The efficacy of a toggle recoil drop piece adjustment technique in the treatment of sacroiliac dysfunction.

By

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I, Ronél Cornelia Jacobs, do declare that this dissertation is representative of my own work in both conception and execution.

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DEDICATION

I dedicate this to my exceptional parents for their unconditional love, their support and for them believing in me.

AKNOWLEDGEMENTS

To my family, thank you for your never ending support and love.

To Kobus for ALWAYS believing in me even when I didn't. For encouraging me all the way through my five years of studying, for always being there for me, supporting me.

To Charmaine for her help as supervisor, her motivation when I wanted to give up and all the hours, whether it was late at night or before eight in the morning, which she has put in to help me through this.

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To all my friends, for being there for me, for both the good and the tough times.

To all the patients who participated in the study, without whose assistance this study would not have been possible.

ABSTRACT

One of the most common clinical disorders known is mechanical low back pain (Painting et al. 1998:110). A significant source of low back pain is the sacroiliac joint and therefore, according to Schwarzer et al. (1995:31), it warrants further study.

With respect to treatment, Gatterman (1995) states that specific manipulative therapy is the treatment of choice for sacroiliac dysfunction. This is supported by clinical studies (Cassidy et al., 1992), which have shown significant improvement with daily manipulation over a 2-3 week period in 90% of the patients suffering from sacroiliac dysfunction.

Different adjusting techniques for the sacroiliac joint include side posture adjustment and prone drop piece adjustments (Bergmann, 1993). With respect to side posture, Bergmann (1993) further states that the side posture adjustment is the most common position used. However, it has been noted that side posture can produce unwanted rotation in the lumbar spine. This may be detrimental to patients who have contra-indications to torsioning such as abdominal aortic aneurisms, nerve root entrapment or disc pathology. Patients, who experience anterior catching of the hip capsule or decreased flexibility with side posture adjustments, experience more discomfort and could therefore benefit from a different technique (Gatterman, 1995). Hence the need for an effective adjustment technique that does not rely on torsioning (e.g. drop piece technique).
(White, 2003; Pooke, 2003; Hyde, 2003; Pretorius, 2003; Haldeman, 2003; Cramer, 2003; Engelbrecht, 2003).

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

Therefore this study was aimed at determining the efficacy of a toggle recoil drop piece adjustment technique.

The study included a total of eighty subjects, divided into two groups of thirty and one group 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 who met the inclusion and exclusion criteria was asked to select a piece of paper from an envelope, on which the letters "A", "B" or "C" was printed. Group A included those who received treatment, group B included those who received placebo and group C included those in the control group.

Treatment included a toggle recoil drop piece adjustment to the symptomatic sacroiliac joint. The placebo group received a sham drop piece adjustment with patient contact and the control group received a sham drop piece adjustment 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 showed an improvement in group A and no improvement in groups B and C in terms of subjective and objective data - with regards to a single toggle recoil drop piece adjustment to the symptomatic sacroiliac joint.

Therefore, the results implied that a single toggle recoil drop piece adjustment is effective for the treatment of sacroiliac dysfunction in terms of objective and subjective findings for immediate and short-term measures.

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DEFINITIONS

Grade 5 adjustments are defined as adjustments 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).

Bergmann (1993) states that an ***adjustment*** is a specific form of articular manipulation that is characterised by a dynamic thrust of controlled velocity, amplitude, and direction.

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)

A high velocity low amplitude (HVLA) adjustment 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)

From the above definitions it can be implied that drop table adjustments are grade 5 adjustments as they are described as high velocity low amplitude (HVLA) adjustments. Gatterman et al., (2001).

Sacroiliac dysfunction has been described by several authors as pain over one or both sacroiliac joints as a result of joint dysfunction or sustained muscle contraction, which may be referred to the groin, trochanter and buttock. 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).

CHAPTER 1

INTRODUCTION

1.1. The problem and its setting

In a review of the literature on low back pain, sacroiliac dysfunction was noted as the primary source of the pain in 22.5% of patients (Bernard and Kirkaldy-Willis, 1987:2107-2130). This concurs with the prevalence of sacroiliac dysfunction between 19.3% and 47.9% as noted by Toussaint et al., (1999).

In the South African context, incidences of low back pain found in Lesotho mothers were found to be 58.84% (Worku, 2000:147-154). Docrat (1999) found that the occurrence of low back pain in South Africa was calculated at 78.2% in the Indian community and 76.6% in the Coloured community. Van der Meulen (1997) found that the prevalence of low back pain in the South African black community of Chesterville was 53.1%.

With the incidence and prevalence of low back pain being so high in the South African community, it could be assumed that a high percentage could be due to sacroiliac dysfunction - based on results found by Bernard and Kirkaldy-Willis (1987:2107-2130) and Toussaint et al., (1999).

Cull and Will (1995) found that treatment for low back pain by a chiropractor was more effective than other manual therapies. One of the techniques utilised by chiropractors is the drop table thrusting technique, which is widely used in private practice. These techniques are thought to be effective treatments for patients suffering from problems associated with nerve, joint and muscle pathologies. None of these studies, however, was based on a toggle recoil drop table thrusting technique (Haldeman et al., 1993) as cited by Gatterman et al., (2001).

As there are no clinical studies on drop piece adjusting techniques, especially with respect to the toggle recoil drop table adjustment techniques on sacroiliac dysfunction, this research is aimed at determining the efficacy of such a technique with respect to the immediate outcomes (in terms of objective and subjective findings).

1.2. Objectives of the study

Objective one: To evaluate the efficacy of a toggle recoil drop piece adjustment technique versus placebo intervention in the treatment of sacroiliac dysfunction in terms of objective clinical findings.

- Hypothesis one: Patients receiving the toggle recoil drop piece adjustment will improve significantly in terms of objective clinical findings, when compared to the placebo group.

Objective two: To evaluate the efficacy of a toggle recoil drop piece adjustment technique versus placebo intervention in the treatment of sacroiliac dysfunction in terms of objective clinical findings.

- Hypothesis two: Patients receiving the toggle recoil drop piece adjustment will improve significantly in terms of subjective clinical findings, when compared to the placebo group.

Objective three: To evaluate the efficacy of a toggle recoil drop piece adjustment technique versus placebo intervention for immediate outcome improvement in the treatment of sacroiliac dysfunction in terms of objective and subjective findings.

- Hypothesis three: Patients receiving the toggle recoil drop piece adjustment 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 dysfunction.

Objective four: To evaluate the efficacy of a toggle recoil drop piece adjustment technique versus a control placebo intervention in the treatment of sacroiliac dysfunction in terms of objective clinical findings.

- Hypothesis four: Patients receiving the toggle recoil drop piece adjustment will improve significantly in terms of objective clinical findings, when compared to the control placebo group.

Objective five: To evaluate the efficacy of a toggle recoil drop piece adjustment technique versus control placebo intervention in the treatment of sacroiliac dysfunction in terms of subjective clinical findings.

- Hypothesis five: Patients receiving the toggle recoil drop piece adjustment will improve significantly in terms of subjective clinical findings, when compared to the control placebo group.

Objective six: To evaluate the efficacy of a toggle recoil drop piece adjustment technique versus control placebo intervention for immediate outcome improvement in the treatment of sacroiliac dysfunction in terms of objective and subjective findings.

- Hypothesis six: Patients receiving the toggle recoil drop piece adjustment 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 dysfunction.

Objective seven: To compare a placebo intervention and a control placebo intervention in the treatment of sacroiliac dysfunction in terms of objective clinical findings.

- Hypothesis seven: Patients receiving the placebo and control placebo intervention will show no significant improvement or difference between the two groups in terms of objective clinical findings.

Objective eight: To compare a placebo intervention and a control placebo intervention in the treatment of sacroiliac dysfunction in terms of subjective clinical findings.

- Hypothesis eight: Patients receiving the placebo and control placebo intervention will show no significant improvement or difference between the two groups in terms of subjective clinical findings.

Objective nine: To compare a placebo intervention and a control placebo intervention for immediate outcome improvement in the treatment of sacroiliac dysfunction in terms of objective and subjective findings.

- Hypothesis nine: 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 dysfunction.

Objective ten: To evaluate whether there is a psychophysical touch effect in the treatment of sacroiliac dysfunction in terms of objective and subjective findings.

- Hypothesis ten: There will be no psychophysical touch effect in the treatment of sacroiliac dysfunction in terms of objective and subjective findings.

1.3. The Rationale

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

This research aimed to evaluate the efficacy of a toggle recoil drop piece adjustment technique in the treatment of sacroiliac dysfunction in terms of objective and subjective findings.

Cooperstein <u>et al.</u> (2001) stated that it is still unknown which specific chiropractic treatment methods are the most appropriate for specific clinical conditions. Further stated is the importance that outcomes for the treatment of specific conditions need to be researched.

Gatterman (1995) stated that lower force/velocity techniques should be used before high velocity thrusts; therefore drop piece techniques should be employed before side-posture techniques. This may be beneficial to patients who have contra-indications to torsioning such as abdominal aortic aneurisms. Patients who could also benefit from this technique are those experiencing discomfort due to anterior catching of the hip capsule or decreased flexibility with side posture adjustments. Hence the need for the most effective drop piece technique (White, 2003; Pooke, 2003; Hyde, 2003; Pretorius, 2003; Haldeman, 2003; Cramer, 2003; Engelbrecht, 2003).

To ensure that the practitioner can provide optimal care for each patient and their unique clinical setting, it is necessary to investigate other treatment options.

CHAPTER 2

LITERATURE REVIEW

2.1. The Incidence and Prevalence of Low Back Pain.

In the South African context, the incidence of low back pain found in Lesotho mothers was found to be 58.84% (Worku, 2000:147-154). Docrat (1999) found that the incidence of low back pain in South Africa was calculated at 78.2% in the Indian community and 76.6% in the Coloured community. Van der Meulen (1997) found that the prevalence of low back pain in the South African black community of Chesterville was 53.1%.

In comparison to this, it has been found that low back pain affects 75% to 85% of the global population (Hoiriis et al., 2004). Daum (1995) found that as many as 40% of patients, who presented with low back complaints, included sacroiliac dysfunction. This is in contrast to Bernard and Kirkaldy-Willis (1987:2107-2130) who found that low back pain was characterised in 22.5% of 1293 patients as sacroiliac joint dysfunction, which they noted as the primary source of the pain. This concurs with the prevalence of sacroiliac dysfunction between 19.3% and 47.9%, as noted by Toussaint et al., (1999). Thus, the conclusions presented by Schwarzer, April and Bogduk (1995:31-37) with respect to the sacroiliac joint being a significant source of pain in patients with low back pain, seems to have been validated.

With the incidence and prevalence of low back pain being so high in the South African community, it can be assumed that a high percentage could be due to sacroiliac dysfunction - based on results found by Bernard and Kirkaldy-Willis (1987:2107-2130) and Toussaint et al., (1999).

To fully appreciate the mechanism related to sacroiliac dysfunction, we will first discuss the anatomy of the joint and the surrounding structures in order to contextualise the discussions of the dysfunction and its affect.

2.2. Anatomy of the sacroiliac joint

The sacroiliac joint is described as a true synovial joint as it fulfils the following criteria stated in Moore and Dalley (1999:340).

