing for the return of normal movement.

Small differences are present between the degree of increased internal and external rotation of the hip and could be explained by the fact that there are differences in fixations of the sacroiliac joints. These differences would include the number of fixations present; which side had most fixations; whether they were unilateral or bilateral fixations and the length of time for which those fixations were present.

4.8.1.1.5) Passive internal left

There was a highly significant treatment effect for passive internal left ($p<0.001$). Subjects in group A improved at a faster rate than in the other groups.

TABLE 11: WITHIN AND BETWEEN SUBJECTS EFFECTS FOR REPEATED MEASURES ANOVA FOR PASSIVE INTERNAL LEFT

Effect	Statistic	p-value
Time	Wilk’s lambda 0.588	<0.001
Group	F 0.505	0.612
Time*Group	Wilk’s Lambda 0.504	<0.001

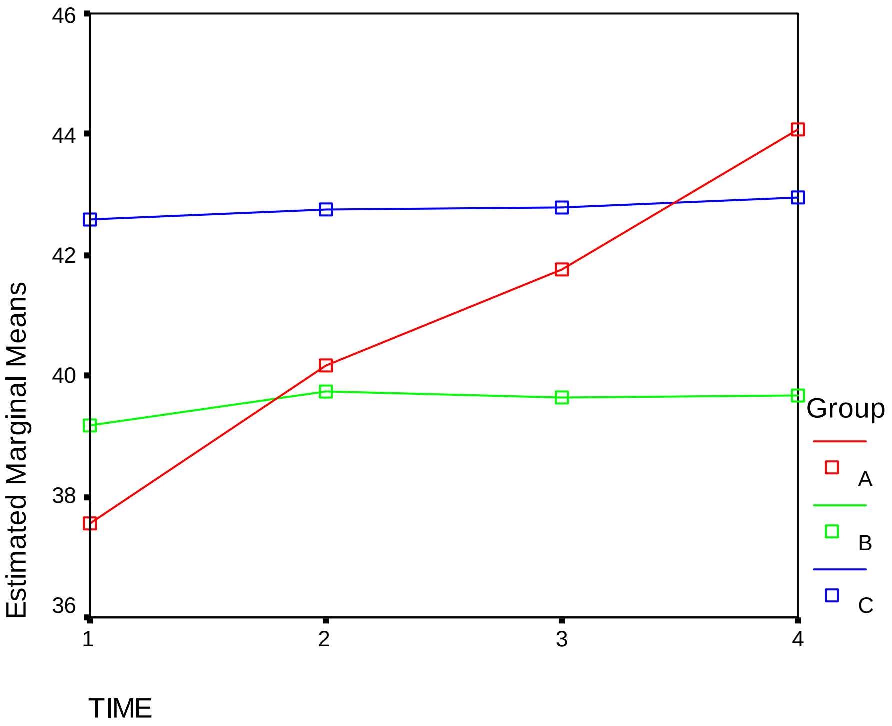


FIGURE 5: PROFILE PLOT OF MEAN PASSIVE INTERNAL LEFT MEASUREMENTS OVER TIME BY GROUP

4.8.1.1.6) Passive internal right

Passive internal right movement improved significantly in the treated group compared to the placebo group (p<0.001) as can be seen in Figure 6 below.

TABLE 12: WITHIN AND BETWEEN SUBJECTS EFFECTS FOR REPEATED MEASURES ANOVA FOR PASSIVE INTERNAL RIGHT

Effect	Statistic	p-value
Time	Wilk's lambda 0.593	<0.001
Group	F 1.192	0.309
Time*Group	Wilk's Lambda 0.560	<0.001

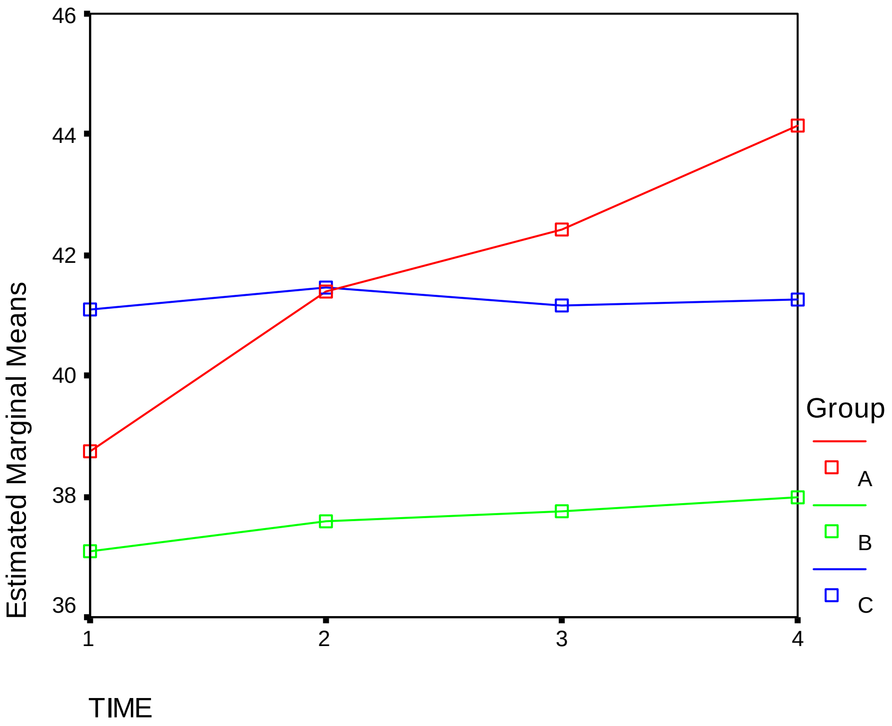


FIGURE 6: PROFILE PLOT OF MEAN PASSIVE INTERNAL RIGHT MEASUREMENTS OVER TIME BY GROUP

4.8.1.1.7) Passive external left

There was a highly significant group time interaction for passive external left side. Thus the treatment had a highly significant effect. Figure 7 shows that the slope of the profile for those in Group A was far steeper than those in the other groups.

TABLE 13: WITHIN AND BETWEEN SUBJECTS EFFECTS FOR REPEATED MEASURES ANOVA FOR PASSIVE EXTERNAL LEFT

Effect	Statistic	p-value
Time	Wilk's lambda 0.562	<0.001
Group	F 0.149	0.862
Time*Group	Wilk's Lambda 0.641	<0.001

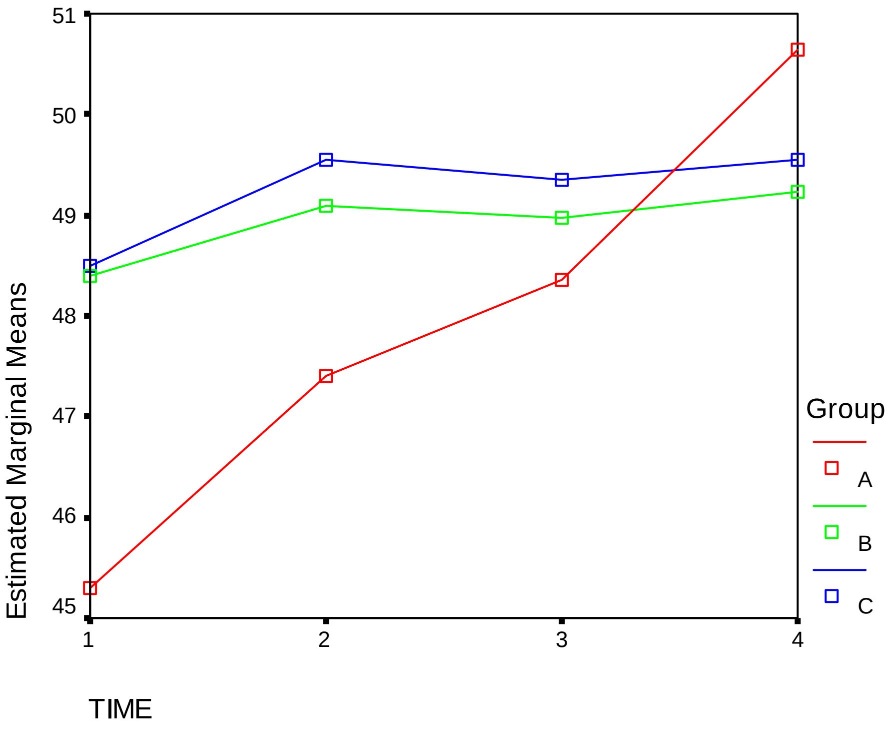


FIGURE 7: PROFILE PLOT OF MEAN PASSIVE EXTERNAL LEFT MEASUREMENTS OVER TIME BY GROUP

4.8.1.1.8) Passive external right

Passive external right side measurements improved significantly more in Group A subjects than in the other two groups. (p<0.001). This is shown in Figure 8, where although they started off lower than the other two groups, the mean value at time 4 in group A was equal to the highest placebo value at time 4.

TABLE 14: WITHIN AND BETWEEN SUBJECTS EFFECTS FOR REPEATED MEASURES ANOVA FOR PASSIVE EXTERNAL RIGHT

Effect	Statistic	p-value
Time	Wilk's lambda 0.674	<0.001
Group	F 0.738	0.481
Time*Group	Wilk's Lambda 0.711	<0.001

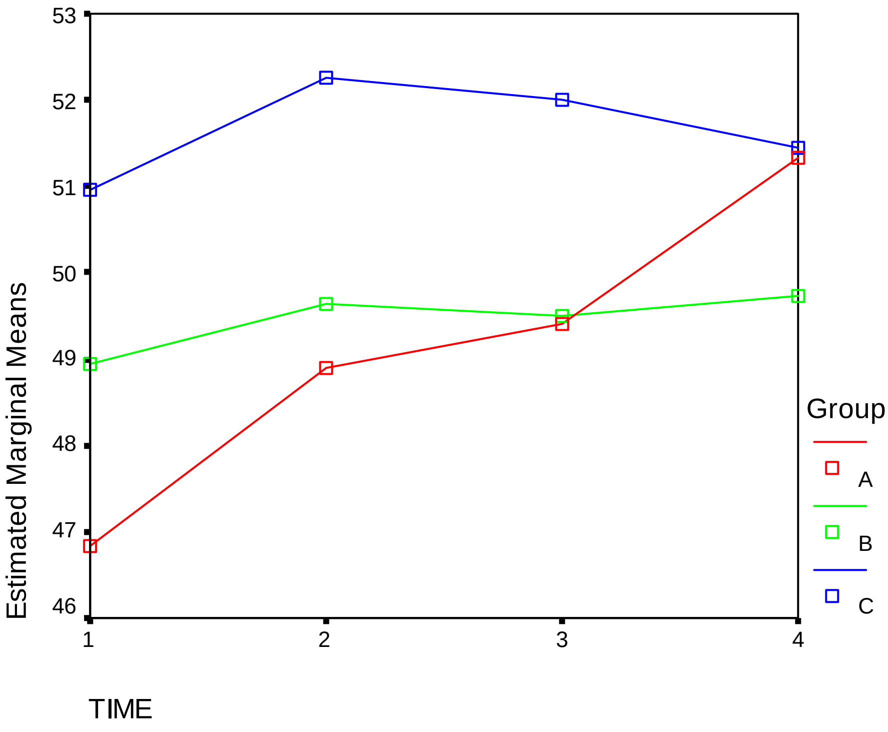


FIGURE 8: PROFILE PLOT OF MEAN PASSIVE EXTERNAL RIGHT MEASUREMENTS OVER TIME BY GROUP

One of the possible differences between active and passive baseline readings would be that during active internal and external rotation of the hip, agonistic and antagonistic muscle contraction occurs which reduces the maximum amount of internal or external range of motion achievable. Due to the presence of the syndrome, the muscles (antagonistic / agonistic) may also be producers of pain, even if treatment has been implemented, as the rate at which the muscle fibres are returned to normal after a pathological condition is at a slower rate than that of the joint normalisation or neurological reflex responses that allowed for the muscle to relax and therefore heal (Mense, Gatterman and Goe – Leach 1994: 103 - 104). Furthermore, with the effect of the maintained contact drop piece manipulation, the muscle is not put on a stretch as would be the case in a side posture manipulation (Gatterman and Goe – Leach 1994: 103), therefore the effects directly related to the muscle are reduced. This could also increase the response time in muscle healing.

Group A showed a sustained improvement over time, this could be due to group A having had a reduced overall hip range of motion, which may be correlated with the fact that group A had a more severe clinical presentation of the sacroiliac syndrome (as assessed against the algometer readings). This reduction in group A would have allowed for a greater increase compared to group B or C.

It is, however, also possible that the groups had differences in the hip range of motion (not assessed in this study), which could have effected the readings for the range of motion. These restrictions could have been subclinical and presented within the clinical pathological range as suggested by Vernon and Mrozek (2005) and would therefore have gone undetected, yet effected the outcomes for this parameter.

4.8.1.2) Algometer

Algometer measurement increased significantly more in Group A subjects relative to the other groups.

TABLE 15: WITHIN AND BETWEEN SUBJECTS EFFECTS FOR REPEATED MEASURES ANOVA FOR ALGOMETER MEASUREMENTS

Effect	Statistic	p-value
Time	Wilk's lambda 0.516	<0.001
Group	F 0.630	0.535
Time*Group	Wilk's Lambda 0.389	<0.001

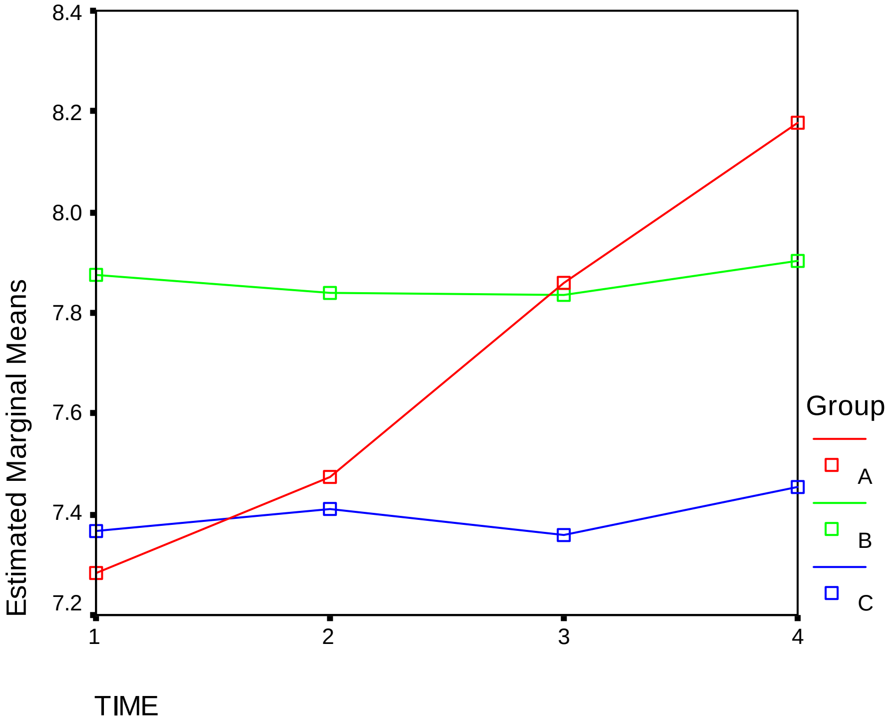


FIGURE 9: PROFILE PLOT OF MEAN ALGOMETER MEASUREMENTS OVER TIME BY GROUP

To understand the significance of the readings obtained by the algometer it is essential to understand the procedure utilised in obtaining the information. The patient was positioned prone and an imaginary line dropped down from the PSIS, at the point where this line intersected with a horizontal line from the second sacral tubercle, the algometer was used to measure pressure threshold over the piriformis. The use of the algometer is therefore in congruence with the literature (Fischer 1987:122), where it is indicated that the algometer reading be taken over soft tissue.