- It has a joint cavity.
- It has articular cartilage
- It has an articular capsule, which is lined with a synovial membrane (the synovial membrane produces synovial fluid that lubricates the joint)
- The articular capsule is strengthened by ligaments

Moore and Dalley (1999:340) state that with respect to the joint itself, the anatomy includes:

- The sacroiliac articulations are between the articular surfaces of the sacrum and the ilium.
- The articular surfaces have irregular elevations and depressions, which result in the partial interlocking of the bones and limited movement (Sturesson, 1997:174; Harrison et al., 1997:615 and Walker, 1992:911-913). This arrangement decreases the strain on the supporting ligaments of the joint. However, in contrast to that, it increases the load in the joint and therefore promotes early degeneration.
- With respect to the early degeneration, it is thought that this is related to the type of cartilage found in the sacroiliac joint (hyaline cartilage on the sacral side of the joint and fibrocartilage.on the iliac side (Sherman, 2004)**.** This degeneration is thought to be as a result of the lining of the joint being damaged to irregular loading. With repeated inflammation, damage adhesions and restrictions are formed, increasing the likelihood of further degeneration.
- The strong articular capsule is attached close to the articulating surfaces of the sacrum and ilium, but stronger anteriorly than posteriorly, resulting in increased stress on the surrounding ligaments, which act as a supporting strut.

- These ligaments not only support the capsule (e.g. the posterior and interosseous sacroiliac ligaments) but also assist in suspending the sacrum between the iliac bones, thereby stabilising the lower lumbar spine in order to take the weight of the body.

2.2.1. Ligamentous Anatomy

In order to refine the understanding of the functions of the ligaments, more attention will be given to the different ligaments and their structure.
Moore (1992:251), Harrison, Harrison and Troyanovich (1997:609) and Moore and Dalley (1999:340 and 550), discuss and concur with regards to the following:

1. The ***anterior sacroiliac ligament*** is an anterior inferior thickening of the joint capsule, where it covers the abdominopelvic surface of this articulation. As the anterior sacroiliac ligament is only a thickening of the anterior capsule, it weakly opposes translation of the sacrum up or down and separation of the joint surfaces. This ligament therefore also resists forward movement of the sacral promontory.
2. In contrast to this, the ***interosseous sacroiliac ligaments*** are massive, very strong ligaments that unite the iliac and sacral tuberosities. They fill the irregular spaces posterior and superior to the joint as well as being the largest syndesmosis in the body and the strongest connection in this region. These ligaments strongly resist joint separation and translations along the y- and z-axes (vertical and anteroposterior movements). However, should these ligaments be injured, they stand to cause the greatest degree of restriction resulting in degeneration.
3. The ***posterior sacroiliac ligaments*** that cover the interosseous ligaments together make up the posterior two thirds of the S.I. support.
   In this respect, the posterior sacroiliac ligaments are composed of:
   a) Strong, short transverse fibres joining the ilium and the first and second tubercles of the lateral crest of the sacrum

b) Long, vertical fibres uniting the third and fourth transverse tubercles of the sacrum to the posterior iliac spines.

The above mentioned ligaments, which act as principle stabilizers, are assisted in their function by the following accessory ligaments: the sacrotuberous, iliolumbar, sacrospinous and pubis symphysis ligaments.

1. The ***sacrotuberous ligament*** fibres pass from the anterolateral border of the sacrum and run inferolaterally to attach to the ischial tuberosity. It functions as opposition to sacral rotation around the x-axis (flexion).

2. The ***iliolumbar ligament*** is a strong triangular ligament that runs from the transverse processes of L4 and L5 to the iliac crest posteriorly. It is important because it limits rotation and anterior gliding of L5 vertebra on the sacrum. It functions as a limitation of all motions between the distal lumbar spine and sacrum.

3. The ***sacrospinous ligament*** is a thin triangular ligament that extends from the lateral margin of the sacrum and coccyx to the ischial spine. It also functions as a counteract rotation around the x and y-axes.

4. The pubic symphysis is composed of three ligaments: the ***superior pubic, arcuate pubic and interpubic ligaments***. It resists shear stresses, y-axis rotation of the sacrum and joint separations.

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

Besides their stabilizing functions, the ligaments are also responsible for assisting with proprioceptive feedback about the joint to the central nervous system with respect to balance, coordination and integrated movement. In order to achieve these functions, the ligaments contain specialized nerve endings, (especially the complex Ruffini-type endings) which are a subdivision of the Type A beta afferents, and are sensitive to intra-articular pressure changes as well as stretch (Leach, 1994).

Therefore, when any pathology that disrupts the function of these nerve endings is present (e.g. sacroiliac dysfunction), there will be a concomitant set of signs and symptoms which reflects changes in balance, coordination (asymmetrical movement) and integrated movement (restriction).

2.2.2. Muscles of the Sacroiliac joint

Although it has been noted that no single muscle or muscle group crosses the sacroiliac joint (Harrison et al., 1997:610), there are various adjacent muscles that have fibrous expansions that blend with the sacroiliac joint ligaments and thereby induce movements within the joint. These muscles include the Gluteus Maximus, Gluteus Minimus, Piriformis, Iliacus, Quadratus Lumborum and Erector Spinae (Walker, 1992:904).

In addition the muscles, through their attachment to the ligaments, create a self-bracing mechanism. This mechanism is not only necessary for stability of the sacroiliac joint but also because the resting, as well as active contraction of the muscles, causes compression and movement of the joint, which is imperative in aiding the nutrition of the joint surfaces.

However, Walker (1992:304) has concluded that the muscle activity is likely to increase any symptoms arising from sacroiliac joint pathology due to these functions, as both the compressive as well as the shear forces that are imparted into the joint irritate the inflamed joint surfaces and increase the pain and discomfort experienced by the subject.

This increased pain and discomfort induced by the muscles arise, not only from the inflammatory irritation that is worsened, but also from the muscle itself. In this respect, when looking more closely at the constitution of the muscle, it is found that the muscle contains specific pain receptors as well as receptors responsible for proprioception and those responsive to excessive loading of the muscle in order to protect it from injury. These receptors include muscle spindle receptors (responsive to changes between intra and extrafusal muscle fibers – movement and proprioception), Golgi tendon organs (responsive to tension), pressure receptors (pain) and unmyelinated pain receptors (Leach 1994).

These receptors are important when considering pathologies (e.g. sacroiliac dysfunction) of the sacroiliac joint, as these are thought to be partly responsible for the presence of pain, as well as the perpetuation of the signs and symptoms of the pathology.

An example in this respect would be that proposed by Korr (1975), in which the muscle origin and insertion are suddenly approximated, causing a decrease in firing of the annulospiral and flowerspray endings. This results in the CNS resetting the “gamma gain” allowing for increased action potential flow to the CNS, restoring the feedback loop. This, however, has a localised affect of preventing elongation of the extrafusal muscle fibers, as any elongation results in reactive spasm. This reactive spasm has been implicated in the development of motion restriction within the joints affected by the muscle in which the reset “gamma gain” is present (Korr in Leach, 1994).

This theory could be applicable to the development of the sacroiliac dysfunction, especially when one considers that sacroiliac dysfunction often develops in the presence of uneven joint loading or as a result of a sudden application of an uneven force through the joint. This uneven loading could conceivably be seen as that force which approximates the origin and insertion of one or more of the muscles around the sacroiliac joint - thereby causing a restriction in its motion and the development of the dysfunction.

Furthermore, the receptors within the surrounding muscles and the ligaments become accustomed to the greater levels of facilitation at the spinal cord level associated with the dysfunction, thereby allowing for any small stimulation to set off the pathological pain cycle at a spinal cord level (Patterson and Steinmetz, 1982). Stimulated perpetuation is thought to lead to the development of the “neurological scar”. This is thought, on a clinical level, to be responsible for the recurrence of the dysfunction if not appropriately treated or if the initiating stimulus at some further point is of the same origin. (Patterson and Steinmetz, 1982).

2.2.3. Innervation of the sacroiliac joint

In addition to the receptors found within the muscles, which have been implicated in the development of sacroiliac dysfunction, the receptors within the ligaments and capsule play an equally important role.
However in order to understand this role, it is important to contextualise the neurology from a global to a micro scale.

The articular branches to the sacroiliac joints are derived from the superior gluteal nerves and the sacral plexus: the dorsal rami of S1 and S2 nerves (Moore 1992:252). In this respect Daum (1995:476) states that the sacroiliac joint has extensive afferent sensation which forms part of the innervation.

According to Hilton’s law, a joint is innervated by any nerve that crosses it. Therefore, the sacroiliac joint may be innervated from L2 to L3 or L4 (Bernard and Cassidy 1991:2111).

The ligaments and muscles around the sacroiliac joint are richly innervated (Willard 1995) and any abnormalities in these structures would produce pain in the area.

2.2.4. Biomechanics and function of the Sacroiliac joint

The primary function of the sacroiliac joints is to act as links in the kinetic chain between the spine and the legs. Therefore, it is of fundamental importance that it has mobility, stability and the ability to withstand forces acting on it (Mior, Ro and Lawrence 1999:221).

According to Norkin and Levangie (1992:156) movements of nutation and counternutation occur at the sacroiliac joints. During nutation, the sacrum rotates so that the promontory moves anteriorly and inferiorly, while the coccyx and apex move posteriorly. Thus the antero-posterior diameter is reduced and the pelvic outlet increased. Also, the iliac bones approximate and the ischial tuberosities separate.

Counternutation involves movement in the opposite direction. The promontory moves posteriorly and superiorly, and the apex moves anteriorly. The antero-posterior diameter of the pelvic brim is increased and the pelvic outlet is decreased. The pelvic bones move apart and the ischial tuberosities approximate.

When this function becomes deranged, Gatterman (1995:454) describes the accompanying restricted motion as a sacroiliac subluxation (restriction), which is a simple joint locking with resultant hypermobility in adjacent joints. This compensation allows for overall movement to remain the same within the low back, even though there is a loss of movement in the sacroiliac joint. This is supported by Dreyfuss et al. (1994:1138) who states that sacroiliac dysfunction can also be defined as a state of relative hypomobility within a portion of the joint’s range of motion with subsequent altered structural (positional) relationships between the sacrum and the ilium.

In addition to the locked joint, there may be simultaneous pathological changes in the surrounding nerves (pain and pain referral), ligaments (tautness as the muscles pull on them), muscles (hypertonicity) and connective tissue (swelling) (Gatterman, 1995:454).

Sacroiliac syndrome (Gatterman, 1995:454) is sometimes referred to as sacroiliac dysfunction, which Hendler et al. (1995:171) describes as a subluxation, which occurs when the ilium "slips" on the sacrum. According to Hendler et al., an irregular prominence of one articular surface becomes wedged upon the prominence of an opposed articular surface. The ligaments also become taut, there is severe muscle spasm and the pain is intense and continuous.

According to Vleeming et al. (1990), the subluxation is most often caused by abnormal loading of the sacroiliac joint. This abnormal loading creates an unbalanced force that forces the sacroiliac joint into a position where the complimentary ridges and depressions do not match. This abnormal loading of the sacroiliac joint can be caused by different activities, some as simple as twisting when getting out of bed or stepping off of a curb. Other causes include lifting injuries or falling on the buttocks (Gatterman, 1990).

Following on from the development of sacroiliac dysfunction, Hertling (1997:707) stated sacroiliac dysfunction presents with the following symptoms:

- unilateral sacroiliac joint pain, local to the joint itself, but possibly referring down the posterolateral aspect of the ipsilateral leg;
- a short period of stiffness - especially in the mornings that eases with movement and weight bearing;
- pain aggravated with prolonged sitting or standing;
- pain aggravated by walking, climbing stairs

In summary, sacroiliac dysfunction has been described by several authors as pain over one or both sacroiliac joints as a result of joint dysfunction or sustained muscle contraction, which may be referred to the groin, trochanter and buttock. 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) (Gardiner et al., 2000; McCulloch, 1997; Souza, 1997).

Therefore, with respect to treatment, Gatterman (1995) states that specific manipulative therapy is the treatment of choice for sacroiliac dysfunction.
This is supported by clinical studies (Cassidy et al., 1992) which have shown significant improvement with daily manipulation over a 2-3 week period in 90% of the patients suffering from sacroiliac dysfunction (Gatterman 1995:464). Normally, the abnormal movement patterns or failure to function is reduced and function returns to normal. Therefore, the objective of the chiropractic treatment is to reduce the subluxation, which results in an increased range of motion, reduced nerve irritability and improved function.

Haldeman (2000) discussed the following theories pertaining to the chiropractic adjustment and its effects:

1. **Nerve compression theories for the adjustment**

This theory states that the correction of the subluxation (restriction) is the primary effect of the adjustment. This restoration of the abnormal biomechanic relations between joint surfaces needs to occur in order to restore normal function by decreasing interference with normal nerve function. This results in decreased pain or other clinical symptoms or signs.

2. **Reflex theories of the adjustment**

Restrictions stimulate the receptors found in the ligaments and joint capsule, resulting in activation of neural reflex centres and potential muscle spasm.
These receptors are responsive to mechanical (position, motion and tissue distortion), inflammatory (nociceptive), and temperature changes.

3. **Pain relief theories for the adjustment**

It has been suggested that the adjustment can result in hypoalgesia. This could be as a result of central facilitation from the stimulation of spinal structures, the ability of the adjustment to change cutaneous and muscular pain thresholds, or the release of endorphins.

The most applicable theories with respect to sacroiliac dysfunction are points 2 and 3, as the degree of nerve compression is limited with the sacral foramina being fixed bony structures without the ability to be influenced by the motion within the sacroiliac joint.

2.3. The affect of sacroiliac dysfunction on hip range of motion

Kirkaldy-Willis and Burton (1992) and Shekelle (1994) explained that a sacroiliac adjustment may reduce hypertonicity in the posterior muscles. This could be as a result of the adjustment stimulating joint mechanoreceptors and/or the adjustment influencing the exitability of the motor neurons. This in turn, creates reflexogenic muscle tone changes in the muscles surrounding the joint (DeFranca, 1996). By stimulating the joint mechanoreceptors, it is further hypothesised that an adjustment may lead to joint relaxation or normalisation, due to the fact that the sacroiliac and hip joint have common innervation (Moore and Dalley, 1999). As a result, it is thought that the adjustment may have to lead to relaxation and normalization of the hip joint (Bisset, 2003).

2.4. Different adjustment techniques applied to the sacroiliac joint

Different adjusting techniques for the sacroiliac joint include side posture adjustment and prone drop piece adjustments (Bergmann, 1993). With respect to side posture, Bergmann (1993) further states that the side posture adjustment is the most common position used. However, it has been noted that side posture can produce unwanted rotation in the lumbar spine. This may be detrimental to patients who have contra-indications to torsioning such as Abdominal Aortic Aneurisms, nerve root entrapment or disc pathology. Patients who experience more discomfort due to anterior catching of the hip capsule or decreased flexibility with side posture adjustments could therefore benefit from a different technique (Gatterman, 1995). Hence the need for an effective adjustment technique, that does not rely on torsioning (e.g. drop piece technique) (White, 2003; Pooke, 2003; Hyde, 2003; Pretorius, 2003; Haldeman, 2003; Cramer, 2003; Engelbrecht, 2003).

In congruence with this, Gatterman (1995) thus stated that lower force / velocity techniques should be used before high velocity thrusts; therefore drop piece techniques should be employed before side-posture techniques.

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

Therefore, 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 need to be researched.

The aim of this research is to evaluate the efficacy of a toggle recoil drop piece adjustment technique in the treatment of sacroiliac dysfunction in terms of objective and subjective findings.

CHAPTER 3

MATERIALS AND METHODS

3.1. Introduction

This chapter includes the data, the subjects, inclusion and exclusion criteria, the method, measurements used and the interventions utilised and the statistical evaluation employed.

3.2. Research Design

This study was a prospective, pre-post clinical assessment of the immediate effects of a toggle recoil drop piece adjustment technique on sacroiliac dysfunction.

3.3. Advertising

With respect to the recruitment of patients, posters were displayed around campus, at gyms and various sport clubs. In addition to this, pamphlets were handed out in the Glenwood area. Advertisements were also placed in the local newspapers to target the population of the greater Durban area (Appendix E).

3.4. Sampling

3.4.1. Method

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

3.4.2. Allocation

A study done by Ventegodt et al. (2004) showed that therapeutic touch has a powerful effect on reducing pain and discomfort.

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 psychosocial effects of touch.

Therefore it was thought that in order to control for the psychophysical effects, 3 groups where utilised in the study:

Group A = Treatment (30 subjects)

- Drop table sacroiliac adjustment with toggle recoil
- Contact on the subject

Group B = Placebo (30 subjects)

- Sham adjustment (see 3.9)
- Contact on subject

Group C= Control (20 subjects)

- Sham adjustment (see 3.9)
- No contact on subject

Each subject had to meet the inclusion and exclusion criteria that were utilised to delineate the study before inclusion. Then, in order to allocate participants to each group, subjects were asked to select a piece of paper from an envelope on which the letters “A”, “B” or “C” were printed. In this manner, each subject had a chance of being in either group and allocation was random.

3.4.3. Size

The study included a total of eighty subjects divided into three groups.

3.5. Telephonic screen

Pertinent questions were asked over the telephone to determine whether the subject was a suitable candidate for the research sample. These included:

- The age of the subject,
- Whether a history of trauma / surgery was present,
- The area of pain,
- The pain rating as per a verbal NRS pain rating of greater than 5,
- Whether the subjects experienced any associated radicular pain of any degree,
- Whether any neurological deficits where part of the presenting symptoms e.g. numbness, tingling, pins and needles, muscle or weakness.

These criteria were utilised in order to decrease the chance of unsuitable subjects being called in for an initial consultation. Appropriate referral could be made at this stage to other interns in the clinic, in order for them to receive standard clinical care on an outpatient basis.

During the initial consultation, the subject was assessed according to a case history (appendix A), physical examination (appendix B), and a lumbar regional examination (appendix C), in order to assess their compliance with the following inclusion and exclusion criteria:

3.6. The inclusion criteria for the study were:

1. Subjects 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).
2. The pain rating scale on the NRS had to be greater than 5 (and correspond with the area of the sacroiliac joint), allowing for the subject improvement or lack of improvement to be reflected adequately in the readings. Significances, if shown, were thereby capable of indicating trends or not, based on sample homogeneity (Mouton, 1996:135).
3. The subjects were required to present joint dysfunction of the sacroiliac joint, as evidenced by hypomobility in the joint and tested by the Gillet-Liekens method (Leach, 1994).
4. Subjects had to have joint tenderness on springing of the involved sacroiliac joint (Bergmann et al, 1993:485).
5. Orthopaedic tests were not part of the diagnostic criteria for sacroiliac dysfunction. They were, however, utilised to confirm the diagnosis. For the purpose of this research two out of the four tests described below had to be positive (Kirkaldy-Willis, 1992:125):

   As no one orthopaedic test has shown to be useful and no one test guarantees a diagnosis or rates severity consistently (Laslett and Williams, 1994), the clinician is tasked to make an informed decision regarding the clinical relevance of a particular test, its validity, reliability, specificity and sensitivity (Walsh, 1998). Thus it has been suggested that multiple tests triangulated are best in the clinical situation. Thus in this research the following were used:

   1. **Patrick Faber**

The subject was lying supine. The examiner placed the subject's test leg so that the foot of the test leg was above the knee of the opposite straight leg. The examiner then pushed the test leg into abduction while stabilising the opposite hemi-pelvis with the other hand. A true positive test was indicated by a decrease in abduction as well as pain in the sacroiliac joint, indicating sacroiliac dysfunction (Magee 1997:473).

2. Gaenslen's test

The subject was lying supine. The test hip was extended beyond the edge of the table. The subject had to draw both legs up to the chest and then lower the test leg off the edge of the table into extension, with help from the examiner. The examiner placed a shearing pressure in the opposite direction. The other leg was tested similarly. A positive test was indicated by pain in the sacroiliac joint (Magee 1997:446).

3. Yeoman's test

The subject lay prone. One hand applied pressure to the affected sacroiliac joint, while the other hand had lifted the ipsilateral leg into hyperextension, with the knee flexed at 90 degrees. Pain in the sacroiliac joint indicated a positive test (Schaefer and Faye 1990:271).

4. Posterior Shear test

The subject was supine. The hip was flexed and adducted while the examiner applied a force by pushing posteriorly along the line of the femur. A positive test was indicated by pain over the sacroiliac joint (Laslett and Williams 1994).

6. In addition to the above 5 criteria, all tests had to be positive on the same side, as this would support increased sample homogeneity (Mouton, 1996).
7. Subjects had to sign an informed consent document in order to ensure that their participation was voluntary and based on an informed decision (Appendix G).

3.7. The exclusion criteria for the study were:

1. Subjects where not allowed to have had pain that was radicular in origin (in either or both extremities). However, pain referred from the sacroiliac joint was accepted (Haldeman et al., 1993 In: Gatterman et al., 2001).
2. No hard neurological signs could be present in order to participate in the study (Haldeman et al., 1993 In: Gatterman et al., 2001).
3. The subjects were not allowed to have had any medication or any other form of treatment, including manual or modality intervention, within the last 48 hours preceding participation in the research (Poul et al., 1993).
4. Subjects were not included in the study if they had had previous exposure to drop piece adjustment techniques. This was done so that these patients did not have any prior expectations on entry to the study and thus negate the influence patient perception and expectation which could have influenced the subjective readings taken in this study (Mouton, 1996).
5. Subjects who failed to sign the informed consent form were excluded by default , as this was taken to mean that they were either unable to understand the constraints of the study, or were unwilling to participate or have their information made part of the study findings.
6. Subjects who presented contra-indications to manipulation were referred to other interns for treatment of their condition. These were exclusions for this study based on Giles and Singer's work (1997:352) defining contra-indications as the following:
    - Cancer or other destructive lesions of the spine.
    - Severe osteopaenia.
    - Active spondyloarthropathies

- Cauda equina dysfunction
- Referred pain from visceral disease
- Significant psychological overlay

7. Subjects with a previous history of surgery to the low back and / or pelvis were excluded from this study as the source of their pain might be related to the previous surgical procedure (Maroon et al., 1999). In addition, surgical procedures may have induced artificial motion parameters within the lumbar spine, pelvis or both which would affect the outcome of this study.
8. Subjects that required further investigations (blood tests, X-rays etc.) in order to confirm the diagnosis were excluded so as to maintain a homogenous sample population (Mouton, 1996:135).
9. Subjects needed to be literate in English in order for them to read the patient information sheets; complete subjective data records and understand the processes that were followed. Without these critical elements, informed consent and accurate data would not have been achievable thus having implications for the accuracy of the study as a whole. This is supported by the need for questionnaires in different languages (Baynham, 1995:190) in order to reduce their effect on the study outcomes.
10. Subjects who presented pain of facet origin on the NRS of 4 or more (for pain associated of non sacroiliac origin) were excluded from this study as this could influence the accuracy of the NRS relating to sacroiliac dysfunction.