This, however, implies an interesting suggestion in that the manipulative procedure employed did not effect the muscle by means of a stretch, as found in the normal side posture, where it can be argued that the muscle relaxation and improvement is due to the dynamic stretch reflex as discussed by Korr (Leach 1994: 98), where the effect of the manipulation and the sudden stretch imparted into the muscle are responsible for the muscle improvement, with this not apparent here in terms of the technique utilised in group A. Thus, by default, another mechanism whereby the muscular response was facilitated, is present.

This could be as a result of one of these two factors:

1. Sacroiliac syndrome causes, amongst other reflexes, an excess stimulation of the nociciptors by means of the inflammation and inflammatory products built up during the pathogenesis of the sacroiliac syndrome (Mense, Gatterman and Goe – Leach 1994: 103 - 104). Depolarisation of the hyperpolarised segments of the spinal cord, as a result of the manipulation has been suggested as a mechanism in the normalisation of the pathological neural pathways (Patterson and Steinmetz – Leach 1994: 99) thereby facilitating a relaxation of all tissues that were previously irritated. This results in a resolution of the syndrome.

2. A reduction in the mechanical dysfunction of the joint whereby the depressions and ridges are re-aligned and the joint surfaces are returned to their normal position allowing for the return of normal movement and thus stimulation of the large mechanoreceptor fibres (Wyke type I, II and III). These fibres have been implicated in overriding the smaller type C nociceptor fibres thereby inducing a gait control effect (Melzack and Wall, 1965), which reduces pain and increases muscle relaxation, thereby inducing resolution of the syndrome.

4.8.1.3) Average NRS

Since average NRS value did not change over time for any subject in any group, time effects and treatment effects are not able to be estimated. There were no inter-group differences in average NRS (p = 0.089). Figure 10 shows the constant profiles over time.

TABLE 16: WITHIN AND BETWEEN SUBJECTS EFFECTS FOR REPEATED MEASURES ANOVA FOR AVERAGE NRS MEASUREMENTS

Effect	Statistic	p-value
Time	Wilk's lambda cannot be estimated	
Group	F 2.495	0.089
Time*Group	Wilk's Lambda cannot be estimated	

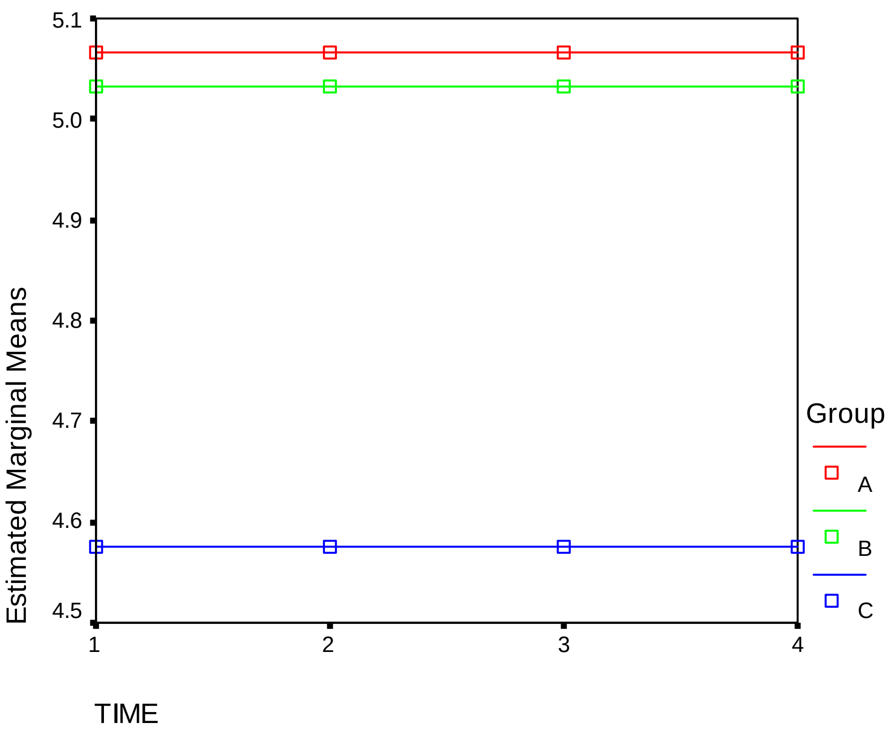


FIGURE 10: PROFILE PLOT OF MEAN AVERAGE NRS MEASUREMENTS OVER TIME BY GROUP

Bolton and Wilkinson (1998) stated that when pain was assessed on multiple occasions with the NRS-101, it was possible for subjects to memorise the report, which seems to be the case in this study where the reporting of these readings happened in the space of 24 hours therefore not allowing for "memory decay" .

4.8.1.4) Current NRS

There was a highly significant treatment effect for current NRS (p<0.001). NRS scores decreased at a faster rate in treated subjects than in placebo subjects. This is evident from the profile plot in Figure 11.

TABLE 17: WITHIN AND BETWEEN SUBJECTS EFFECTS FOR REPEATED MEASURES ANOVA FOR CURRENT NRS

Effect	Statistic	p-value
Time	Wilk's lambda 0.386	<0.001
Group	F 2.372	0.100
Time*Group	Wilk's Lambda 0.265	<0.001

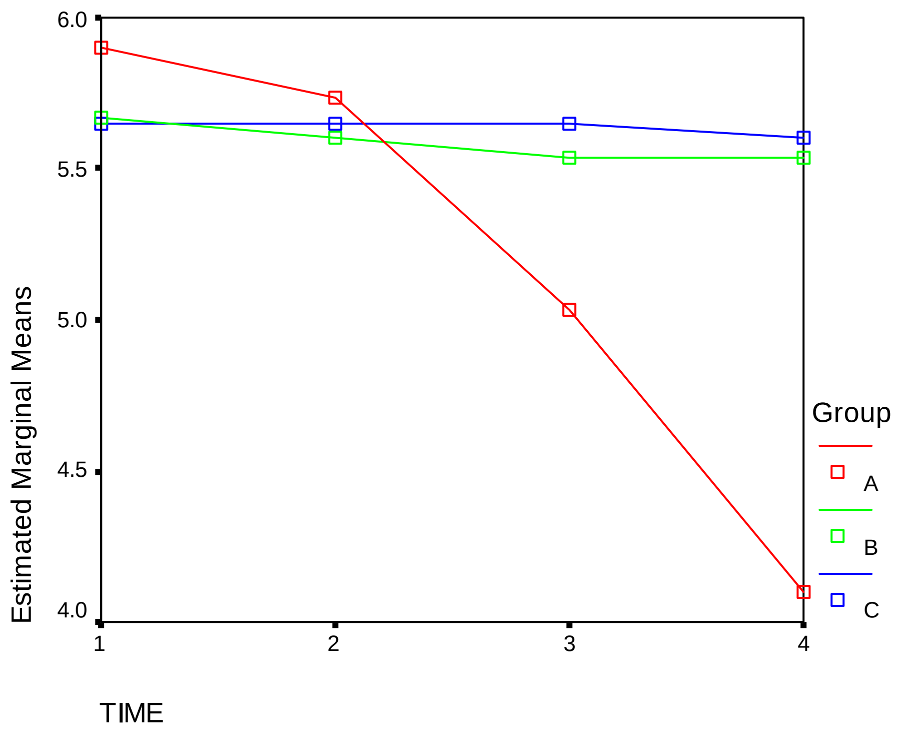


FIGURE 11: PROFILE PLOT OF MEAN CURRENT NRS MEASUREMENTS OVER TIME BY GROUP

It is important to remember that the algometer measures the amount of pressure imparted through it into the soft tissue, and increases in readings show an improvement.

With regards to the above statement, the trends noted in the NRS reflect the trends noted in the algometer and support the theories stated above and it is suggested in this research that the same principles are followed (Refer to 4.8.1.2 above).

4.8.1.5) Categorical outcomes

4.8.1.5.1) Motion palpation (sacroiliac restrictions)

Motion palpation as per the Gillet-Liekens method (Leach 1994) was used and the researcher was blinded as a neutral party proficient in the technique took the readings. This was done because although the drop-piece manipulation was applied with one force in one direction, an increase in joint range of motion would indicate that gapping of the sacroiliac joint occurred.

4.8.1.5.1.1) Right upper flexion:

Figure 12 shows that the percentage of positive subjects decreases to 0 in Group A by time 2, while it remains constant in the two placebo groups. Table 18 shows that there was a significant interaction effect (p=0.001) between time and group, with an increase in odds of a positive outcome as the group by time level got higher. Thus group A (first group) had the lowest odds of a positive response with time. This is echoed in Figure 12.

TABLE 18: WITHIN AND BETWEEN SUBJECTS EFFECTS GEE FOR RIGHT UPPER FLEXION

Effect	Odds ratio	p-value
Time	0.61	<0.001
Group	1.07	0.819
Time*Group	1.19	0.001

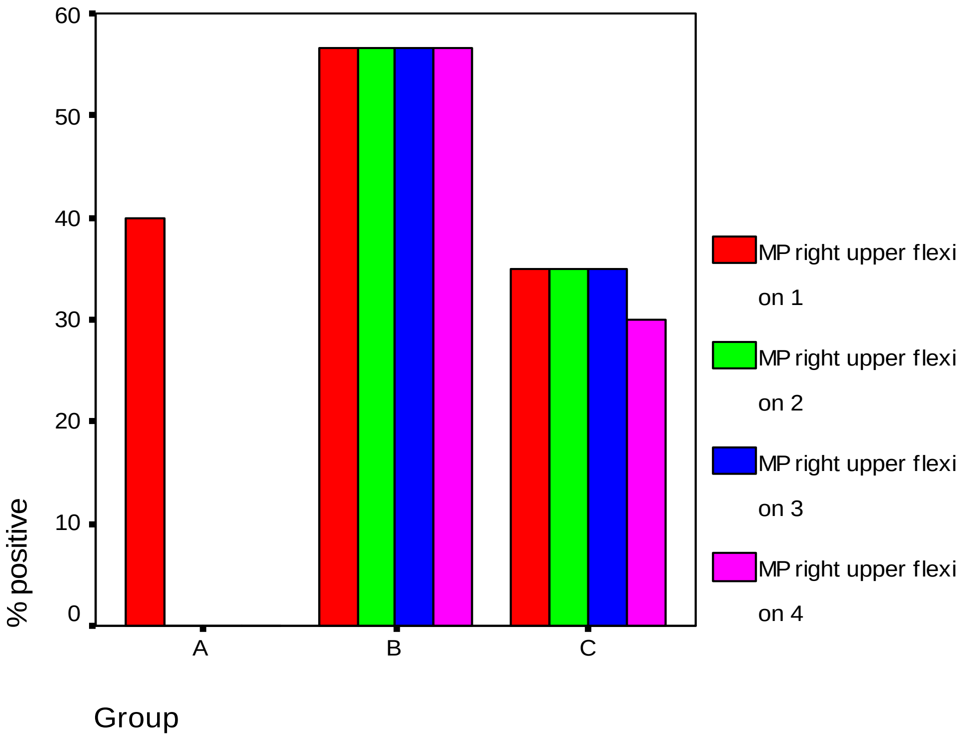


FIGURE 12: PROPORTION OF POSITIVE SUBJECTS BY GROUP OVER TIME FOR RIGHT UPPER FLEXION

Group A indicates that after the initial treatment, improvement was recorded such that no restrictions were found for right upper flexion for the remainder of the readings taken. This is in contrast to groups B and C where group B maintained the dysfunction following treatment and group C showed variable effects. These effects could have been due to group C having a smaller sample size where minor changes in readings were less likely to be masked or averaged and / or the effects of placebo (Gatterman, 1997:184). The effects are unlikely to be due to variance in intervention application as all the subjects in group B and C were placed in the same positions and had the same forces imparted into the femurs and not the sacroiliac joints. In support of this, group B should have improved over group C if one were to consider the theories associated with psychophysical touch. These theories indicate that psychophysical touch should at best stimulate the large mechanoreceptor fibres and serotonin release in order to decrease pain and stimulate improvement.

4.8.1.5.1.2) Right lower flexion:

For this outcome there was no statistical evidence of a treatment effect (p = 0.258) although there was a trend in that the odds ratio for a positive outcome increased as the time and group increased. Figure 13 shows that there was a slight decrease in percentage of positive subjects over time in group A while there was no change or an increase in the other two groups.

TABLE 19: WITHIN AND BETWEEN SUBJECTS EFFECTS GEE FOR RIGHT LOWER FLEXION

Effect	Odds ratio	p-value
Time	0.755	0.277
Group	1.15	0.819
Time*Group	1.16	0.258

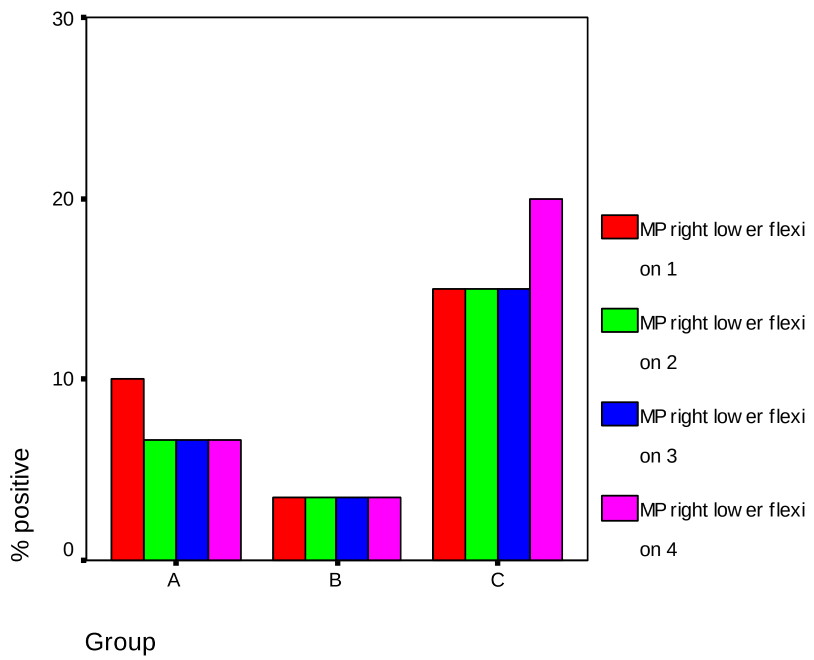


Figure 13: Proportion of positive subjects by group over time for right lower flexion

Group A follows the trend as in right upper flexion above (Refer to 4.8.1.5.1.1 above).