Those subjects who did not meet the inclusion criteria were referred to other interns in the Chiropractic day clinic for treatment of their condition, as this lay outside the scope of this research proposal.

3.8. Intervention

Subjects were given a letter of information and the informed consent sheet (Appendix G) prior to inclusion, after having being deemed suitable.

Motion palpation of the sacroiliac joints was then utilised as per the Gillet-Liekens method, as described by Leach (1994) to determine the presence or absence of restrictions within the joints.

Subjects from group A (treatment group) received a toggle-recoil drop piece adjustment used to treat sacroiliac dysfunction as described by Gatterman et al., (2001):

The sacroiliac joint was placed over the drop segment of the table, the contact hand was placed over the posterior superior iliac spine and a force was applied to that joint.

It can best be described as follows:

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 was raised and the tension in the drop section set so that it did not drop with the patient's body weight, but was able to drop with the addition of minimal force, beyond that of the patient's weight.

Procedure that was applicable once all the above were in place: contact was taken and skin slack removed. A high velocity, low amplitude with toggle recoil adjustment was then applied to the symptomatic sacroiliac joint. Subjects received one adjustment.

Subjects from group B (placebo group) received a placebo adjustment, which can be described as follows:

Differing from group A, the subjects sacroiliac joint was not placed over the drop section, but the femur was; again contact was taken on the sacroiliac joint (posterior superior iliac spine), but the thrust was applied to the table itself and not through the hand contacting the subject.

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 was raised and the tension in the drop section was set so that it did not drop with the patient’s body weight, but was able to drop with the addition of minimal force, beyond that of the patient’s weight.

Procedure that was applicable once all of the above were in place, included the contact hand being placed over the sacroiliac joint with the indifferent hand on the drop section of the table. The thrust was then imparted via the indifferent hand and not the contact hand. Thus a high velocity, low amplitude toggle recoil adjustment was applied to the table to activate the drop piece, with no thrust applied to the subject (Bronfort et al, 2001).

Subjects received one adjustment, which was classified as a sham intervention.

Subjects from group C (control placebo group) received a placebo adjustment, which can be described as follows:

As with group B, the femur was placed over the drop section of the table, no contact was taken on the sacroiliac joint, but on the table only (i.e. neither the contact nor the indifferent hands contacted the patient). The thrust was then applied to the table.

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 was raised and the tension in the drop section set so that it did not drop with the patient's body weight, but was able to drop with the addition of minimal force, beyond that of the patient's weight.

Procedure that was applicable once all the above were in place, with the contact taken on the drop section of the table and not on the patient – thus there was no subject contact. A high velocity low, amplitude with toggle recoil adjustment was applied to the table to activate the drop piece, with no thrust applied to the subject.
The one adjustment that was applied was classified as a sham adjustment for purposes of this research.

3.8.1. Intervention frequency

The subjects accepted underwent two consultations

- Consultation one included the subject evaluation for inclusion into the study as well as the treatment.
- The second consultation included the 24 hour follow up readings only.

3.9. Data collection

3.9.1. Frequency

Data collection included:

- Pre assessment,
- Immediately post treatment,
- At 1 hour post treatment
- And then within 24 hours post treatment.

This was done to determine whether there were any significant changes in the data acquired pre and post (immediate, 1 hour and 24 hour) treatment as well as between the treatment, control and placebo group.

3.9.2. Measurements

3.9.2.1. Objective data:

1. An algometer was used to assess tenderness of the piriformis muscle as per definition of sacroiliac dysfunction. (Fischer 1987:122).

   The algometer measures the maximum pain or discomfort as a result of pressure that a subject can tolerate and is therefore used to quantify the response to treatment. By providing a means of measuring the subjects' improvement, the algometer allows for a quantitative and reliably reproducible measure (Fischer 1987:122).

   The algometer was placed on a spot where a vertical line drawn from the posterior superior iliac spine crossed a line drawn horizontally at the level of the second sacral tubercle.

2. Motion palpation as per the Gillet-Liekens method (Leach 1994) was completed by a blinded examiner in order to ensure that the restrictions noted where objectively and independently assessed.

The subject had to stand upright with their hands against the wall (to keep their balance). The examiner was behind the subject placing one thumb on the ipsilateral posterior superior iliac spine and the other thumb on the second sacral tubercle. The subject was then asked to lift the ipsilateral leg to induce upper flexion of the sacroiliac joint.

With normal movement, it was expected that examiner's thumbs would move closer together as the posterior superior iliac spine moved inferior and posterior relative to the sacral tubercle.

To test for extension restrictions, the above procedure was followed with the exception of flexing the contra-lateral leg instead of the inpsilateral leg, which induced extension of the sacroiliac joint.

With normal extension movements, it was expected that the examiner's thumbs would move apart as the posterior superior iliac spine moved superior and anterior relative to the sacral tubercle.

For lower sacroiliac restrictions the same procedures as above were followed except for placing the one thumb on the fourth sacral tubercle instead of the second.

Hip range of motion was tested bilaterally with the inclinometer.

Internal and external rotation (both actively and passively) was measured as Bisset (2003) found that restrictions within the sacroiliac joints affected the range of motion negatively and that when adjustments were applied, the affect was positive (i.e. range of motion increased).

Hip range of motion was tested bilaterally with the inclinometer. This assisted in determining whether an adjustment of the sacroiliac joint, after a drop piece adjustment, showed an increase, decrease or no change to hip range of motion (as there is no audible joint cavitation with drop table adjustments) to ascertain that joint movement had indeed taken place.

The subject was lying prone. A strap was put around the posterior superior iliac spines to prevent pelvic movement. The subject had to flex the knee of the affected leg to 90 degrees. The inclinometer was attached to the subject's leg just below the ankle. The inclinometer was zeroed and the subject was then asked to actively externally rotate the leg to the maximum. Thereafter the subject had to maximally rotate the leg internally. Readings were taken at the maximum of each movement. For the passive movements the subject had to completely relax and the examiner then moved it into maximal internal and external rotation. Readings were taken.

3.9.2.2. Subjective data

The Numerical Pain Rating Scale (NRS) was used to give an objective rating of the severity of the sacroiliac dysfunction. The NRS pain rating scale was used as it was found to be an effective and reliable tool to evaluate pain reduction with treatment and the degree of reduction with ongoing treatment (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 subject. 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.

Subjects 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 any immediate effect of treatment on their pain

3.10. Statistical analysis

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.

Demographic details such as age and occupation were evaluated to determine if trends exist in certain population groups, with respect to improvement or lack of improvement. Furthermore, the demographics were also utilised to compare groups in order to ensure that there was no bias in the data according to one or more of the demographic variables assessed in this study.

Demographic variables were compared among groups using chi square tests for categorical variables and Kruskal-Wallis tests for quantitative variables (non-parametric tests were used due to skewness of demographic data). Baseline outcome variables were similarly compared among the three groups in order to check for pre-existing differences between the groups prior to the intervention. This is with the exception 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.

Demographic details are represented by descriptive statistical analysis, which were performed on the data collected and represented in the dissertation in the form of graphs, plot charts, pie charts and bar graphs in addition to the discussion that is presented in the context of the literature.

Further data were collected from the NRS, algometer, inclinometer and motion palpation. Motion palpation restrictions for SI dysfunction 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 were 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 also recorded and they included Patrick Faber, Gaenslen, Yeoman and posterior shear tests. A positive test was allocated a ‘1’ while a negative test was allocated a ‘0’ for statistical purposes. These tests were then correlated with improvement or lack of improvement with respect to other measures - both subjective and objective.

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 generalised estimating equation (GEE) models with robust standard errors adjusted for clustering in patient number. Inferential statistics were completed by the use of parametric tests (20 or more per group) and the appropriate paired and unpaired t-tests were applied. These statistics were performed at a significance level of $p = 0.05$ and / or confidence interval of 95 % - as appropriate. These statistics were utilised in order to maximally represent and present intragroup analyses.

CHAPTER 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 subjects that adhered to 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 – Generalised estimating equations
SD - standard deviation

4.3. Sample description

Eighty subjects were 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). Subjects where excluded on the basis of the inclusion and exclusion criteria and it was noted that of those subjects accepted none withdrew from the study for any reason. They ranged in age from 22 to 55, with a mean age of 37.4 years (SD 9.0 yrs). Most subjects did no physical activity (74%), and the most common occupation was that of a driver - 46.3%.

4.4. Demographics by group

Demographic variables (race, age, occupation, smoking, level of activity, weight, time since last injury in years), were compared by group in order to assess whether there was an equal distribution of each variable by group as expected. Descriptive statistics and p values are shown in Tables 1 and 2. There was a significant difference only in weight between the 3 groups, with group A having the lowest median weight of all groups ($p = 0.004$).

Table 1: 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	68.4%	0.382
	Yes	7	23.3%	12	40.0%	6	31.6%	
Race	White	3	10.0%	6	20.0%	7	35.0%	0.322
	Black	22	73.3%	22	73.3%	12	60.0%	
	Indian	4	13.3%	2	6.7%	1	5.0%	
	Coloured	1	3.3%	0	0%	0	0%	
Sitting occupations	No	12	40%	9	30%	7	35%	0.719
	Yes	18	60%	21	70%	13	65%	

Table 2: Comparison of medians of quantitative demographic variables by group

GROUP		AGE (Years)	WEIGHT (Kg's)	Time since injury (years)
A	Median	34.00	68.50	3.00
	Minimum	22	41	1
	Maximum	55	92	23
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	38.00	74.00	3.00
	Minimum	22	41	1
	Maximum	55	104	23
p value		0.631	0.004	0.559

It must be noted that weight was used as a covariate in all the subsequent inter-group analyses in order to adjust for the significantly different mean weights of subjects in the three groups, which may have influenced the outcomes.

Nonetheless, it was found that the sample used in this study is representative of the general population and congruent with McGregor et al. (1998) who found that low back pain was most prevalent at age 44.7 years (mean) +/- 13.7 years (SD) and Moodley (2002) at 38.08 years (mean).

However, with respect to the intragroup analysis, the age in groups B and C is similar, but group A stands alone. Therefore by implication, group A could have had a less chronic condition which is more easily treated (Haas et al., 2004) and this could have biased the results. When this is seen in the context of the time (in years) since the most recent injury, the groups were evenly matched. This indicates that the severity of the conditions that presented over the 3 groups was of a similar nature and duration, thus age should not have been a factor in biasing the data.

In the South African context, the incidence of low back pain in Lesotho mothers was found to be 58.84% (Worku, 2000), 78.2% in the Indian community (Docrat, 1999), 76.6% in the Coloured community (Docrat, 1999) and 53.1% in the South African black community of Chesterville (Van der Meulen, 1997). This is comparable to the global norm of 75% to 85% (Hoiriis et al., 2004) and thus this study had the opportunity to sample from a fairly large proportion of low back pain sufferers, which would be representative of global norms.

Although smoking was not linked to the subjects' low back pain in this study, it was found that a high proportion of the patients did not participate in any sort of sporting activity which has been linked to increased low back pain (Oleske et al., 2004). In addition, a high proportion of work related activities predisposed the subjects to low back pain – i.e. driving (Krause et al., 2004) and manual tasks such as lifting (Palmer et al., 2003). This may explain why, in the absence of smoking, these patients still have a high prevalence of low back pain.