Group B follows the same theory as group B.

Group C complements the above theory of group B in that it does not show improvement over time (at 24 hours) but rather regression. This could be due to:

- subjects becoming aware that they received a sham treatment or
- a change in their actions that led to a greater number of fixations developing within 24 hours of their last reading.

4.8.1.5.1.3) Right upper extension:

Statistics could not be computed for this outcome as the proportions of positive and negative subjects remained constant over time in each group, as shown in Figure 14. Thus there was no treatment effect for this outcome since there were no positive subjects at baseline.

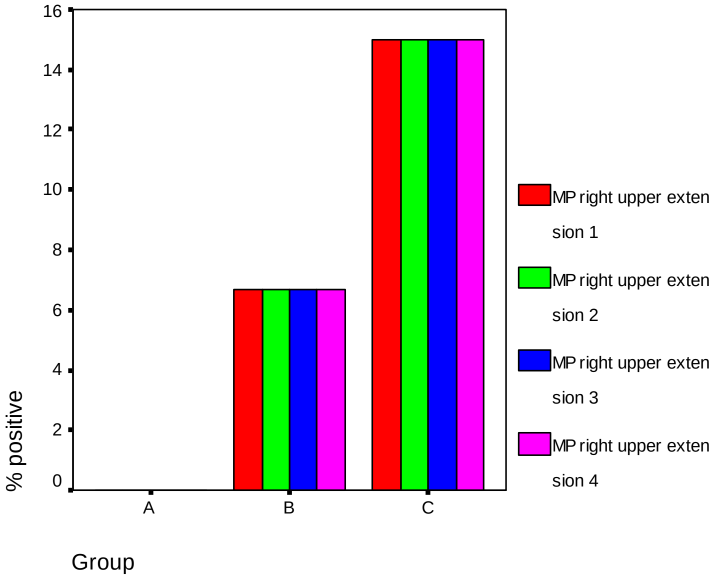


FIGURE 14: PROPORTION OF POSITIVE SUBJECTS BY GROUP OVER TIME FOR RIGHT UPPER EXTENSION

4.8.1.5.1.4) Right lower extension:

Similarly, statistics could not be computed for this outcome as group A had no positive subjects at any time point, and the percentage of positive subjects was very low overall, as shown in Figure 15. Thus there was no treatment effect for this outcome.

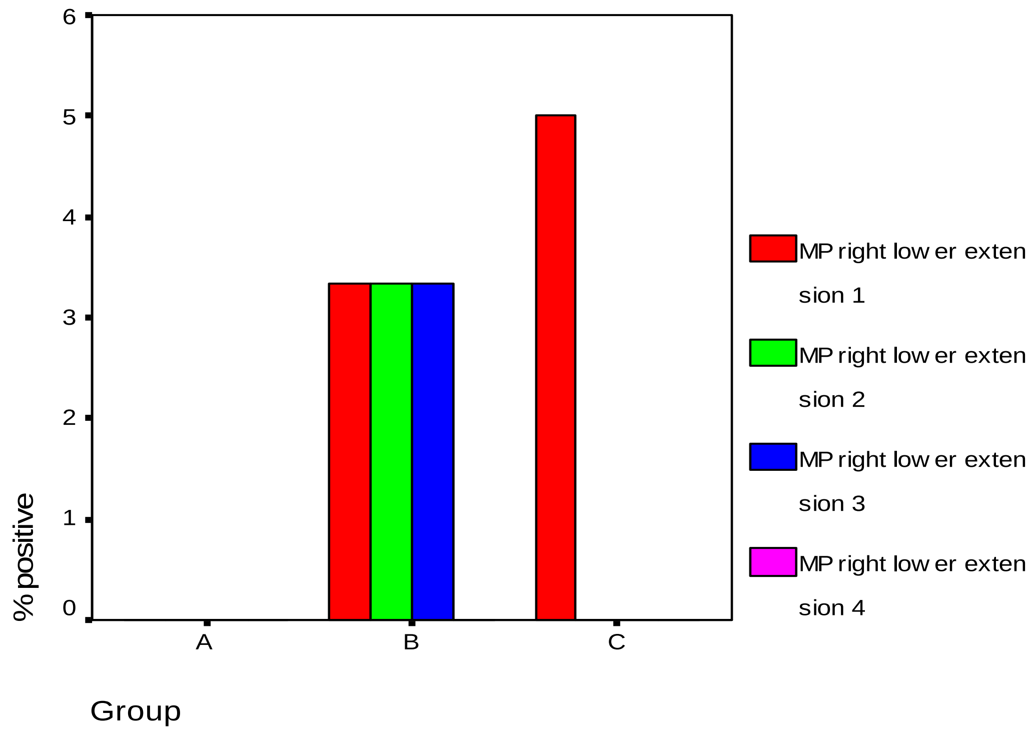


FIGURE 15: PROPORTION OF POSITIVE SUBJECTS BY GROUP OVER TIME FOR RIGHT LOWER EXTENSION

Group A and B show no effect, while group C on the other hand showed a marked improvement. These effects could have been due to group C having a smaller sample size where minor changes in readings were less likely to be masked or averaged and / or due to the effects of placebo (Gatterman, 1995:184).

4.8.1.5.1.5) Left upper flexion:

This outcome showed a significant treatment effect (p<0.001). Figure 16 shows that the proportion of positive subjects in group A decreased over time whilst it increased or remained the same in the other two groups.

TABLE 20: WITHIN AND BETWEEN SUBJECTS EFFECTS GEE FOR LEFT UPPER FLEXION

Effect	Odds ratio	p-value
Time	0.14	<0.001
Group	0.51	0.033
Time*Group	2.20	<0.001

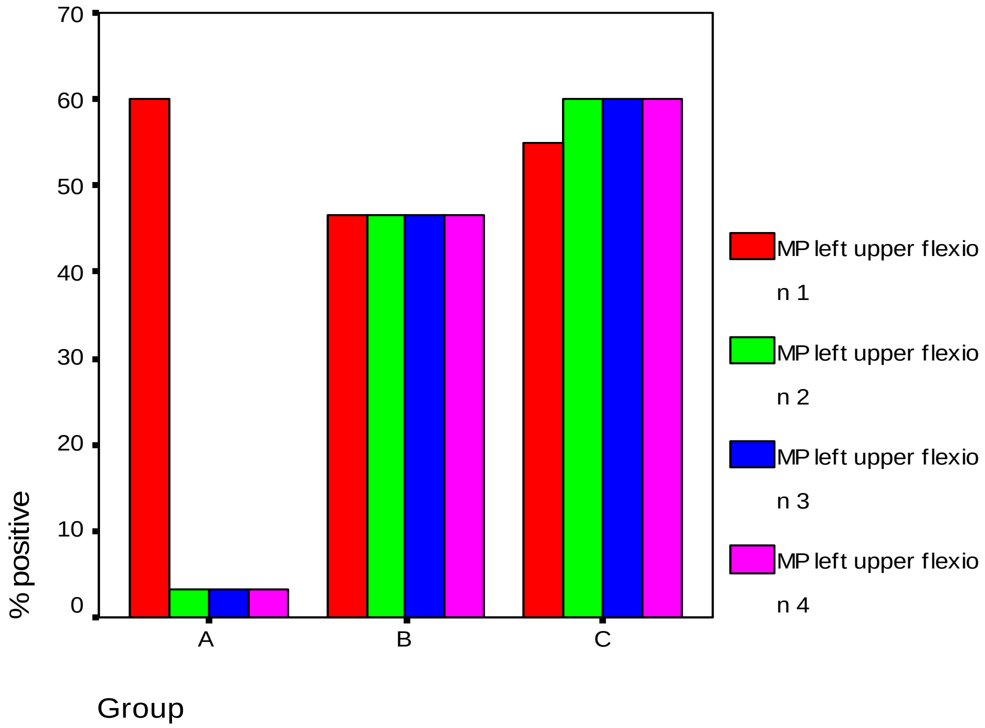


FIGURE 16: PROPORTION OF POSITIVE SUBJECTS BY GROUP OVER TIME FOR LEFT UPPER FLEXION

Group A indicates that after the initial treatment, improvement was recorded such that restrictions were markedly reduced for left upper flexion for the remainder of the readings taken. This is in contrast to groups B and C where group B maintained the dysfunction following treatment. Group C complements the above theory (4.8.1.5.1.1) of group B (mentioned under right upper flexion) in that it does not show improvement over time (at 24 hours) but rather regression.

4.8.1.5.1.6) Left lower flexion:

This outcome had a very small percentage who were positive, thus although trends are demonstrated towards a treatment effect (Figure 17), this is not statistically significant (p = 0.117).

TABLE 21: WITHIN AND BETWEEN SUBJECTS EFFECTS GEE FOR LEFT LOWER FLEXION

Effect	Odds ratio	p-value
Time	0.67	0.121
Group	0.82	0.702
Time*Group	1.16	0.117

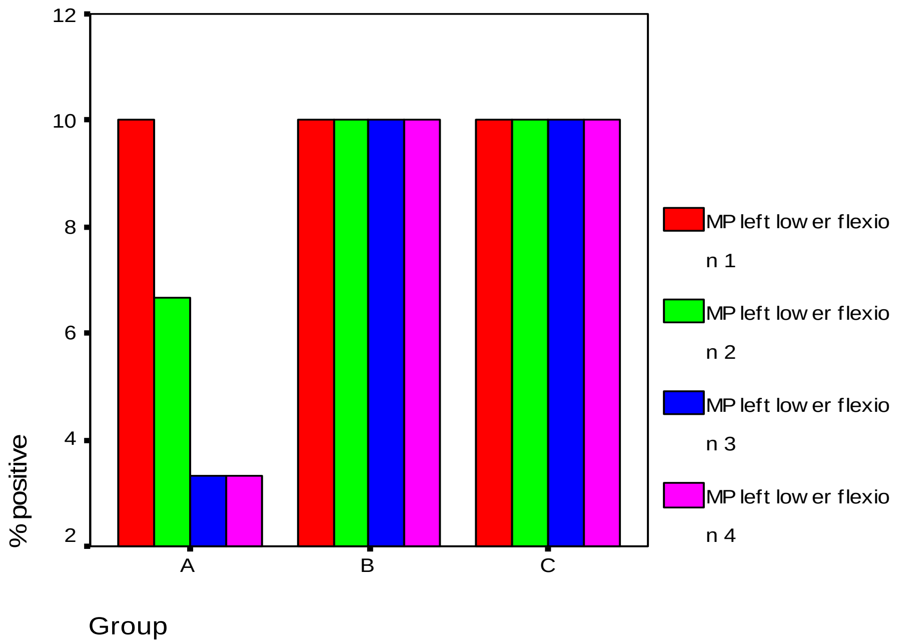


FIGURE 17: PROPORTION OF POSITIVE SUBJECTS BY GROUP OVER TIME FOR LEFT LOWER FLEXION

Group A follows the trend as in right upper flexion above (Refer to 4.8.1.5.1.1 above).

Group B and C follows the same theory as in right upper extension above (Refer to 4.8.1.5.1.3 above).

4.8.1.5.1.7) Left upper extension:

Statistics could not be computed for this outcome since there were no positive subjects in both groups A or C, and the proportion of positives overall was low (Figure 18).

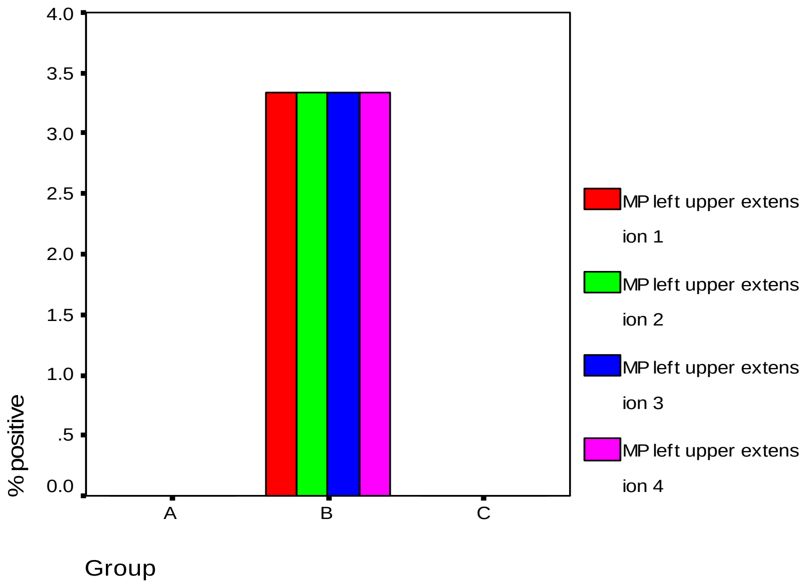


FIGURE 18: PROPORTION OF POSITIVE SUBJECTS BY GROUP OVER TIME FOR LEFT UPPER EXTENSION

4.8.1.5.1.8) Left lower extension:

Statistics could not be computed for this outcome since there were no positive subjects in either groups B or C, and the proportion of positives overall was low (Figure 19).

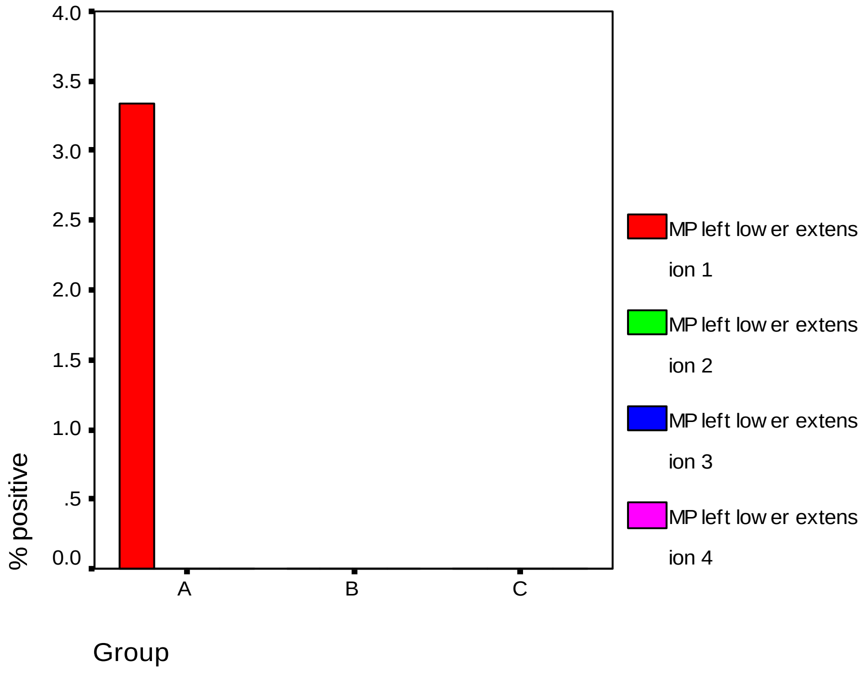


FIGURE 19: PROPORTION OF POSITIVE SUBJECTS BY GROUP OVER TIME FOR LEFT LOWER EXTENSION

Group A improved but is not comparable to groups B and C who had no dysfunctions.

4.8.1.5.2) Orthopedic tests

4.8.1.5.2.1) Faber Right

There was a significant treatment effect for this outcome (p<0.001). Figure 20 shows that the percentage of positive subjects in group A decreased over time while in the other groups it was relatively constant.

TABLE 22: WITHIN AND BETWEEN SUBJECTS EFFECTS GEE FOR FABER RIGHT

Effect	Odds ratio	p-value
Time	0.30	<0.001
Group	0.54	0.065
Time*Group	1.58	<0.001

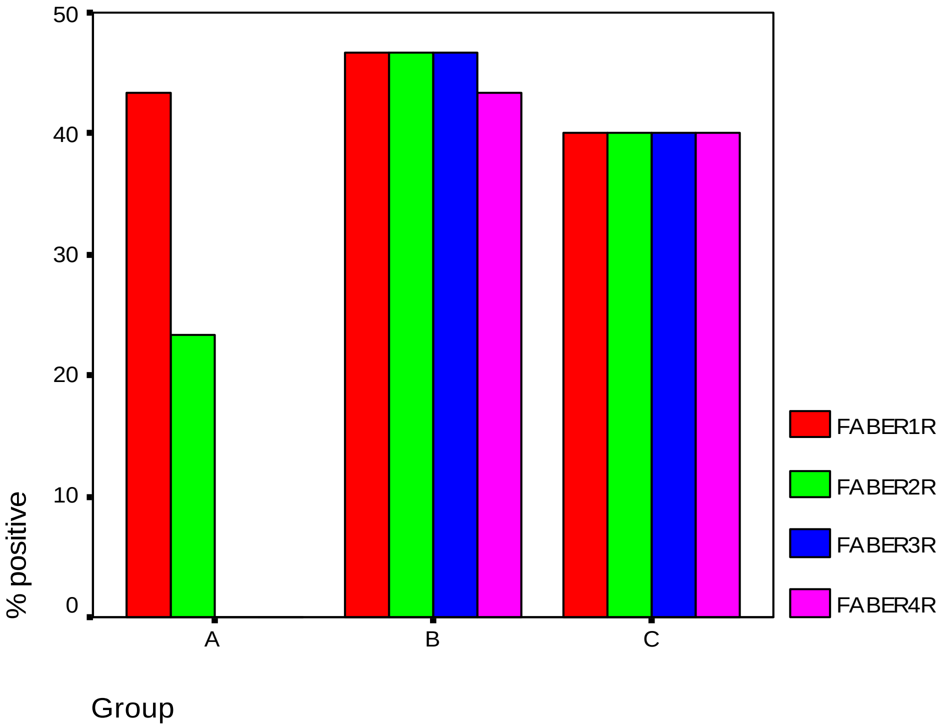


FIGURE 20: PROPORTION OF POSITIVE SUBJECTS BY GROUP OVER TIME FOR FABER RIGHT

4.8.1.5.2.2) Faber left

There was a significant benefit to treatment in Group A (p<0.001). Figure 21 shows that the proportion of subjects who were positive decreased over time in Group A, whilst it remained constant in the two placebo groups.

TABLE 23: WITHIN AND BETWEEN SUBJECTS EFFECTS GEE FOR FABER LEFT

Effect	Odds ratio	p-value
Time	0.24	<0.001
Group	0.61	0.131
Time*Group	1.74	<0.001

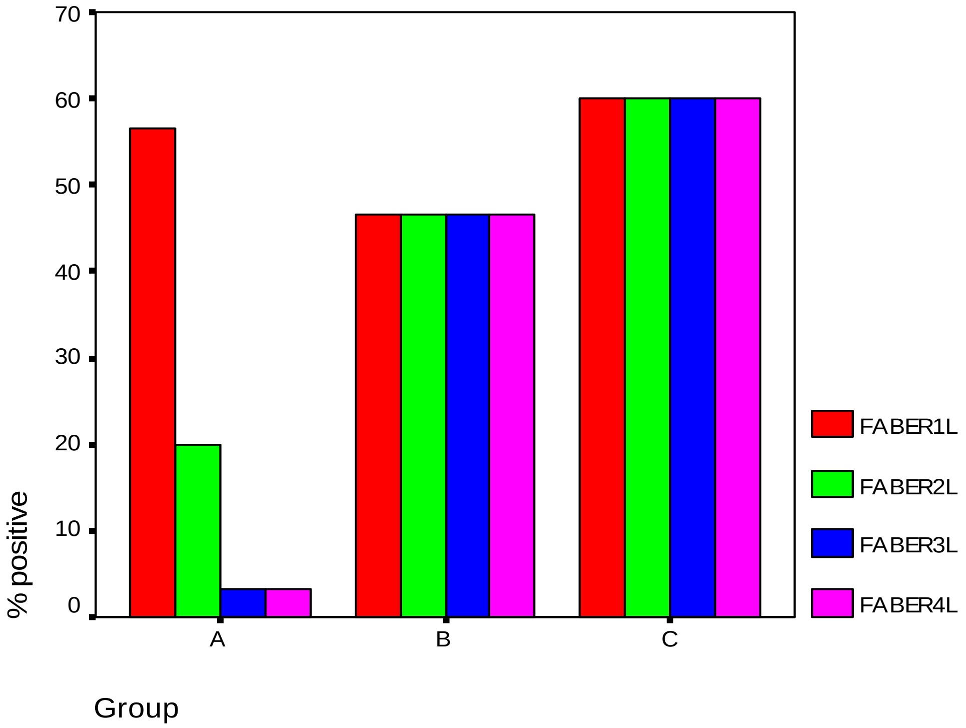


FIGURE 21: PROPORTION OF POSITIVE SUBJECTS BY GROUP OVER TIME FOR FABER LEFT

4.8.1.5.2.3) Gaenslens test right

For this outcome there was no statistical evidence of a treatment effect (p = 0.071), although a trend is visible from Figure 22. There were a very small proportion of subjects in Group A who were positive for this outcome at baseline, and by time 3 there was 0% positive in this group. There was also a slight decrease of positivity over time in Group B, but not in Group C.

TABLE 24: WITHIN AND BETWEEN SUBJECTS EFFECTS GEE FOR GAENSLENS RIGHT

Effect	Odds ratio	p-value
Time	0.714	0.074
Group	1.30	0.473
Time*Group	1.13	0.071

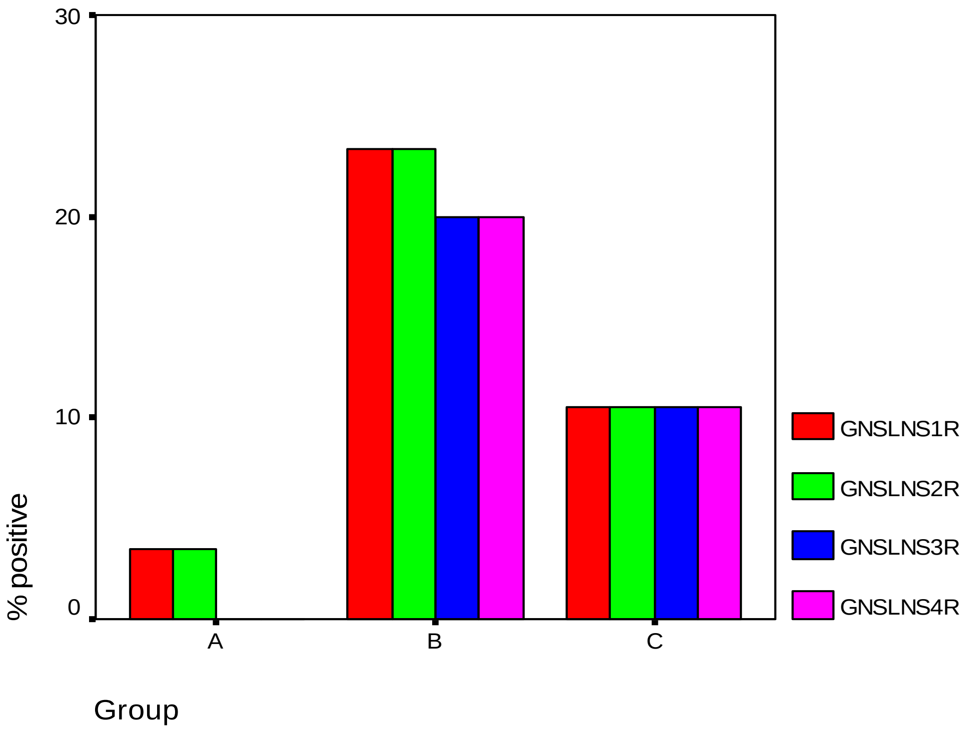


FIGURE 22: PROPORTION OF POSITIVE SUBJECTS BY GROUP OVER TIME FOR GAENSLENS RIGHT

4.8.1.5.2.4) Gaenslens left

This outcome showed a highly significant treatment effect (p<0.001). Figure 23 shows that the percentage of positives decreased over time in Group A, but not in the other two groups.

TABLE 25: WITHIN AND BETWEEN SUBJECTS EFFECTS GEE FOR GAENSLENS LEFT

Effect	Odds ratio	p-value
Time	0.43	<0.001
Group	1.06	0.874
Time*Group	1.38	<0.001

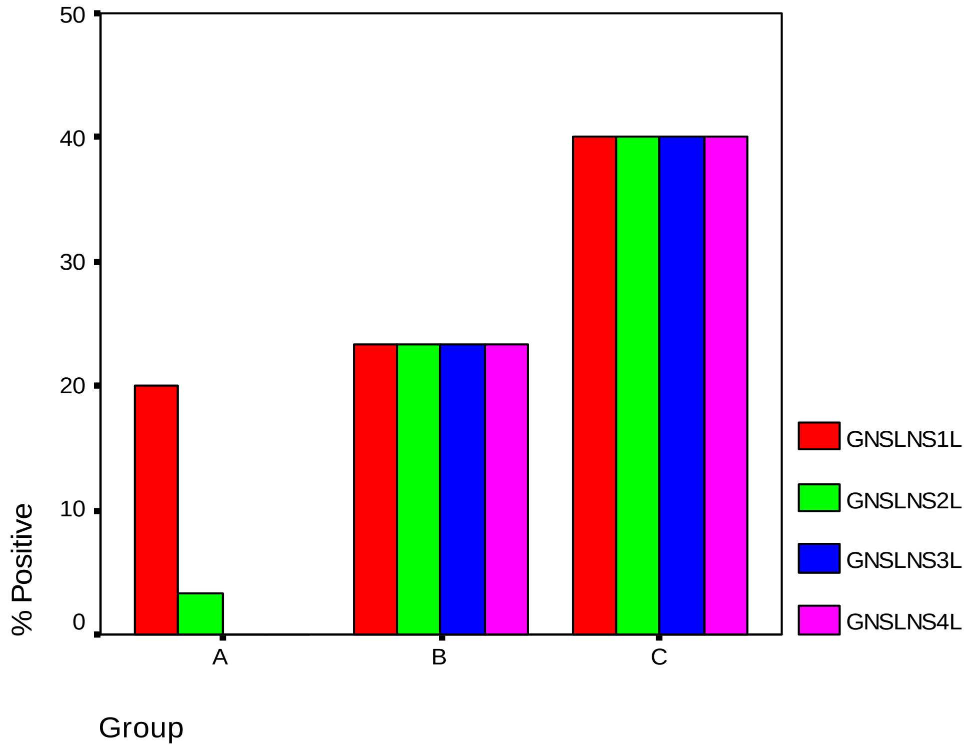


FIGURE 23: PROPORTION OF POSITIVE SUBJECTS BY GROUP OVER TIME FOR GAENSLENS LEFT

4.8.1.5.2.5) Yeoman right

There was a highly significant treatment effect for this outcome (p<0.001), as the percentage of positives decreased over time in Group A and not in the other two groups (Figure 24).

TABLE 26: WITHIN AND BETWEEN SUBJECTS EFFECTS GEE FOR YEOMAN RIGHT

Effect	Odds ratio	p-value
Time	0.47	<0.001
Group	0.73	0.319
Time*Group	1.33	<0.001

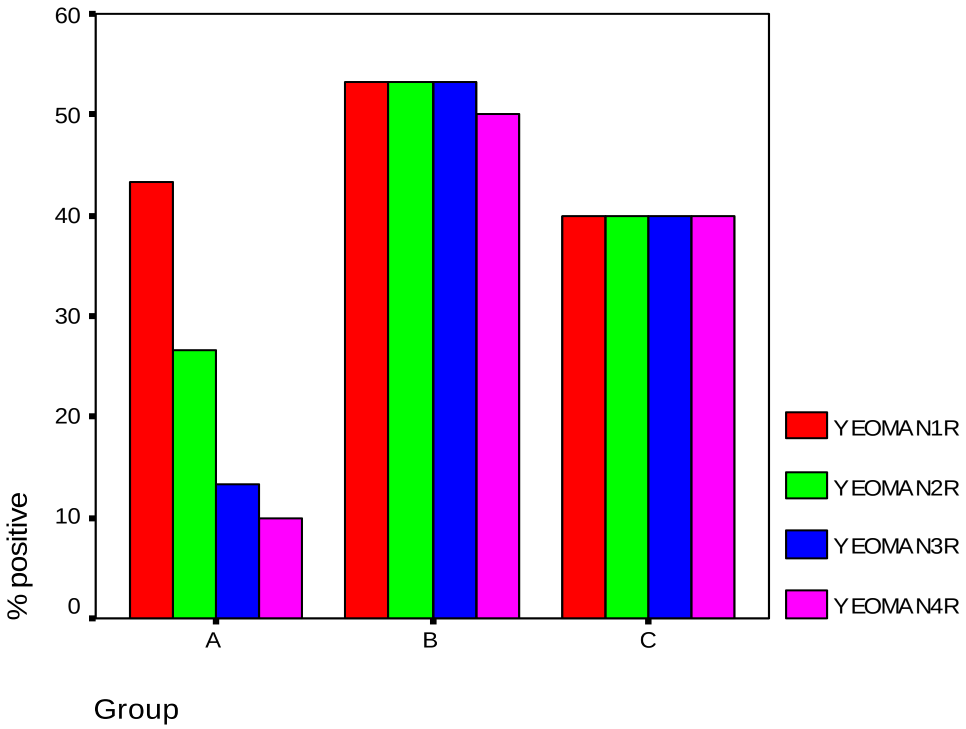


FIGURE 24: PROPORTION OF POSITIVE SUBJECTS BY GROUP OVER TIME FOR YEOMAN RIGHT

4.8.1.5.2.6) Yeoman left

There was a highly significant treatment effect for Yeoman left test (p<0.001). Figure 25 shows that the percentage of positive subjects decreased in Group A but not in the other two placebo groups.