4.5. Baseline outcome comparison by group

In order to ensure that the groups were comparable at baseline, initial values for each outcome were compared between the groups. Once again, there was no significant difference among any of the groups with regard to the outcomes measured. Table 3 shows the means and standard deviations for each quantitative outcome by group, and Table 4 shows the results of the ANOVA tests. Table 5 shows the chi square statistics and p values for the comparison of categorical baseline outcomes by group. The only outcomes which were significantly statistically different among the groups at baseline, were algometer measurements, which was significantly lower in Group A than in the Group B (p=0.001), and motion palpation left upper extension which had a higher proportion of positive subjects in group A compared to the other groups (p=0.001). The other outcomes were not significantly different between the groups at baseline.

Table 3: Descriptive statistics for baseline quantitative outcomes by group

	GROUP					
	A		B		C	
	Mean	SD	Mean	SD	Mean	SD
Inclinometer active internal left 1	32	12	30	10	32	8
Inclinometer active external left 1	40	12	41	9	40	8
Inclinometer passive internal left 1	43	10	39	11	43	9
Inclinometer passive external left 1	51	9	48	10	49	8
Inclinometer active internal right 1	31	8	29	11	32	9
Inclinometer active external right 1	43	11	41	9	44	7
Inclinometer passive internal right 1	41	9	37	11	41	10
Inclinometer passive external right 1	51	12	49	9	51	8
Ave NRS1	4.9	0.9	5.0	0.9	4.6	0.9
Current NRS 1	5.7	0.7	5.7	0.8	5.7	0.7
Algometer 1	6.55	1.47	7.88	1.21	7.36	1.40

<u>Table 4: ANOVA table for comparison of quantitative baseline outcomes between the three groups</u>

		Sum of Squares	df	Mean Square	F	p
Inclinometer active internal left 1	Between Groups	84.067	2	42.033	.385	.682
	Within Groups	8399.733	77	109.087		
	Total	8483.800	79			
Inclinometer active external left 1	Between Groups	9.154	2	4.577	.048	.953
	Within Groups	7347.833	77	95.426		
	Total	7356.987	79			
Inclinometer passive internal left 1	Between Groups	277.467	2	138.733	1.327	.271
	Within Groups	8052.333	77	104.576		
	Total	8329.800	79			
Inclinometer passive external left 1	Between Groups	95.888	2	47.944	.591	.556
	Within Groups	6246.500	77	81.123		
	Total	6342.388	79			
Inclinometer active internal right 1	Between Groups	119.017	2	59.508	.632	.534
	Within Groups	7251.783	77	94.179		
	Total	7370.800	79			
Inclinometer active external right 1	Between Groups	142.033	2	71.017	.852	.431
	Within Groups	6421.917	77	83.402		
	Total	6563.950	79			
Inclinometer passive internal right 1	Between Groups	318.750	2	159.375	1.538	.221
	Within Groups	7976.800	77	103.595		
	Total	8295.550	79			
Inclinometer passive external right 1	Between Groups	69.871	2	34.935	.346	.708
	Within Groups	7765.617	77	100.852		
	Total	7835.488	79			
Algometer 1	Between Groups	26.886	2	13.443	7.288	.001
	Within Groups	142.034	77	1.845		
	Total	168.920	79			
Ave NRS1	Between Groups	2.542	2	1.271	1.606	.207
	Within Groups	60.946	77	.792		
	Total	63.488	79			
Current NRS 1	Between Groups	.033	2	.017	.028	.972
	Within Groups	45.517	77	.591		
	Total	45.550	79			

Factors which could have affected the algometer readings include the following:
In South Africa, Chiropractic is limited to the English speaking population that is familiar with western culture and has been exposed to health care disciplines outside of the traditional medicine or allopathic medicines that have dominated in South Africa. In this study a great percentage of the sample was Black people who are still mainly exposed to their traditional medicine. In effect, most of them had never experienced the procedure before and did not know what was expected from them. The Hawthorn-effect (http://encyclopedia.laborlawtalk.com/Hawthorne_effect), which states that people often respond as result of the special attention being paid to them and not necessarily due to the intervention, could also have played a role.

Table 5: 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	2.272	0.321
MP right lower flexion 1	5.965	0.051
MP right upper extension 1	2.284	0.319
MP right lower extension 1	1.368	0.505
MP left upper flexion 1	0.668	0.716
MP left lower flexion 1	3.200	0.202
MP left upper extension 1	13.562	0.001
MP left lower extension 1	Cannot be computed-no positive subjects in any group	
Faber 1 Right	0.486	0.784
Faber 1 left	3.502	0.174
Gaenslens 1 Right	1.889	0.389
Gaenslens 1 Left	3.556	0.169
Yeoman 1 Right	1.022	0.600
Yeoman 1 Left	1.642	0.440
Shear 1 Right	0.956	0.620
Shear 1 Left	1.043	0.594

Left upper extension fixations were most common in the sample used in this research. When taking into consideration that 46% of the sample were truck drivers, it could possibly be linked to the fact that driving heavy trucks is associated with the double clutch mechanism when changing gears. This repetitive action could be responsible for the development of muscle fatigue, increased joint loading and thus possible decrease movement in the joint (Kirkaldy Willis and Burton, 1992). This is further compounded by the manner in which truck drivers manoeuvre in and out of the trucks, by swinging out and onto the ladder in order to descend to the ground.

The second most common was right lower extension fixations. These could be linked to having the right leg in a fixed position on the accelerator, resulting in prolonged immobility and muscle shortening. This has been hypothesised to lead to reactive muscle spasm and trigger point formation (Travell and Simons, 1999) which has been associated with decreased joint movement / restriction.

The above mechanisms could be further complicated by the way the subject lifts heavy items while loading the trucks (i.e. the question of bending their knees and using their leg muscles to lift or the bending of their lower lumbar spine and overloading the joints including the sacroiliac joints as well as the overloading of the muscles in and around the area). In this respect Gatterman (1990) found that lifting with torsioning is a causative factor of sacroiliac dysfunction.

4.6. Longitudinal analysis

4.6.1. Inter-group analysis

Weight was used as a covariate in all the subsequent inter-group analyses in order to adjust for the significantly different mean weights of subjects in the three groups, which may have influenced the outcomes.

4.6.1.1. Inclinometer

A discussion of the inclinometer results (active range of motion) will follow at the end of 4.6.1.1.4., and the results for passive range of motion after 4.6.1.1.8.

4.6.1.1.1. Active internal left:

There was a significant interaction between time and group (p=0.007). 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 6: Within and between subjects effects for repeated measures ANOVA for active internal left

Effect	Statistic	p-value
Time	Wilk's lambda 0.943	0.224
Group	F 0.786	0.460
Time*Group	Wilk's Lambda 0.789	0.007

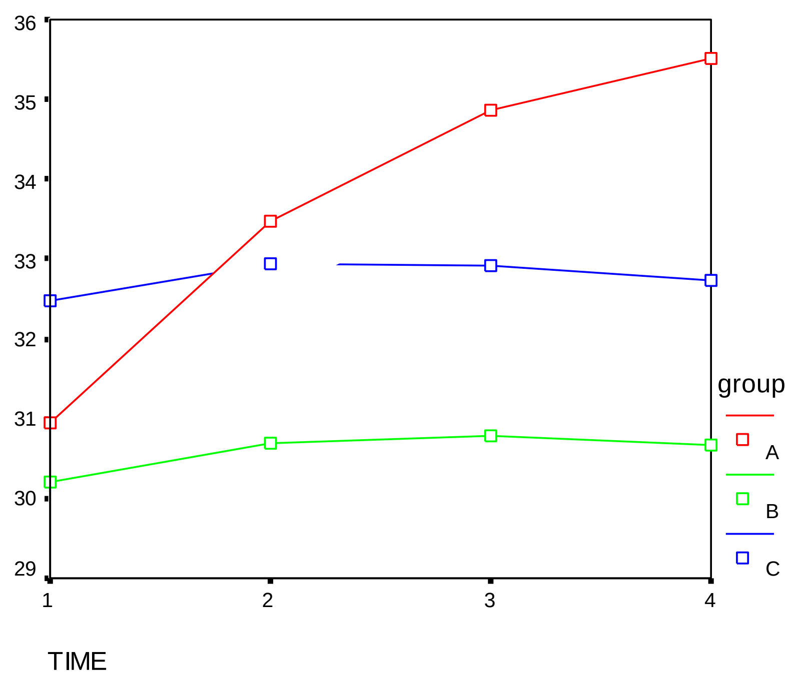

Figure 1: Profile plot of mean active internal left measurements over time by group

4.6.1.1.2. Active internal right

There was a significant treatment effect (p<0.001) for this outcome. Thus there was a significant benefit to treatment in group A for this outcome, which is shown in Figure 2.

Table 7: Within and between subject effects for repeated measures ANOVA for active internal right

Effect	Statistic	p-value
Time	Wilk's lambda 0.974	0.586
Group	F 0.457	0.635
Time*Group	Wilk's Lambda 0.700	<0.001

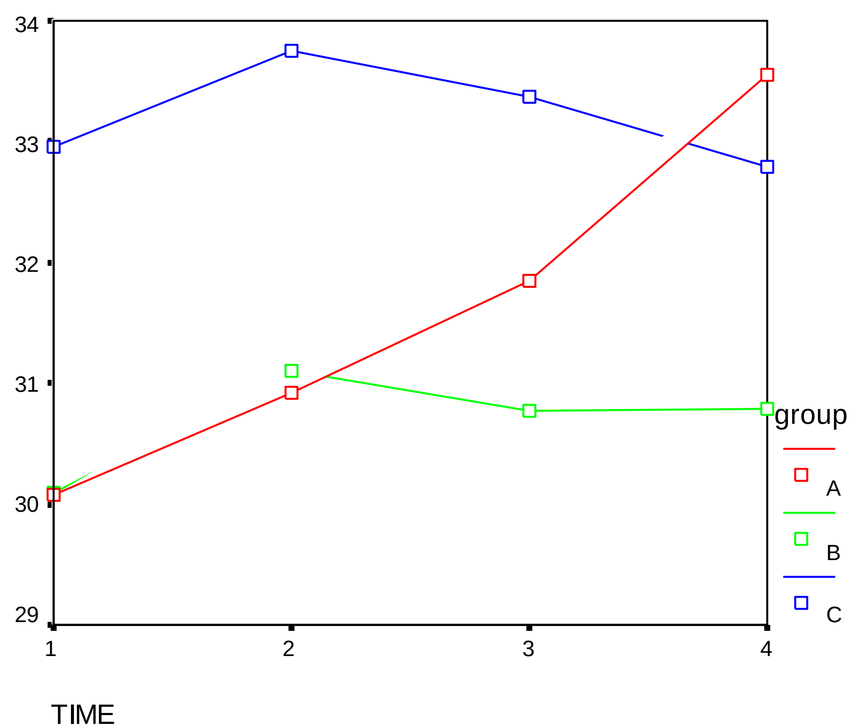

Figure 2: Profile plot of mean active internal right measurements over time by group

4.6.1.1.3. Active external left

There was a significant treatment effect for active external left (p=0.018). Figure 3 shows that the subjects in Group A experienced a steeper rise in this outcome than the other groups.

Table 8: Within and between subject effects for repeated measures ANOVA for active external left

Effect	Statistic	p-value
Time	Wilk's lambda 0.900	0.049
Group	F 0.114	0.893
Time*Group	Wilk's Lambda 0.816	0.018

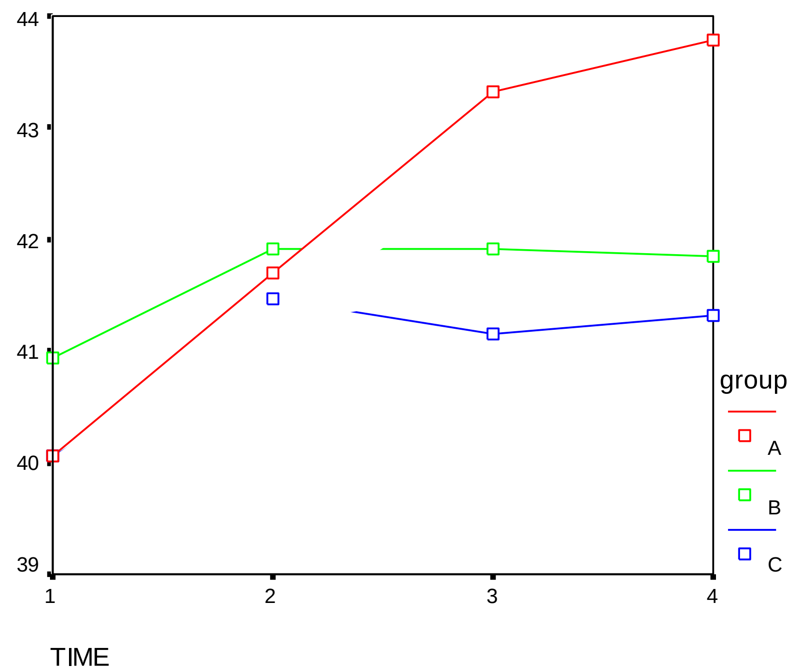

Figure 3: Profile plot of mean active external left measurements over time by group

4.6.1.1.4. 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 9: Within and between subject effects for repeated measures ANOVA for active external right

Effect	Statistic	p-value
Time	Wilk's lambda 0.960	0.391
Group	F 0.636	0.532
Time*Group	Wilk's Lambda 0.718	<0.001

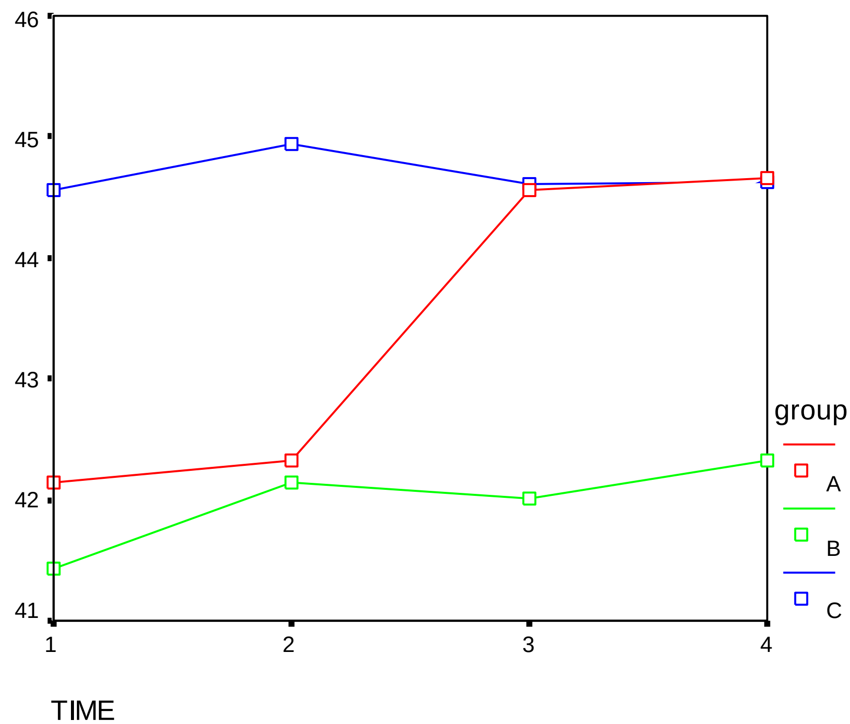

Figure 4: Profile plot of mean active external right measurements over time by group

It would seem that the results from this study support the results of a previous study performed by Bisset (2003), as it was shown in this research that adjustment was effective as inferred from the significant improvement (4.6.1.1.1. – 4.6.1.1.4.) found in both internal and external rotation bilaterally.

With internal rotation improvement, it would seem that the following would need to hold true:

- Decreased hypertonicity in the piriformis and other external rotators (Norkin and Levangie, 1992), which would allow for them to be stretched in maximal internal rotation both actively and passively.
- Decreased hypertonicity in the iliopsoas and other internal rotators (Moore, 1993), which would allow for maximal contraction of the muscles, initiating an increased active movement.

This reduction in hypertonicity can be affected by 2 mechanisms, one is related to the sudden stretch of the concerned muscle and the other is the indirect effect of the joint separation affecting spinal cord depolarization (at the affected) level, thereby reducing muscle spasm of the muscles supplied by the same neurological level (Korr in Leach, 1994).

Thus with improved internal rotation, the following could be applied if one considers that the treatment affected was in the prone (partly flexed) position (as a result of the drop piece segment):

- The external rotators could not have been affected by the muscle stretch, as the position of the subject did not allow for the muscle to be placed in a stretched position during the application of the adjustment. Therefore any change within the muscle would have had to have been as a result of the change in joint mechanics, resulting from the imparted thrust, stimulating the joint mechanoreceptors (Wyke, in Leach 1994) thereby depolarizing the affected spinal cord level and resulting in muscle relaxation.

- On the contrary the iliopsoas muscle is placed in a shortened position when the patient is prone and slightly flexed, as for a prone drop piece toggle recoil adjustment (Gatterman et al., 2001). Thus the adjustment would, by implication, impart a sudden stretch of the intrafusal muscle fibres, which occur with high velocity, low amplitude adjustments (Leach 1994:99) as well as the drop of the table. The resultant reduction in gain (gamma motor neuron discharge), caused by the excessive increase in the impulses to the central nervous system, results in decreased muscle spasm and an increase in the active non painful range of motion.

4.6.1.1.5. Passive internal left:

There was a significant treatment effect for passive internal left (p=0.031). Subjects in group A improved at a faster rate than in the other groups.

Table 10: Within and between subject effects for repeated measures ANOVA for passive internal left

Effect	Statistic	p-value
Time	Wilk's lambda 0.970	0.525
Group	F 0.991	0.376
Time*Group	Wilk's Lambda 0.831	0.031

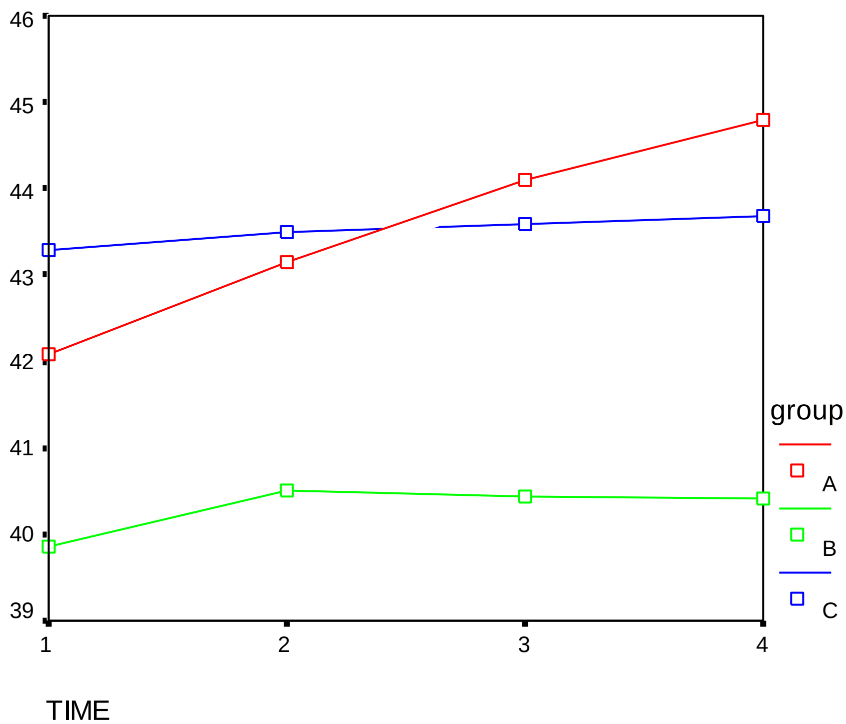

Figure 5: Profile plot of mean passive internal left measurements over time by group

4.6.1.1.6. 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 11: Within and between subject effects for repeated measures ANOVA for passive internal right

Effect	Statistic	p-value
Time	Wilk's lambda 0.930	0.146
Group	F 1.131	0.328
Time*Group	Wilk's Lambda 0.661	<0.001

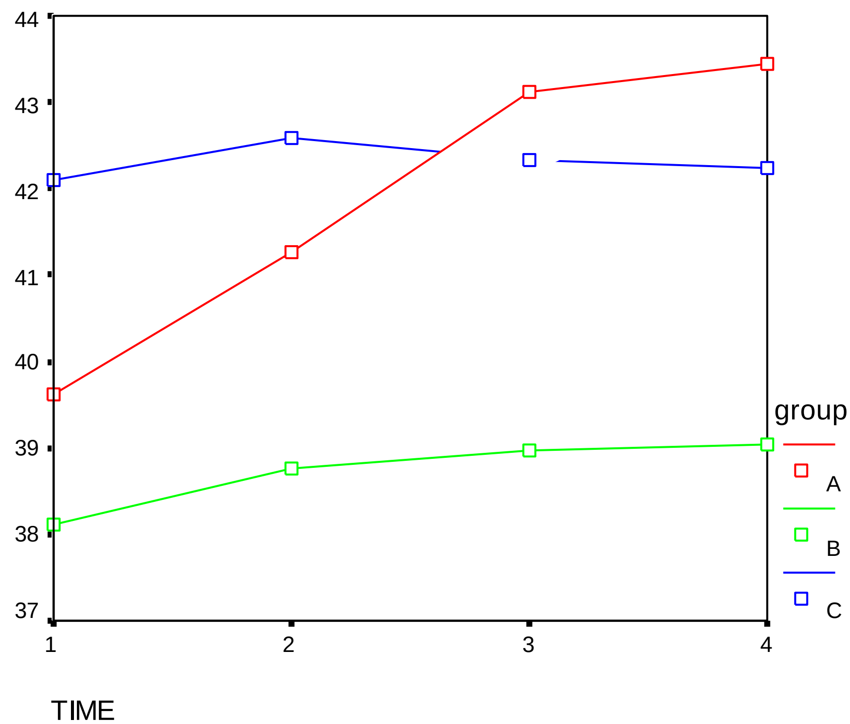

Figure 6: Profile plot of mean passive internal right measurements over time by group

4.6.1.1.7. Passive external left

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

Table 12: Within and between subject effects for repeated measures ANOVA for passive external left

Effect	Statistic	p-value
Time	Wilk's lambda 0.976	0.614
Group	F 0.756	0.473
Time*Group	Wilk's Lambda 0.764	0.003