TABLE 27: WITHIN AND BETWEEN SUBJECTS EFFECTS GEE FOR YEOMAN LEFT

Effect	Odds ratio	p-value
Time	0.30	<0.001
Group	0.53	0.065
Time*Group	1.60	<0.001

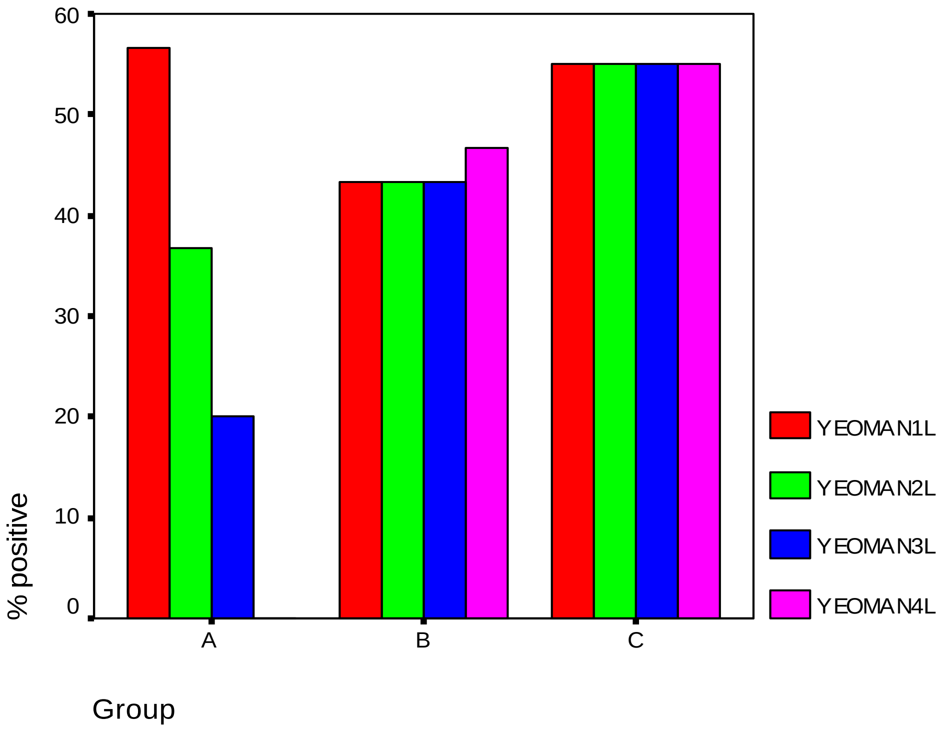


FIGURE 25: PROPORTION OF POSITIVE SUBJECTS BY GROUP OVER TIME FOR YEOMAN LEFT

4.8.1.5.2.7) Shear Right

No significant treatment effect was found for this outcome (p = 0.131). If one examines Figure 26, it can be seen that there was a very small percentage of positive subjects in Group A at baseline. All subsequently became negative, but this could have happened by chance alone, thus there was not enough statistical evidence, although a trend is visible.

TABLE 28: WITHIN AND BETWEEN SUBJECTS EFFECTS GEE FOR SHEAR RIGHT

Effect	Odds ratio	p-value
Time	0.854	0.147
Group	1.67	0.129
Time*Group	1.06	0.131

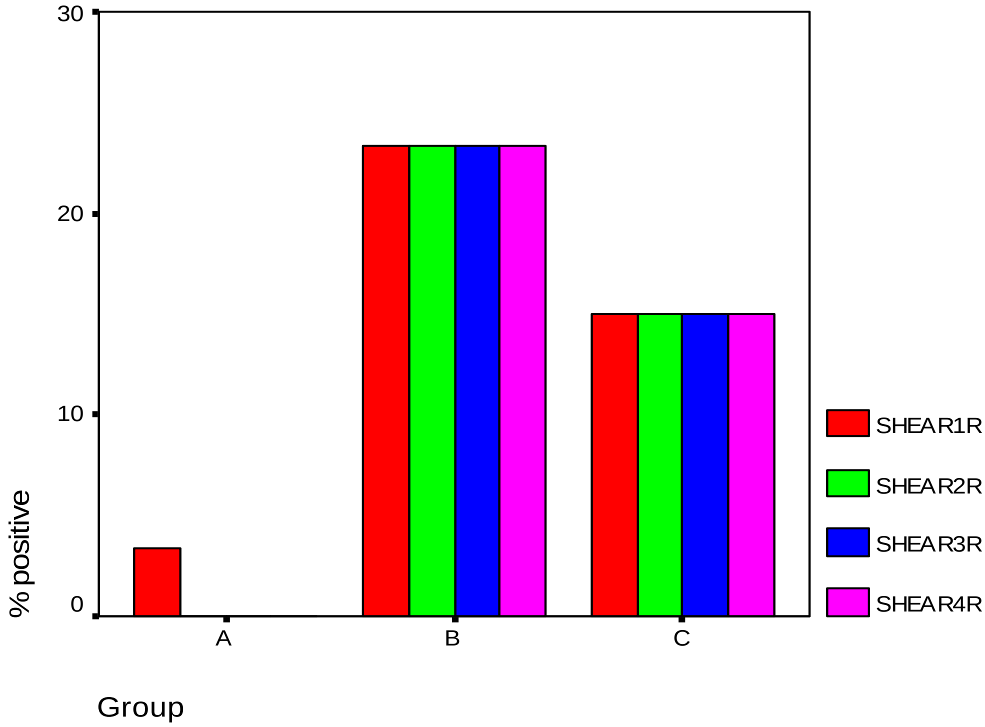


FIGURE 26: PROPORTION OF POSITIVE SUBJECTS BY GROUP OVER TIME FOR SHEAR RIGHT

4.8.1.5.2.8) Shear left

There was statistical evidence of a treatment effect for this outcome (p = 0.020). Figure 27 shows that the proportion of positives decreased in Group A but not in the other two groups.

TABLE 29: WITHIN AND BETWEEN SUBJECTS EFFECTS GEE FOR SHEAR LEFT

Effect	Odds ratio	p-value
Time	0.43	0.022
Group	0.959	0.949
Time*Group	1.36	0.020

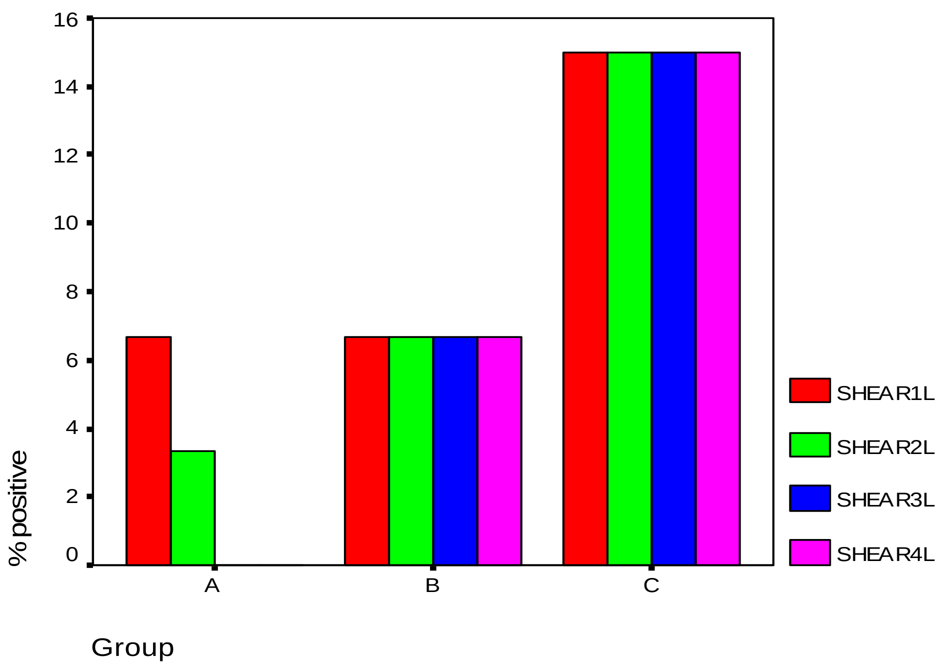


FIGURE 27: PROPORTION OF POSITIVE SUBJECTS BY GROUP OVER TIME FOR SHEAR LEFT

With regards to all the orthopaedic tests above, it can be seen that the active treatment group improved over time while groups B and C, who received no treatment, stayed the same or regressed.

The function of these orthopaedic tests is to stress the joint and provoke pain, however, if points 1 and 2 below are applicable, then the test severity should decrease with time.

1. Sacroiliac syndrome causes amongst other reflexes an excess stimulation of the nociciptors by means of the inflammation and inflammatory products built up during the pathogenesis of the sacroiliac syndrome (Mense, Gatterman and Goe – Leach 1994: 103 - 104). Depolarisation of the hyperpolarised segments of the spinal cord, as a result of the manipulation has been suggested as a mechanism in the normalisation of the pathological neural pathways (Patterson and Steinmetz, 1986 in Leach, 1994: 101), thereby facilitating a relaxation of all tissues that were previously irritated. This results in a resolution of the syndrome.

2. A reduction in the mechanical dysfunction of the joint whereby the depressions and ridges are re-aligned and the joint surfaces are returned to their normal position allowing for the return of normal movement and thus stimulation of the large mechanoreceptor fibres (Wyke type I, II and III). These fibres have been implicated in overriding the smaller type C nociceptor fibres thereby inducing a gait control effect (Melzack and Wall, 1965), which reduces pain and increases muscle relaxation, thereby inducing resolution of the syndrome.

It would seem that the consistent suggestions toward improvement of readings/outcomes from the NRS, algometer and orthopaedic tests, indicates and suggests that the theories presented in this research have consistency and would therefore suggest validity. However further research would need to be completed in order to support this assertion.

4.8.2) Intra-group

4.8.2.1) correlation analysis

4.8.2.1.1) Quantitative outcomes

TABLE 30: SPEARMAN'S CORRELATION BETWEEN CHANGE IN INCLINOMETER, ALGOMETER AND NRS MEASUREMENTS IN GROUP A

		change in active internal left	hange in active external left	change in passive internal left	change in passive external left	change in active internal right	change in active external right	change in passive internal right	change in passive external right	change in algometer	change in current NRS
change in active internal left	Correlation Coefficient	1.000	.197	.841(**)	.524(**)	-.037	-.189	.161	-.215	-.091	.032
	Sig. (2-tailed)	.	.296	.000	.003	.848	.317	.395	.254	.633	.865
change in active external left	Correlation Coefficient	.197	1.000	.194	.670(**)	.316	.404(*)	.459(*)	.207	-.105	-.193
	Sig. (2-tailed)	.296	.	.304	.000	.089	.027	.011	.273	.582	.307
change in passive internal left	Correlation Coefficient	.841(**)	.194	1.000	.527(**)	-.001	-.121	.237	-.069	-.266	.171
	Sig. (2-tailed)	.000	.304	.	.003	.995	.525	.206	.716	.155	.367
change in passive external left	Correlation Coefficient	.524(**)	.670(**)	.527(**)	1.000	.369(*)	.116	.478(**)	.161	-.083	-.039
	Sig. (2-tailed)	.003	.000	.003	.	.045	.542	.007	.396	.663	.838
change in active internal right	Correlation Coefficient	-.037	.316	-.001	.369(*)	1.000	.464(**)	.732(**)	.592(**)	.101	.123
	Sig. (2-tailed)	.848	.089	.995	.045	.	.010	.000	.001	.594	.518
change in active external right	Correlation Coefficient	-.189	.404(*)	-.121	.116	.464(**)	1.000	.318	.639(**)	.052	.003
	Sig. (2-tailed)	.317	.027	.525	.542	.010	.	.087	.000	.785	.986
change in passive internal right	Correlation Coefficient	.161	.459(*)	.237	.478(**)	.732(**)	.318	1.000	.396(*)	.157	.144
	Sig. (2-tailed)	.395	.011	.206	.007	.000	.087	.	.030	.407	.448
change in passive external right	Correlation Coefficient	-.215	.207	-.069	.161	.592(**)	.639(**)	.396(*)	1.000	-.136	-.056
	Sig. (2-tailed)	.254	.273	.716	.396	.001	.000	.030	.	.473	.770
change in algometer	Correlation Coefficient	-.091	-.105	-.266	-.083	.101	.052	.157	-.136	1.000	-.184
	Sig. (2-tailed)	.633	.582	.155	.663	.594	.785	.407	.473	.	.332
change in current NRS	Correlation Coefficient	.032	-.193	.171	-.039	.123	.003	.144	-.056	-.184	1.000
	Sig. (2-tailed)	.865	.307	.367	.838	.518	.986	.448	.770	.332	.

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

For the intra-group correlation analysis, it can be argued that the changes that occurred bilaterally, with regards to internal and external hip rotation, could be due to both sacroiliac joints being over the drop section of the table. This positioning of the sacroiliac joints could lead to both joints being effected by the manipulation procedure, even though only one joint received the thrust.

It cannot be assumed that the patient was adjusted on the one or another side, therefore it is assumed that the correlations are based on the directional association only and discussion surrounds the determination of the relationship between the movements.