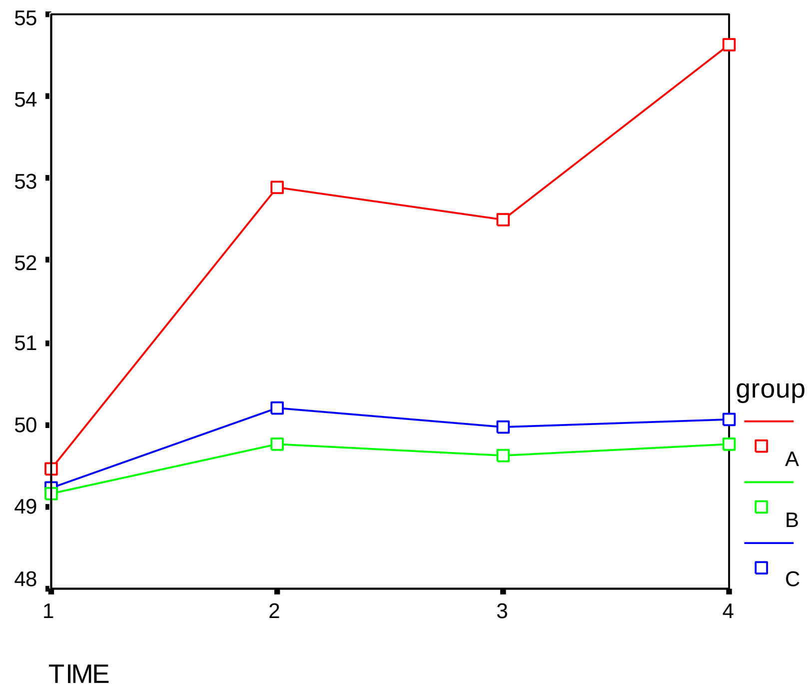

Figure 7: Profile plot of mean passive external left measurements over time by group

4.6.1.1.8. Passive external right

Passive external right side measurements improved significantly more in Group A subjects than in the other two groups. (p=0.005). This is shown in Figure 8.

Table 13: Within and between subject effects for repeated measures ANOVA for passive external right

Effect	Statistic	p-value
Time	Wilk's lambda 0.968	0.496
Group	F 1.168	0.316
Time*Group	Wilk's Lambda 0.780	0.005

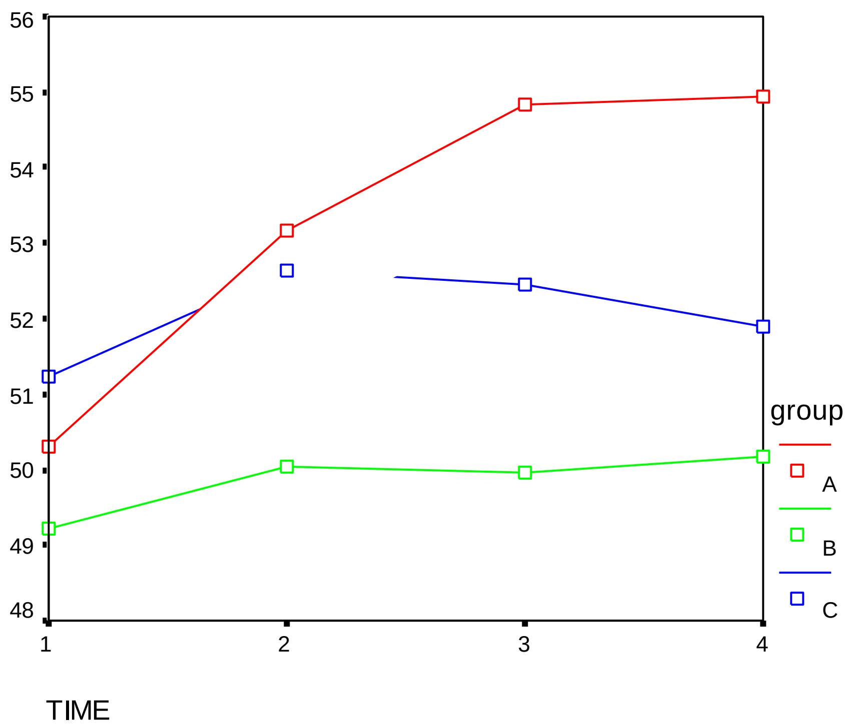

Figure 8: Profile plot of mean passive external right measurements over time by group

The passive range of motion was significantly increased in both internal and external rotation bilaterally, indicating the treatment effect to be significant. In order to achieve increased passive range of motion in the hip joint, one of two possibilities had to have taken place:

1. Relaxation of hypertonic internal and external rotator muscles through the adjustment affecting the muscles directly (Shakelle, 1994). Alternatively, through a neurological feedback loop that caused a reflexogenic change in muscle tone, as described by Korr (1994), Wyke (in Leach, 1994) and Patterson and Steinmetz (1986).

2. Joint normalisation through the adjustment stimulating mechanoreceptors.

Time was not significant, which indicates that there is still an underlying resolution taking place e.g. resolution of inflammatory products which normally take 72 hours to resolve (Vizniak, 2003).

When comparing the active and passive results, there is concurrence in both improvement and possible theories for improvement. Therefore the inferences made in the results discussed thus far, seem to be of merit in describing the effects of the toggle recoil drop piece adjustment.

4.6.1.2. Algometer

Algometer measurement increased significantly more in Group A subjects relative to the other groups (p<0.001).

Table 14: Within and between subject effects for repeated measures ANOVA for algometer measurements

Effect	Statistic	p-value
Time	Wilk's lambda 0.951	0.287
Group	F 0.666	0.517
Time*Group	Wilk's Lambda 0.587	<0.001

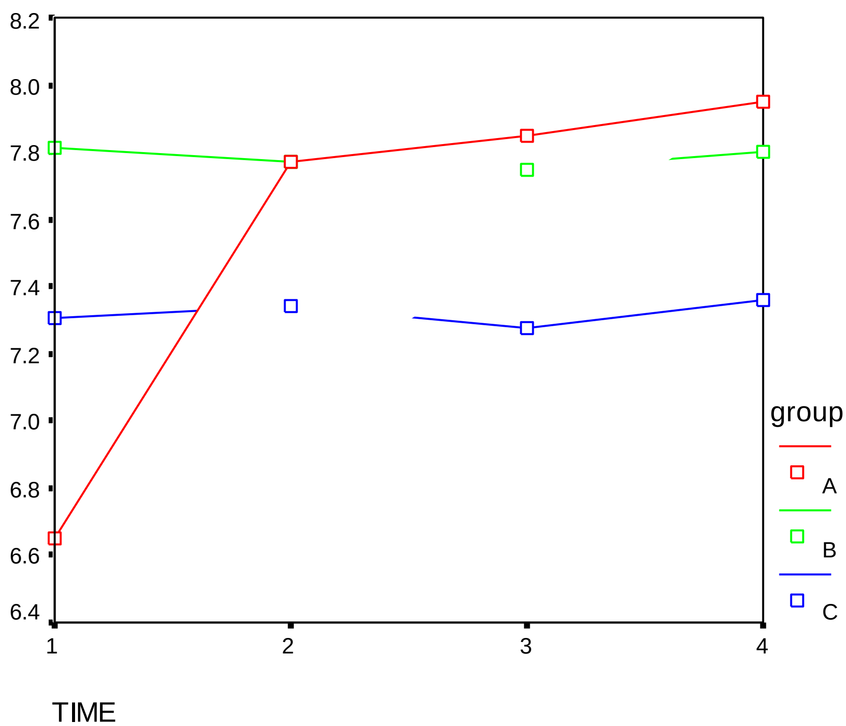

Figure 9: Profile plot of mean algometer measurements over time by group

An algometer was used to assess tenderness of the piriformis muscle as per definition of sacroiliac dysfunction (Fischer 1987:122). The algometer measures the maximum pain or discomfort as a result of pressure that a patient can tolerate and is therefore used to quantify the response to treatment.

The reason for the significant improvement of algometer readings in group A compared to groups B and C could be attributed to the reduction in hypertonicity of the Piriformis muscle after the adjustment as explained in 4.6.1.1.4.

Another possibility explaining the results is to apply the gate control theory of Melzack and Wall:

> The adjustment could lead to a reduction in the mechanical dysfunction of the joint by re-aligning the depressions and ridges of the joint surfaces, returning it to its normal position allowing for the return of normal movement and thus stimulation of the large mechanoreceptor fibers (Wyke type I, II and III) (Wyke in Leach, 1994). These fibers have been implicated in overriding the smaller type C nociceptive fibers thereby inducing a gait control effect (Melzack and Wall, 1965), which reduces pain and increases muscle relaxation, thereby inducing resolution of the dysfunction.

4.6.1.3. 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 was no inter-group differences in average NRS (p = 0.212). Figure 10 shows the constant profiles over time.

Table 15: Within and between subject effects for repeated measures ANOVA for average NRS measurements

Effect	Statistic	p-value
Time	Wilk's lambda cannot be estimated	
Group	F 1.583	0.212
Time*Group	Wilk's Lambda cannot be estimated	

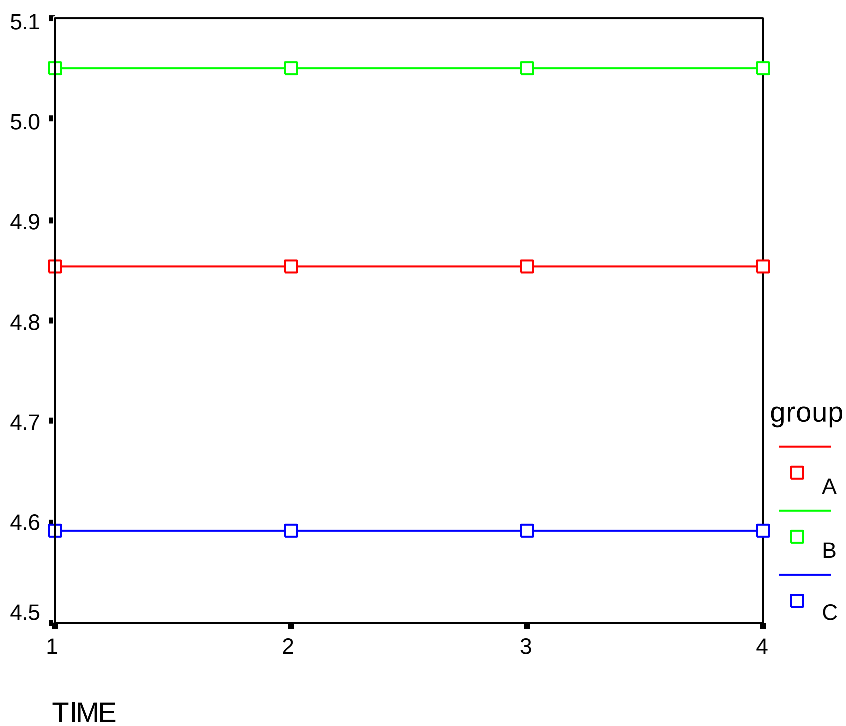

Figure 10: Profile plot of mean average NRS measurements over time by group

Assessing pain on multiple occasions with the NRS-101, makes it possible for subjects to remember their previous report (Bolton and Wilkinson, 1998). This seems to be the case in this study where the reporting of these readings happened in the space of 24 hours (NRS measurements were taken pre- adjustment, post adjustment, within 1 hour and within 24 hours) and therefore not allowing for “memory decay” (Mouton, 1996).