Reference movement	**Significantly associated movement(s)**	**Discussion**
Association 1: Change in active internal left	Change in passive internal left	The association is positive therefore there is an increase in the measurements (degrees) for this association. In group A both sacroiliac joints where placed over the drop section, thus the implication arises that both the joints where affected mechanically irrespective of the joint that was contacted by the contact hand imparting the thrust. Thereby with the restoration of the joint movement, there is an increased probability that there would be associated muscle relaxation (Korr in Leach 1994:98). This results in: 1. Increased passive range of motion as the antagonist muscle allows for increased stretch (i.e. internal rotation increases as the external rotators (piriformis) relaxes). 2. The restoration of the motion of the joint should stimulate an increase in the firing pattern of the mechanoreceptors in and around the joint. This stimulation allows for increased type A (large fiber) fiber stimulation, which is thought to activate the gate control theory decreasing pain. With this decrease in pain the degree of reactive muscle spasm in muscles of the same neurological level (L2 – S4) (Ombregt, et al,. 1995:691). This would account for agonist and antagonist muscle relaxation and increased range of movement. This mechanical overriding of the pain fibers may also have been enhanced by the psychophysical effect of touch, which would also stimulate these receptors. 3. The effect of a sudden stretch on the iliopsoas muscle could also have been a factor that affected the rate of improvement and the degree of association between the external and internal ranges of motion (active or passive), which cannot be discounted. Active range of motion could also have independently been affected in that the muscle has returned to its normal physiological state (post relaxation), allowing for the muscle to achieve maximum contraction ability.
	Change in passive external left	
Association 2: Change in active external left	Change in passive external left	The theories as above would apply in that the muscle (piriformis) would have relaxed allowing the muscle to be stretched (passive) and then also giving it the ability to contract maximally from the physiologically normal position.
	Change in active external left	
	Change in passive internal right	

Association 3: Change in passive internal left	Change in passive external left	It would seem that the effects as discussed for association 1 above hold true however the effects may be reversed (i.e. cycle starting with point 3 and moving towards point 1).
Association 4: Change in passive external left	Change in active internal right	It could be argued that the effects as discussed for association 1 above would also hold true especially with regards to points 2 and 3.
	Change in passive internal right	
Association 5: Change in active internal right	Change in passive internal right	Refer to discussion as for association 1
	Change in active external right	
	Change in passive external right	
Association 6: Change in active external right	Change in passive external right	Refer to discussion as for association 2
Association 7: Change in passive internal right	Change in passive external right	Refer to discussion as for association 2

The discussions in the above table have been based on a limited sample that is less than the total number of patients seen in groups A, as the associations are only applicable to certain patients. Therefore it is recognized that increased sample sizes in future research would be imperative, as well as structured inclusion and exclusion criteria which delimit :

Sacroiliac joint syndrome symptoms on the side of fixation (as in this study)
The side of thrust application needs to be consistent (as in this study)

as well as

Subgroup division of patients based on their principle range of movement improvement, such that the associations based on the principle movement are more clearly defined. This would require that each subgroup would need a larger sample size – preferably more than 20 participants per subgroup.

TABLE 31: SPEARMAN'S CORRELATION BETWEEN CHANGE IN INCLINOMETER, ALGOMETER AND NRS MEASUREMENTS IN GROUP B

		change in active internal left	change in active external left	change in passive internal left	change in passive external left	change in active internal right	change in active external right	change in passive internal right	change in passive external right	change in algometer	change in current NRS
change in active internal left	Correlation Coefficient	1.000	.059	.481(**)	.116	.150	.006	.115	-.015	.109	-.087
	Sig. (2-tailed)	.	.758	.007	.541	.428	.973	.547	.937	.565	.649
change in active external left	Correlation Coefficient	.059	1.000	.320	.398(*)	.454(*)	.213	.356	.399(*)	.026	-.099
	Sig. (2-tailed)	.758	.	.084	.030	.012	.259	.054	.029	.893	.605
change in passive internal left	Correlation Coefficient	.481(**)	.320	1.000	.144	.061	.022	.255	.175	.034	-.301
	Sig. (2-tailed)	.007	.084	.	.446	.749	.909	.173	.354	.856	.106
change in passive external left	Correlation Coefficient	.116	.398(*)	.144	1.000	.576(**)	.430(*)	.529(**)	.468(**)	.176	-.127
	Sig. (2-tailed)	.541	.030	.446	.	.001	.018	.003	.009	.353	.505
change in active internal right	Correlation Coefficient	.150	.454(*)	.061	.576(**)	1.000	.154	.397(*)	.279	.417(*)	-.202
	Sig. (2-tailed)	.428	.012	.749	.001	.	.417	.030	.136	.022	.285
change in active external right	Correlation Coefficient	.006	.213	.022	.430(*)	.154	1.000	.553(**)	.558(**)	.268	-.553(**)
	Sig. (2-tailed)	.973	.259	.909	.018	.417	.	.002	.001	.153	.002
change in passive internal right	Correlation Coefficient	.115	.356	.255	.529(**)	.397(*)	.553(**)	1.000	.520(**)	.223	-.415(*)
	Sig. (2-tailed)	.547	.054	.173	.003	.030	.002	.	.003	.237	.023
change in passive external right	Correlation Coefficient	-.015	.399(*)	.175	.468(**)	.279	.558(**)	.520(**)	1.000	.032	-.222
	Sig. (2-tailed)	.937	.029	.354	.009	.136	.001	.003	.	.865	.237
change in algometer	Correlation Coefficient	.109	.026	.034	.176	.417(*)	.268	.223	.032	1.000	-.403(*)
	Sig. (2-tailed)	.565	.893	.856	.353	.022	.153	.237	.865	.	.027
change in current NRS	Correlation Coefficient	-.087	-.099	-.301	-.127	-.202	-.553(**)	-.415(*)	-.222	-.403(*)	1.000
	Sig. (2-tailed)	.649	.605	.106	.505	.285	.002	.023	.237	.027	.

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

In group B intra-group correlation analysis, the changes associated with internal and external hip rotation could be due to the placebo effect. On the other hand, even though the femurs were placed over the drop section of the table and no thrust was applied to the subject, the biomechanics of the sacroiliac joint could have been altered slightly.

It must be noted that the patients in group B had their femurs placed over the drop section, therefore no sacroiliac manipulation should have taken place.

Reference movement	Significantly associated movement(s)	Discussion
Association 1: Change in active internal left	Change in passive internal left	The association is positive therefore there is an increase in the measurements (degrees) for this association. 1. The effect of a sudden stretch on the iliopsoas muscle could also have been a factor that affected the rate of improvement and the degree of association between the external and internal ranges of motion (active or passive), which cannot be discounted. This could be due to iliopsoas muscle being stretched with the drop table section irrespective of the patient positioning. 2. In addition to this, with the femur being placed over the drop section, it is possible that a fulcrum effect develops and more stretch is imparted on the iliopsoas when the drop section is activated (patient moves from flexed to neutral position) than would be if the sacroiliac joints were placed over the drop section. 3. A placebo effect could account for an increase in active range of motion on the opposite side as the patient could try harder to improve the range of motion, but would still be limited on the affected side due to the fixation or inflammatory reaction still being present. Active range of motion could also have independently been affected in that the muscle has returned to its normal physiological state (post relaxation), allowing for the muscle to achieve maximum contraction ability.
Association 2: Change in active external left	Change in passive external left	Refer to association 1 above
	Change in active internal right	
	Change in passive external right	
Association 3: Change in passive external left	Change in active internal right	Refer to association 1 above
	Change in active external right	
	Change in passive internal right	

	Change in passive external right	
Association 4: Change in active internal right	Change in passive internal right Change in algometer	Refer to association 1 above. The change in the algometer may be due to the natural history of resolution of the syndrome. The association of the algometer lends credence to point 2 in association 1 above where a mechanical joint effect is suggested.
Association 5: Change in active external right	Change in passive internal right Change in passive external right Change in current NRS	Points 1 and 2 from association 1 above could be applicable. Another effect, which should be considered, is that the femur can impart a force into the pelvis when the drop section is activated, in turn affecting the sacroiliac joint. This could account for both the joints being affected mechanically irrespective of the joint being placed over the drop section or not. Thereby with a certain degree of restoration of the joint movement, there is an increased probability that there would be associated muscle relaxation (Korr in Leach 1994:98). The change in NRS could be accounted for through increased type A (large fiber) fiber stimulation by skin contact, which is thought to activate the gate control theory decreasing pain. With this decrease in pain the degree of reactive muscle spasm in muscles of the same neurological level (L2 – S4) (Ombregt, et al,. 1995:691). This would account for agonist and antagonist muscle relaxation and increased range of movement. This mechanical overriding of the pain fibers may also have been enhanced by the psychophysical effect of touch that would also stimulate these receptors. This effect could be enhanced by any mechanical changes in the joint based on the rider noted at the beginning of this table.
Association 6: Change in passive internal right	Change in passive external right Change in NRS (-ve correlation)	Refer to association 5 above.
Association 7: Change in algometer	Change in NRS	This is expected, as the correlation is negative. The NRS is denoted as a reading between 0 and 10 where a resolution of the syndrome favours a trend towards zero. The algometer is an instrument that measures the amount of pressure per square centimeter that is imparted into soft tissue through the instrument, up to a level of 10 kg/sqcm. The patient instructs the researcher when the increasing pressure becomes painful and a reading is taken. As the syndrome resolves, the reading increases.

It would seem that when looking at the associations above, the most plausible inference would be that of the iliopsoas stretch theory. It should also be noted that any inferences made should be subject to validation by larger sample sizes.

TABLE 32: SPEARMAN'S CORRELATION BETWEEN CHANGE IN INCLINOMETER, ALGOMETER AND NRS MEASUREMENTS IN GROUP C

		change in active internal left	change in active external left	change in passive internal left	change in passive external left	change in active internal right	change in active external right	change in passive internal right	change in passive external right	change in algometer	change in current NRS
change in active internal left	Correlation Coefficient	1.000	.266	.408	-.023	.246	.030	-.446(*)	.424	-.067	.386
	Sig. (2-tailed)	.	.256	.074	.923	.295	.900	.049	.063	.779	.093
change in active external left	Correlation Coefficient	.266	1.000	.223	.325	.335	-.207	-.247	.125	.076	-.144
	Sig. (2-tailed)	.256	.	.344	.162	.149	.381	.294	.600	.751	.545
change in passive internal left	Correlation Coefficient	.408	.223	1.000	.155	.656(**)	.334	-.163	.413	.037	.387
	Sig. (2-tailed)	.074	.344	.	.514	.002	.151	.492	.070	.876	.092
change in passive external left	Correlation Coefficient	-.023	.325	.155	1.000	.507(*)	-.085	.148	.112	.193	-.352
	Sig. (2-tailed)	.923	.162	.514	.	.023	.722	.533	.637	.414	.128
change in active internal right	Correlation Coefficient	.246	.335	.656(**)	.507(*)	1.000	.391	-.023	.458(*)	.131	.205
	Sig. (2-tailed)	.295	.149	.002	.023	.	.089	.923	.042	.582	.386
change in active external right	Correlation Coefficient	.030	-.207	.334	-.085	.391	1.000	.238	.403	-.273	.354
	Sig. (2-tailed)	.900	.381	.151	.722	.089	.	.313	.078	.244	.126
change in passive internal right	Correlation Coefficient	-.446(*)	-.247	-.163	.148	-.023	.238	1.000	-.049	.087	-.390
	Sig. (2-tailed)	.049	.294	.492	.533	.923	.313	.	.837	.716	.089
change in passive external right	Correlation Coefficient	.424	.125	.413	.112	.458(*)	.403	-.049	1.000	.082	.083
	Sig. (2-tailed)	.063	.600	.070	.637	.042	.078	.837	.	.732	.729
change in algometer	Correlation Coefficient	-.067	.076	.037	.193	.131	-.273	.087	.082	1.000	-.385
	Sig. (2-tailed)	.779	.751	.876	.414	.582	.244	.716	.732	.	.093
change in current NRS	Correlation Coefficient	.386	-.144	.387	-.352	.205	.354	-.390	.083	-.385	1.000
	Sig. (2-tailed)	.093	.545	.092	.128	.386	.126	.089	.729	.093	.

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Group C had very few intra-group correlation changes. The changes that occurred could be due to the same principles applicable to group B above. The sample size of group C was also smaller than group A or B, therefore these changes could have been masked or averaged.

Table 30 shows the correlation analysis of change in quantitative outcomes within group A. In general the inclinometer measurements were positively correlated with each other, particularly those on the same sides (left or right). Some of the active and passive measurements were also positively correlated with each other. Change in algometer measurements and current NRS were not correlated with any of the inclinometer measurements. Tables 31 and 32 show the correlations between the changes in these outcomes in Groups B and C respectively. In group B there was a moderate negative correlation between change in NRS and change in algometer (rho = -0.403, p = 0.027). Group C did not show many significant correlations.

<table>
<tr><th>Reference movement</th><th>Significantly associated movement(s)</th><th>Discussion</th></tr>
<tr><td>Association 1:
Change in active internal left</td><td>Change in passive internal right</td><td rowspan="4">The association is positive therefore there is an increase in the measurements (degrees) for this association.
1. The effect of a sudden stretch on the iliopsoas muscle could also have been a factor that affected the rate of improvement and the degree of association between the internal ranges of motion (active or passive), which cannot be discounted. This could be due to iliopsoas muscle being stretched with the drop table section irrespective of the patient positioning.
2. In addition to this, with the femur being placed over the drop section, it is possible that a fulcrum effect develops and more stretch is imparted on the iliopsoas when the drop section is activated (patient moves from flexed to neutral position) than would be if the sacroiliac joints were placed over the drop section.
3. A placebo effect could account for an increase in active range of motion on the opposite side as the patient could try harder to improve the range of motion, but would still be limited on the affected side due to the fixation or inflammatory reaction still being present.
4. Natural resolution of the syndrome could also be an effect that should be taken into account.

Active range of motion could also have independently been affected in that the muscle has returned to its normal physiological state (post relaxation), allowing for the muscle to achieve maximum contraction ability.
Points 1 and 2 from above could be applicable.

Another effect, which should be considered, is that the femur can impart a force into the pelvis when the drop section is activated, in turn affecting the sacroiliac joint. This could account for both the joints being affected mechanically irrespective of the joint being placed over the drop section or not. Thereby with a certain degree of restoration of the joint movement, there is an increased probability that there would be associated muscle relaxation (Korr in Leach 1994:98).</td></tr>
<tr><td>Association 2:
change in passive internal left</td><td>Change in active internal right</td></tr>
<tr><td>Association 3:
Change in passive external left</td><td>Change in active internal right</td></tr>
<tr><td>Association 4:
Change in active internal right</td><td>Change in passive external right</td></tr>
</table>

The associations do not seem to be logically connected and seem almost random favouring a placebo or Hawthorne effect (Kirkaldy-Willis et al., 1992).

4.9) Summary and recommendations

This study found that treatment received in Group A led to significantly improved recovery according to many outcomes measured. Where no significant treatment was found, a trend towards a better recovery in Group A was demonstrated but due to small numbers with the outcome in Group A this was not statistically significant (e.g. some of the MP outcomes). Thus treatment A was significantly better than either of the placebo treatments over the time period studied. The consistency with which this was demonstrated in so many outcomes lends further evidence for treatment effect.

4.9.1) Hypothesis one:

Patients receiving the maintained contact drop piece manipulation will improve significantly in terms of subjective and objective findings when compared to the placebo group for immediate outcome improvement in the treatment of sacroiliac syndrome.

The above hypothesis is accepted based on group A having improved significantly more than group B.

4.9.2) Hypothesis two:

Patients receiving the maintained contact drop piece manipulation will improve significantly in terms of subjective and objective findings when compared to the control placebo group for immediate outcome improvement in the treatment of sacroiliac syndrome.

The above hypothesis is accepted based on group A having improved significantly more than group C.

4.9.3) Hypothesis three:

Patients receiving the placebo and control placebo intervention will show no significant improvement or difference between the two groups in terms of objective and subjective findings for the immediate outcome improvement in the treatment of sacroiliac syndrome

The above hypothesis is accepted based on there being no significant improvement of either group, therefore no one group improved more than the other.

4.9.4) Hypothesis four:

There will be no psychosocial touch effect in the treatment of sacroiliac syndrome in terms of objective and subjective findings.

The above hypothesis is accepted, as there was no significant improvement in groups B and C, therefore no psychophysical touch effects were present.

Chapter 5

5) Conclusions and recommendations

5.1) Introduction

This study comprised 80 subjects with sacroiliac syndrome, divided into two groups of thirty and one of twenty. Prior to the onset of the study, suitable study participants were established through a screening process of the prospective participants. All participants underwent a case history, physical examination, and lumbar regional examination.

Data collection took place pre and post treatment, at 1 hour and then within 24 hours.

5.2) Conclusions

It would seem that a single maintained contact drop manipulation was effective for the treatment of sacroiliac syndrome in terms of immediate and short-term effects.

Group A's objective and subjective findings improved based on the hypothesis set out at the beginning of this study.

Group B showed a lack of improvement, which was expected as based on the hypothesis as set out in the beginning of this study.

Group C showed no psychophysical effect in terms of improvement.
The outcomes measures may not have been sensitive enough to measure the psychophysical effect and the group may have been too small, thereby masking any measurable effect.

It would seem, based on this research, that a maintained contact drop piece manipulation is effective for the treatment of sacroiliac syndrome when applied in terms of the technique.

5.3) Recommendations

A larger sample size would be required to increase the validity of the study.

Further research needs to be conducted to assess how much longer the effects of a single maintained contact manipulation last, as this was an immediate and short-term effect study.

The possible mechanism of bilateral internal and external hip range of motion improvement as a result of unilateral drop piece sacroiliac manipulation warrants further investigation.

Placebo patients should be placed in same position as treatment patients to determine whether results obtained were due to the effect of the drop section on the sacroiliac joints or due to the combination of a thrust and the drop section on the sacroiliac joints.

This study was purely a clinical outcomes study; it is recommended that further research into the possible mechanisms for the increased objective measurements observed is conducted.

Patients should be asked whether they were aware of having received a sham adjustment at end of study.

Different drop techniques should be compared on a similar condition, examples should include a toggle recoil manipulation, or even different patient positioning such as supine versus prone positions.

References

Baynham, M. 1995. *Literacy practices: Investigating literacy in social contexts*. Pearson Education Inc., New York. ISBN 0582087090.

Bergmann, F.T., Peterson, D.H. and Lawrence, D.J. 1993. *Chiropractic Technique*. New York: Churchill Livingstone. ISBN 0443087520

Bernard, T. N. and Cassidy, J.D. 1991. The sacroiliac syndrome: Pathophysiology, diagnosis and management. In: Frymoyer, J. W. The adult spine: Principles and practice. Volume 2. Pp. 2107-2130. New York: Raven Press. ISBN 0881676896.

Bernard, T.N. and Kirkaldy-Willis, W.H. 1987. Recognizing specific characteristics of non-specific low-back pain. *Clinical Orthopaedics*, 217:2107-2130

Bisset, G. 2003. The effect of a sacroiliac joint manipulation on hip rotation ranges of motion in patients suffering from chronic sacroiliac syndrome. Masters degree in Technology. Chiropractic dissertation. Durban Institute of Technology, Durban, South Africa.

Bolton, J.E and Wilkinson, R. 1998. Responsiveness of pain scales: A comparison of three pain intensity measures in Chiropractic patients. *Journal of Manipulative and Physiological Therapeutics*, **21**(1): 1-7

Bronfort, G., Evans, R.L., Kubic, P. and Filkin, P. Chronic pediatric asthma and Chiropractic spinal manipulation: a prospective clinical series and randomised clinical pilot study. *Journal of Manipulative and Physiological Therapeutics*, **24**(5): 369-77

Cassidy, J.D. and Mierau, D.R. 1992. Pathophysiology of the sacroiliac joint. In: Haldeman, S. Principles and practice of chiropractic. 2nd ed. Norwalk, Connecticut: Appleton and Lange. 211-223. ISBN 0838563600

Cooperstein, R. et al. 2001. Chiropractic technique procedures for specific low back conditions: Characterising the literature. *Journal of Manipulative and Physiological Therapeutics*, **24**(6): 407-424

Cramer, G. Engelbrecht, R. Haldeman, S. Pooke, H. Pretorius, J.W. White, H. 2003. Personal communication. Casa congress Durban 2003.

Crossman, A.R., Neary, D. 2000. Neuroanatomy. Harcourt publishers limited. ISBN 0443062161

Cull, R.E. and Will, R.G. 1995. Back disorders. In: Edwards, CW and Bouchier, I.A.D. 1995. *Davidson's Priciples and Practice of Medicine.* 17th Ed, New York: Churchill Livingstone. ISBN 0443056072

Docrat, A. 1999. A comparison of the epidemiology of low-back pain in Indian and Coloured communities in South Africa. Masters degree in Technology: Chiropractic. Dissertation. Technikon Natal, Berea, Durban, South Africa.

Fischer A.A. 1987. Tissue compliance meter for objective, quantitative documentation of soft tissue consistency and pathology. *Archive of physical and medical rehabilitation,* **68**: 122-125.

French, S.D., Green, S. and Forbes, A. 2000. Reliability of Chiropractic Methods commonly used to detect manipulable lesions in patients with chronic low-back pain. *Journal of Manipulative and Physiological Therapeutic*. **23**(4): 231-238

Gardiner, S. and Mosby, J.S. 2000. *Chiropractic Secrets*. Philadelphia. Hanley and Belfus, Inc. ISBN 1560533188

Gatterman, M.I. 1990. *Chiropractic management of spine related disorders.* Williams and Wilkins. Baltimore, Maryland 21902, USA. ISBN 0683034383

Gatterman, M.I. 1995. *Foundations of Chiropractic.* Mosby-year-book Inc. 11830 Westline, Industrial drive, St Louis, Missouri 63146. ISBN 0815135432

Gatterman, M.I. et al. 2001. Rating specific chiropractic technique procedures for common low back conditions. *Journal of Manipulative and Physiological Therapeutics*, **24**(7): 449-456

Giles, L.G.F. and Singer, K.P. 1997. Sacroiliac joint. Clinical anatomy and management of low back pain. Volume 1. London: The Bath Press.

Harrison, D. E., Harrison, D. D. and Tryanovich, S.J. 1997. The sacroiliac joint: a review of anatomy and biomechanics with clinical implications. *Journal of Manipulative and Physiological Therapeutics*, **20**(9): 607-616.

Hellman, D.B., Stone J.H. 2000. Arthritis and musculoskeletal disorders. In: Tierney, M.C., McPhee, S.J. and Papadakis M.A. (eds). *Current medical diagnosis and treatment.* McGraw-Hill Companies. ISBN 007112005x.

Hendler, N., Kozikowski, J.G., Morrison, C. and Sethuraman, G. 1995. Diagnosis and management of sacroiliac joint disease. *Journal of the neuromuskuloskeletal system,* **3**(4): 169-174.

Hertling, D. and Kessler, R. 1997. Management of common musculoskeletal disorders. 3rd ed. Lippincott-Raven. ISBN 039755150

Hesch, J. 1997. Evaluation and treatment of the most common patterns of sarcoiliac joint dysfunction. In: Vleeming, A., Dorman, T., Snijders, C., Stoeckart, R. and Mooney, V. (eds.) Movement, stability and low back pain. Edinburgh: Churchill Livingstone. Pp. 535. ISBN 0443055742.

Hollinshead, W. H. 1982. The back and limbs. Anatomy for surgeons. 3rd Ed. Philadelphia: Harper and Row.

Kirkaldy-Willis, W.H., Burton, C.V. And Cassidy, J.D. 1992. The sight and nature of the lesion. In: Kirkaldy-Willis, W.H. *Managing low-back pain*. 3rd ed. New York: Churchill Livingstone. ISBN 044308789

Knutson, G.A. The role of the gamma motor system in increasing muscle tone and muscle pain syndromes: A review of the Johansson/Sojka hypothesis. *Journal of Manipulative and Physiological Therapeutics*, **23**(8): 564-572.

Kurnik, J. 2000. Hamstring Injuries Resulting from Sacroiliac Dysfunction. *Dynamic Chiropractic*. April 3, Vol. 18, issue 8

Laslett, M. and Williams, M. 1994. The reliability of selected pain provocation tests for sacroiliac joint pathology. *Spine*. **19**(11): 1243-1248

Leach R., 1994. The Chiropractic Theories : Principles and Clinical Application.3rd Ed. Williams and Wilkins, Baltimore, USA. ISBN 0-683-04904-6.

Maroon JC, Abla A, Bost J. 1999. Association between peridural scar and persistent low back pain after lumbar discectomy . *Neurol Res*, **21** (Suppl 1): S43-6.

McCulloch, J.A. and Transfeldt, E.E. 1997. *Macnab's Backache*. 3rd ed. Williams and Wilkins. ISBN 0683057979

McGregor, A.H., Doré, C.J., McCarthy, I.D. and Hughes, S.P. 1998. Are subjective clinical findings and objective clinical tests related to the motion characteristics of low back pain subjects? *JOSPT*. **28**(6): 370-377

Melzack R. From the gate to the neuromatrix. *Pain*, 1999 Aug; Suppl 6:S121-6.

Melzack R., Wall, P.D. Pain mechanisms: A new theory. 1965. *Science* **150**: 971-979.

Mior, S.A., Ro, C.S. and Lawrence, D. 1999. The sacroiliac joint. In: Cox, J.M. (ed) Low back pain: Mechanism, diagnosis and treatment. Baltimore: Williams and Wilkins. Pp209-234. ISBN 0683303589.

Mitsuhiko, F., Kazushi, T., Hiroji, T., Katsuo, N. Measurement of whole body vibration in taxi drivers. *Journal of occupational health*, 2004 (46): 119-124.

Mooney, V. 1997. Sacroiliac joint dysfunction. In: Vleeming, A., Dorman, T., Snijders, C., Stoeckart, R. and Mooney, V. (eds.) Movement, stability and low back pain. Edinburgh: Churchill Livingstone. Pp. 37-52. ISBN 0443055742.

Mouton, J. Understanding social research. 1996. Pretoria : Van Schaik,. ISBN 0627021638

Olasfdottir, E., Forshei, S., Fluge, G. and Markestad, T. 2001. Randomised clinical trial of infantile colic treated with chiropractic spinal manipulation. *Arch Dis Child.* **84**:138-141(Feb).

Oleske, D.M., Neelakantan J, Andersson, G.B., Hinrichs, B.G., Lavender, S.A., Morrissey, M.J., Zold-Kilbourn P, Taylor E. Factors affecting recovery from work-related, low back disorders in autoworkers. *Archives of Physical Medical Rehabilitation*, 2004 (85): 1362–4.

Ombregt, L., Bisschop, P., ter Veer, H.J. and Van de Velde, T. 1995. A system of orthopaedic medicine. London. W.B. Saunders Company Ltd. ISBN 0702015954.

Palmer, K.T., Griffin, M.J., Syddall, H.E., Pannett, B., Cooper, C., Coggon, D. The relative importance of whole body vibration and occupational lifting as risk factors for low back pain. *Occupational environmental medicine,* 2003 (60): 715-721.

Poul, J., West, J., Buchannan, N. and Grahame, R. 1993. Local action transcutaneous Flurbiprofen in treatment of soft tissue rheumatism. *British Journal of Rheumatology.* 32:1000-1003

Ruch, W.J. 1997. Atlas of common subluxations of the human spine and pelvis. Boca Raton, Florida: CRC Press.

Sakamoto, N., Yamashita, T., Takebayashi, T., Sekine, M., Ishii, S. 2001. An electrophysiologic study of mechanoreceptors in the sacroiliac joint and adjacent tissues. *Spine*. **26**(20):E468-71.

Schwarzer, A.C., Aprill, C.N. And Bogduk, N. 1995. The sacroiliac joint in chronic low-back pain. *Spine,* **20**(1):31-37.

Snijders, C.J., Vleeming, A. and Stockhart, R. 1993. Transfer of lumbosacral load to iliac bones and legs. Clinical biomechanics, 8:285-294.

Souza, T.A. 1997. *Differential diagnosis for the chiropractor: Protocols and algorithms.* Gaithersburg. ISBN 0834208466

Sturesson, B. 1997. Movements of the sacroiliac joint: A fresh look. In: Vleeming, A., Dorman, T., Snijders, C., Stoeckart, R. and Mooney, V. (eds.) Movement, stability and low back pain. Edinburgh: Churchill Livingstone. Pp. 171-176. ISBN 0443055742.

Toussaint, R. et al. 1999. Sacroiliac dysfunction in construction workers. *Journal of Manipulative and Physiological Therapeutics*, **22**(3): 134-138

Travell J. G., Simons D. G. 1997. Myofascial pain and dysfunction. Volume 2. Lippincott Williams and Wilkins. ISBN 0683083678

Van der Meulen, A.G. 1997. An epidemiological investigation of low-back pain in a formal Black South African Township. Masters degree in Technology: Chiropractic. Dissertation. Technikon Natal, Berea, Durban, South Africa.

Ventegodt, S., Morad, M., Merrick, J. 2004. Clinical holistic medicine: Classic art of healing or the therapeutic touch. *The scientific world journal*. (2004) 4: 134-147.