4.6.1.4. 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 16: Within and between subject effects for repeated measures ANOVA for current NRS

Effect	Statistic	p-value
Time	Wilk's lambda 0.841	0.005
Group	F 39.134	<0.001
Time*Group	Wilk's Lambda 0.225	<0.001

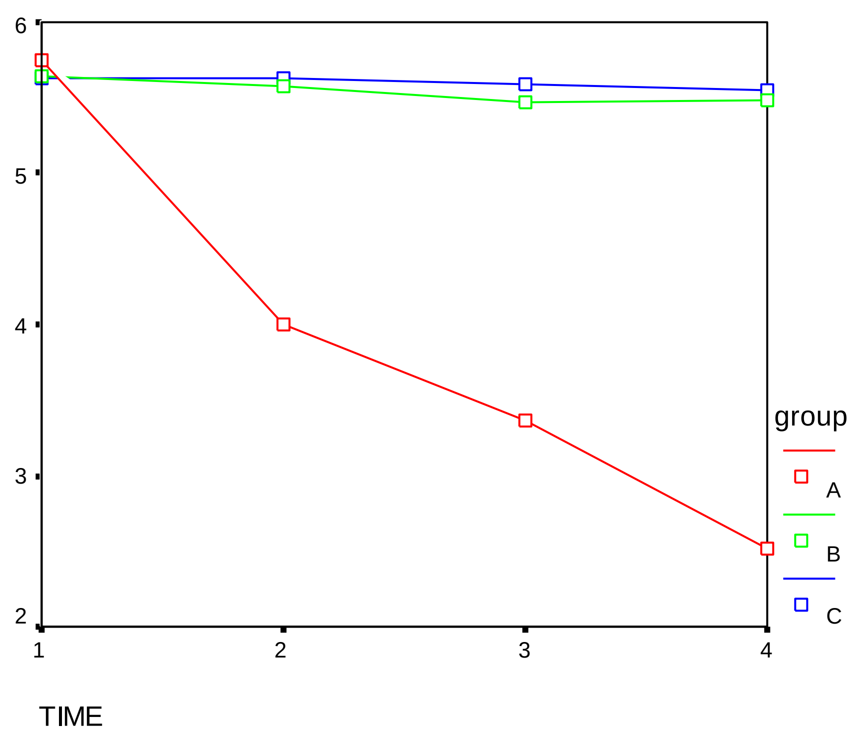

Figure 11: Profile plot of mean current NRS measurements over time by group

The same principles used in explaining the trends found with the algometer readings in terms of the reduction of pain, can be used in explaining the change in NRS. (4.6.1.2.)

In summary, the following theories were used to explain the reduction in pain using the algometer and the NRS:

1. The correction of the mechanical dysfunction of the sacroiliac joint resulting in normal joint motion and relaxation of surrounding muscles (Bergmann, 1993).
2. The gait control theory whereby the stimulation of the bigger A-fibers overrides the smaller nociceptive C-fibers (Melzack and Wall, 1965).
3. The inflammatory theory which states that, with the resolution of the restriction through the adjustment, the resultant increased circulation in the area (Leach, 1994), will wash inflammatory products away, decreasing pain. At the same time the adjustment eliminates the initial stimulus (the restriction) which evoked the inflammatory changes as described by Dvorak (in Leach, 1994).

<u>4.6.1.5. Categorical outcomes</u>

<u>4.6.1.5.1. Motion palpation</u>

Motion palpation as per the Gillet-Liekens method (Leach 1994) was used as describe the material and methods section (chapter 3) of this dissertation.

All motion palpation findings will be discussed at the end of the motion palpation section (after 4.6.1.5.1.6.).

4.6.1.5.1.1. Right upper flexion

Figure 12 shows that the percentage of positive subjects decreases to 0 in Group A by time 3, while it remains constant in the two placebo groups. Table 17 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 had the lowest odds of a positive response with time.

Table 17: Within and between subject effects GEE for right upper flexion

Effect	Odds ratio	p-value
Time	0.45	<0.001
Group	0.77	0.383
Time*Group	**1.33**	<0.001

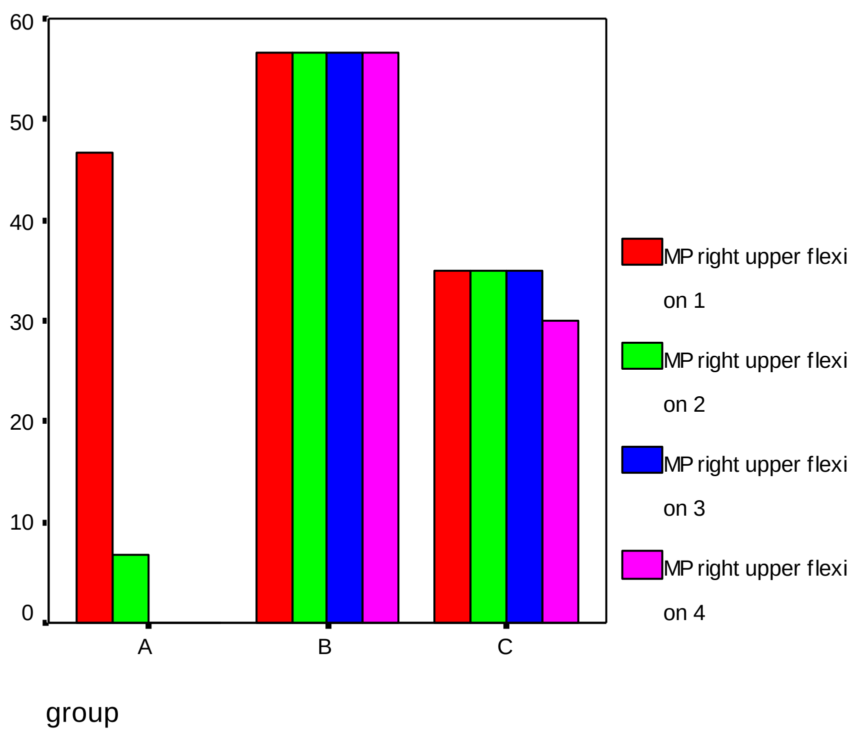

Figure 12: Proportion of positive subjects by group over time for right upper flexion

4.6.1.5.1.2. Right lower flexion:

For this outcome convergence of the statistical model was not achieved. This is due to there being no subjects who were positive in group A at any time point (See figure 13).

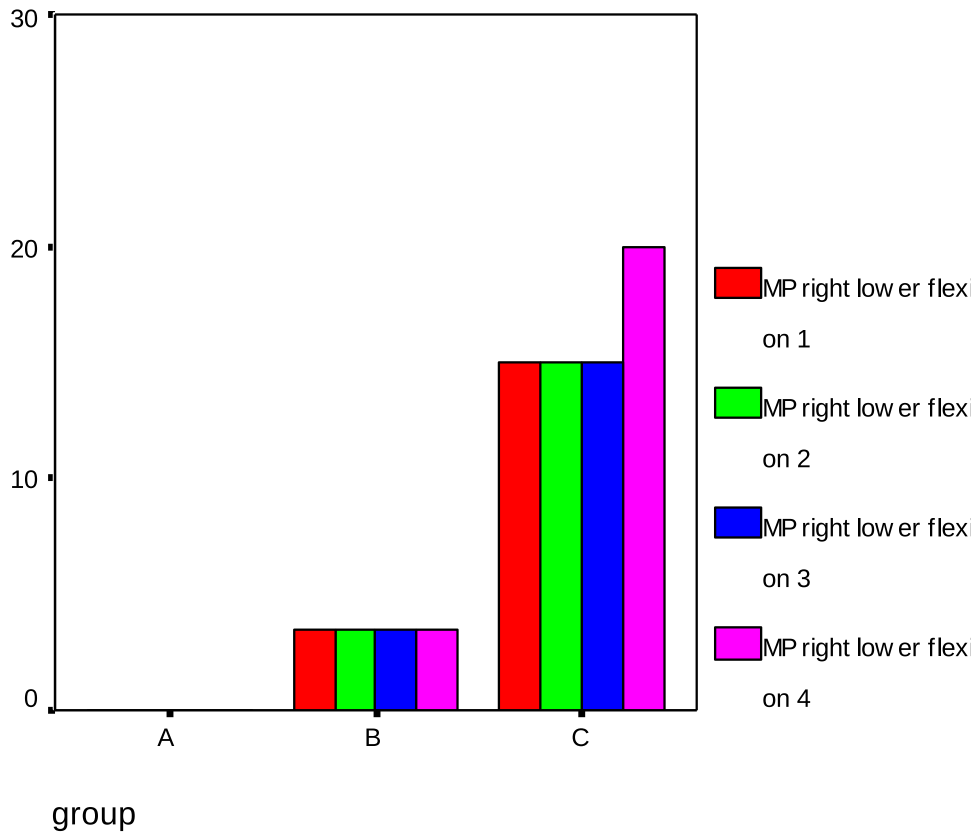

Figure 13: Proportion of positive subjects by group over time for right lower flexion

4.6.1.5.1.3. Right upper extension:

There was a significant treatment effect t for this outcome (p=0.015). Positive subjects were more likely to become negative over time in Group A than in the other groups (See Figure 14).

Table 18: Within and between subject effects GEE for right upper extension

Effect	Odds ratio	p-value
Time	0.24	0.014
Group	0.42	0.159
Time*Group	1.70	0.015

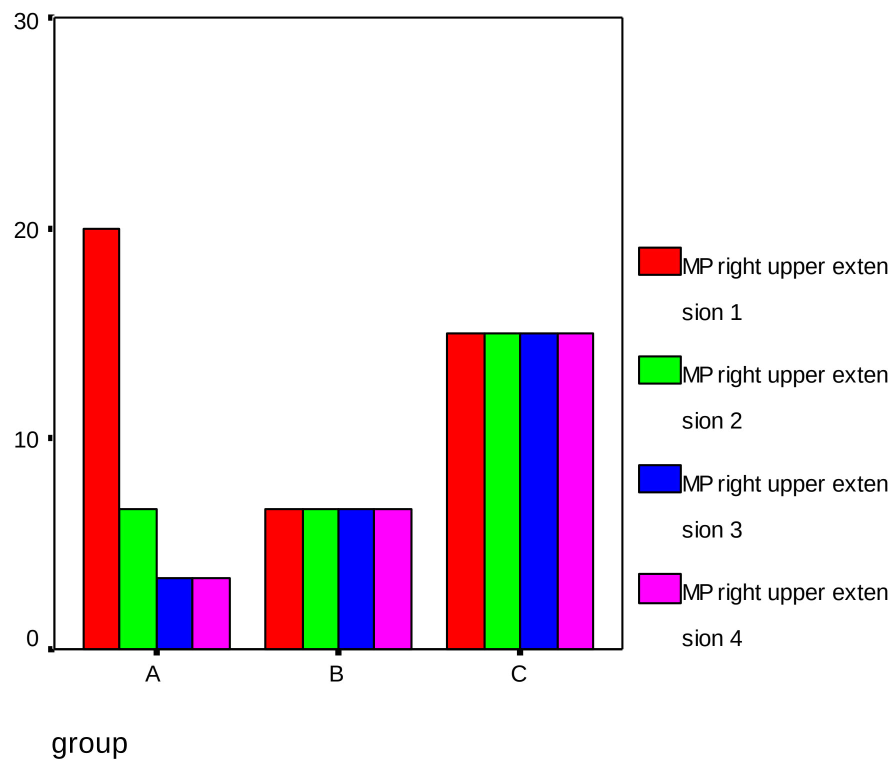

Figure 14: Proportion of positive subjects by group over time for right upper extension

4.6.1.5.1.4. Right lower extension

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.