Vleeming, A., Pool-Goudzwaard, A., Stoeckart, R., van Wingarden, J. and Snijders, C. 1995. The posterior layer of the thoracolumbar fascia. Spine, 20:753-758

Weze, C., Leathard, H.L., Grange, J., Tiplady, P., Stevens, G. 2005. Evaluation of healing by touch. *Journal of the royal institute of health*. 119: 3-10

Worku Z. 2000. Prevalence of low-back pain in Lesotho mothers. *Journal of Manipulative and Physiological Therapeutics*, **23**(3): 147-154

Appendix A:

Case History

DURBAN INSTITUTE OF TECHNOLOGY
CHIROPRACTIC DAY CLINIC
CASE HISTORY

Patient: ____________________ Date: ________

File # : __________ Age: ________

Sex : ________ Occupation: ____________________

Intern : ____________________ ____________________

Signature

FOR CLINICIANS USE ONLY:
Initial visit
Clinician: Signature :

Case History:

Examination:
Previous: Current:

X-Ray Studies:
Previous: Current:

Clinical Path. lab:
Previous: Current:

CASE STATUS:

PTT:	Signature:	Date:

CONDITIONAL: Reason for Conditional:	
Signature:	Date:

Conditions met in Visit No:	Signed into PTT:	Date:
Case Summary signed off:		Date:

Intern's Case History:

1. Source of History:

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

3. Present Illness:

	Complaint 1	**Complaint 2**
▸ Location ▸ Onset : Initial: Recent: 1. Cause: ▸ Duration ▸ Frequency ▸ Pain (Character) ▸ Progression ▸ Aggravating Factors ▸ Relieving Factors ▸ Associated S & S ▸ Previous Occurrences ▸ Past Treatment ➢ **Outcome:**		

4. Other Complaints:

5. Past Medical History:

- General Health Status
- Childhood Illnesses
- Adult Illnesses
- Psychiatric Illnesses
- Accidents/Injuries
- Surgery
- Hospitalizations

6. Current health status and life-style:

- Allergies
- Immunizations
- Screening Tests incl. xrays
- Environmental Hazards (Home, School, Work)
- Exercise and Leisure
- Sleep Patterns
- Diet
- Current Medication
  Analgesics/week:
- Tobacco
- Alcohol
- Social Drugs

7. Immediate Family Medical History:

- Age
- Health
- Cause of Death
- DM
- Heart Disease
- TB
- Stroke
- Kidney Disease
- CA
- Arthritis
- Anaemia
- Headaches
- Thyroid Disease
- Epilepsy
- Mental Illness
- Alcoholism
- Drug Addiction
- Other

8. Psychosocial history:

- Home Situation and daily life
- Important experiences
- Religious Beliefs

9. Review of Systems:

- General
- Skin
- Head
- Eyes
- Ears
- Nose/Sinuses
- Mouth/Throat
- Neck
- Breasts
- Respiratory
- Cardiac
- Gastro-intestinal
- Urinary
- Genital
- Vascular
- Musculoskeletal
- Neurologic
- Haematologic
- Endocrine
- Psychiatric

Durban Institute of Technology

PHYSICAL EXAMINATION: SENIOR

Appendix B:

Physical

Patient Name : ______	**File no :**	**Date :** ______	
Student :	**Signature :**		

VITALS:					
Pulse rate:			Respiratory rate:		
Blood pressure:	R	L	Medication if hypertensive:		
Temperature :			Height:		
Weight:	Any recent change? Y / N		If Yes: How much gain/loss	Over what period	

GENERAL EXAMINATION:		
General Impression		
Skin		
Jaundice		
Pallor		
Clubbing		
Cyanosis (Central/Peripheral)		
Oedema		
Lymph nodes	Head and neck	
	Axillary	
	Epitrochlear	
	Inguinal	
Pulses		
Urinalysis		

SYSTEM SPECIFIC EXAMINATION:
CARDIOVASCULAR EXAMINATION
RESPIRATORY EXAMINATION
ABDOMINAL EXAMINATION
NEUROLOGICAL EXAMINATION
COMMENTS

Clinician:	**Signature :**

Appendix C:

Lumbar Regional

REGIONAL EXAMINATION - LUMBAR SPINE AND PELVIS

Patient:______________________________ File#:______ Date: _________

Intern\Resident:__________________________ Clinician:__________________

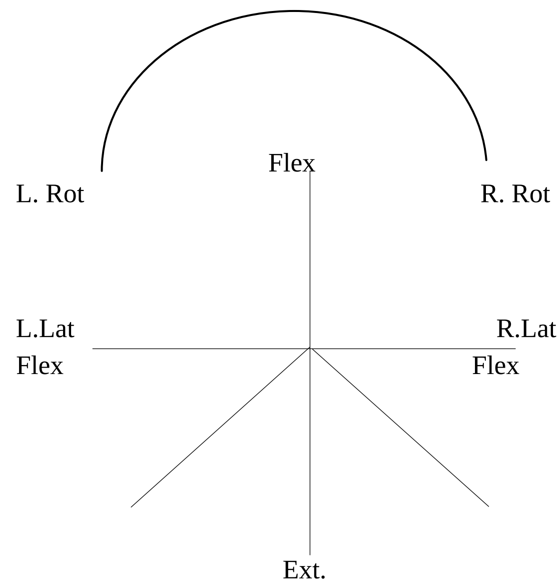
STANDING:

Posture– scoliosis, antalgia, kyphosis
Body Type
Skin
Scars
Discolouration

Minor's Sign
Muscle tone
Spinous Percussion
Scober's Test (6cm)
Bony and Soft Tissue Contours

GAIT:

Normal walking
Toe walking
Heel Walking
Half squat



ROM:

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

Which movt. reproduces the pain or is the worst?

- Location of pain
- Supported Adams: Relief? (SI)
  Aggravates? (disc, muscle strain)

SUPINE:

Observe abdomen (hair, skin, nails)
Palpate abdomen\groin
Pulses - abdominal
- lower extremity

Abdominal reflexes

		Degree	LBP?	Location	Leg pain	Buttock	Thigh	Calf	Heel	Foot	Braggard
SLR	L										
	R										

	L	R
Bowstring		
Sciatic notch		
Circumference (thigh and calf)		
Leg length: actual -		
apparent -		
Patrick FABERE: pos\neg – location of pain?		
Gaenslen's Test		
Gluteus max stretch		
Piriformis test (hypertonicity?)		
Thomas test: hip \ psoas? \ rectus femoris?		
Psoas Test		

SITTING:

Spinous Percussion
Valsalva
Lhermitte

		Degree	LBP?	Location	Leg pain	Buttock	Thigh	Calf	Heel	Foot	Braggard
TRIPOD Sl, +, ++	L										
	R										

Slump 7 test	L										
	R										

LATERAL RECUMBENT:

	L	R
Ober's		
Femoral n. stretch		
SI Compression		

PRONE:

	L	R
Gluteal skyline		
Skin rolling		
Iliac crest compression		
Facet joint challenge		
SI tenderness		
SI compression		
Erichson's		
Pheasant's		

MF tp's	Latent	Active	Radiation
QL			
Paraspinal			
Glut Max			
Glut Med			
Glut Min			
Piriformis			
Hamstring			
TFL			
Iliopsoas			
Rectus Abdominis			
Ext/Int Oblique muscles			

NON ORGANIC SIGNS:

Pin point pain
Axial compression
Trunk rotation
Burn's Bench test
Flip Test
Hoover's test
Ankle dorsiflexion test
Repeat Pin point test

NEUROLOGICAL EXAMINATION

Fasciculations

Plantar reflex

level	Tender?	Dermatomes		DTR		
		L	R		L	R
T12				Patellar		
L1				Achilles		
L2						
L3				Proproception		
L4						
L5						
S1						
S2						
S3						

MYOTOMES					
Action	**Muscles**	**Levels**	**L**	**R**	
Lateral Flexion spine	Muscle QL	T12-L4			
Hip flexion	Psoas, Rectus femoris	L1,2,3,4			5+ Full strength
Hip extension	Hamstring, glutes	L4,5;S1.2			4+ Weakness
Hip internal rotat	Glutmed, min;TFL, adductors				3+ Weak against grav
Hip external rotat	Gluteus max, Piriformis				2+ Weak w\o gravity
Hip abduction	TFL, Glut med and minimus				1+ Fascic w\o gross movt
Hip adduction	Adductors				0 No movement
Knee flexion	Hamstring,	L4,5:S1			
Knee extension	Quad	L2,3,4			W - wasting
Ankle plantarflex	Gastroc, soleus	S1,2			
Ankle dorsiflexion	Tibialis anterior	L4,5			
Inversion	Tibialis anterior	S1			
Eversion	Peroneus longus	L4			
Great toe extens	EHL	L5			

BASIC THORACIC EXAM

History
Passive ROM
Orthopedic

BASIC HIP EXAM

History
ROM: Active
Passive : Medial rotation :

A) Supine (neutral) If reduced - hard \ soft end feel
B) Supine (hip flexed): - Trochanteric bursa

Appendix D:

SOAPE Note

Appendix E:

Advertisement

Do you suffer from **LOW BACK PAIN?**

Are you between 20 and 55 years of age

If you do, you may qualify for

FREE **Chiropractic treatment at the**

DIT chiropractic day clinic.

For further information
Contact: Quentin

Tel: 031 204 2205

Appendix F:

Informed consent form

INFORMED CONSENT FORM

(To be completed by patient / subject)

Date : **2004**

Title of research project : The efficacy of a maintained contact drop piece adjustment technique in the treatment of sacroiliac syndrome

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Name of supervisor : **Dr C. Korporaal**
Tel : **031-2042205**

Name of research student : **Quentin Botha**
Tel : **031-2042205**

Please circle the appropriate answer (YES /NO)

1.	Have you read the research information sheet?	Yes	No
2.	Have you had an opportunity to ask questions regarding this study?	Yes	No
3.	Have you received satisfactory answers to your questions?	Yes	No
4.	Have you had an opportunity to discuss this study?	Yes	No
5.	Have you received enough information about this study?	Yes	No
6.	Do you understand the implications of your involvement in this study?	Yes	No
7.	Do you understand that you are free to withdraw from this study? at any time without having to give any a reason for withdrawing, and without affecting your future health care.	Yes	No
8.	Do you agree to voluntarily participate in this study	Yes	No

9. Who have you spoken to?___________________________________

Please ensure that the researcher completes each section with you
If you have answered NO to any of the above, please obtain the necessary information before signing

Please Print in block letters:

Patient /Subject Name:_______________________________Signature: _____________

Parent/ Guardian:____________________________________Signature:_____________

Witness Name:______________________________________Signature:_____________

Research Student Name:______________________________Signature:_____________

Appendix G:

Patient information letter

LETTER OF INFORMATION

Dear Patient

Welcome to this study!

Title of the study:
The efficacy of a maintained contact drop piece adjustment technique in the treatment of sacroiliac syndrome.

Supervisors: Dr C. Korporaal (031-2042205)

Research student: Quentin Botha (031-2042205)
Institution: Durban Institute of Technology (DIT)

Purpose of the study:
Patients will receive a drop piece adjustment to their symptomatic SI joints, In this respect 3 variations in the application of the treatment will be utilised to assess the clinical improvement and effects of the adjustments with regards to pain and disability (which are as a result of SI syndrome).

Procedures:
Initial visit:
The first consultation will take place at the DIT Chiropractic Day Clinic. Here patients will be screened for suitability for this study, which will be determined by a case history, physical examination and a lumbar spine regional examination. Suitable patients will then receive a drop piece adjustment and subjective and objective data will be gathered immediately and 1 hour after the adjustment.

The second visit:
This consultation will also take place at the DIT Chiropractic Day Clinic. Further subjective and objective data will be gathered.

Risks/discomfort:
The testing is relatively painless, however some muscle stiffness after testing may be experienced.

Benefits:

- The manipulative treatment that will be given is a common treatment intervention in the treatment of sacroiliac syndrome.
- All treatments will be free of charge.
- On completion of your participation in this study you are eligible for two free treatments at the Durban Institute of Technology Chiropractic Day Clinic.

New findings:
You have the right to be made aware of any new findings that are made pertaining to this study.

Reasons why you can be withdrawn from the study without your consent:

- If you change any lifestyle habits during your participation in this study that may affect the outcome of this research. (e.g. Change in medication, supplementation or treatment of any kind)

PLEASE NOTE: You are free to withdraw from the study at any time without giving a reason.

Remuneration:
You will not receive a travel allowance to get to the DIT Chiropractic Day Clinic.

Cost of the study:
All treatments will be free of charge and your participation is voluntary.

Confidentiality:
All patient information is confidential and the results will be used for research purposes only. Supervisors and senior clinic staff may however be required to inspect the records.

Persons to contact with problems or questions:
Should you have any further queries and you would like them answered by an independent source, you can contact my supervisors on the numbers above.

Thank you for your participation.

____

Quentin Botha
(Chiropractic Intern)

____

Dr. C. Korporaal
(Supervisor)

Appendix H:

NRS

Numerical Rating Scale - 101 Questionnaire

Date:____________ File no:____________ Visit no:________

Patient name: ____

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

Please write only **one** number.

0_____10_____20_____30_____40_____50_____60_____70_____80_____90_____100

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

Please write only **one** number.

0_____10_____20_____30_____40_____50_____60_____70_____80_____90_____100

Appendix I:

Data Collection

Patient name: ____ File number:________________

Group: A B C

	Pain – Nrs	Pain - Algometer			Motion Palpation listing	
		1	2	Ave	Right	Left
Pre - Visit (1) Reading 1 Date						
Post Visit (1) Reading 2 Date						
Post Visit (1) Reading 3 Date						
Day Later Visit (1) Reading 4 Date						

	Pre visit (R1)		Post visit (R2)		Post visit (R2)		Day later visit (R4)	
	Yes to pain	No to pain	Yes to pain	No to pain	Yes to pain	No to pain	Yes to pain	No to pain
P Faber								
Gaenslens								
Yeoman's								
Posterior Shear								

Notes:	**Inclinometer**							
	Left				Right			
	Active		Passive		Active		Passive	
	Int rot	Ext rot	Int rot	Ext rot	Int rot	Ext rot	Int rot	Ext rot
Pre - Visit (1) Reading 1 Date								
Post Visit (1) Reading 2 Date								
Post Visit (1) Reading 3 Date								
Day Later Visit (1) Reading 4 Date								

Descriptive stats will be done and represented in the dissertation in graph, plot charts, pie charts and bar graphs in addition to the discussion that will be presented. Inferential statistics will be completed by the use of parametric tests (20 or more per group) and the appropriate paired and unpaired t-tests will be applied. These statistics will be performed at a significance level of $p = 0.05$ and / or confidence interval of 95 % as appropriate.

Demographic details

Age: ___________

Occupation ___________

Smoker / Non-smoker YES NO

Weight ___________

Race W B IN C A other

Sport / leisure ___________

Period of time that the
patient has had low back pain __________

Was the adjustment comfortable? ☐ Yes ☐ No

If No, describe
the discomfort: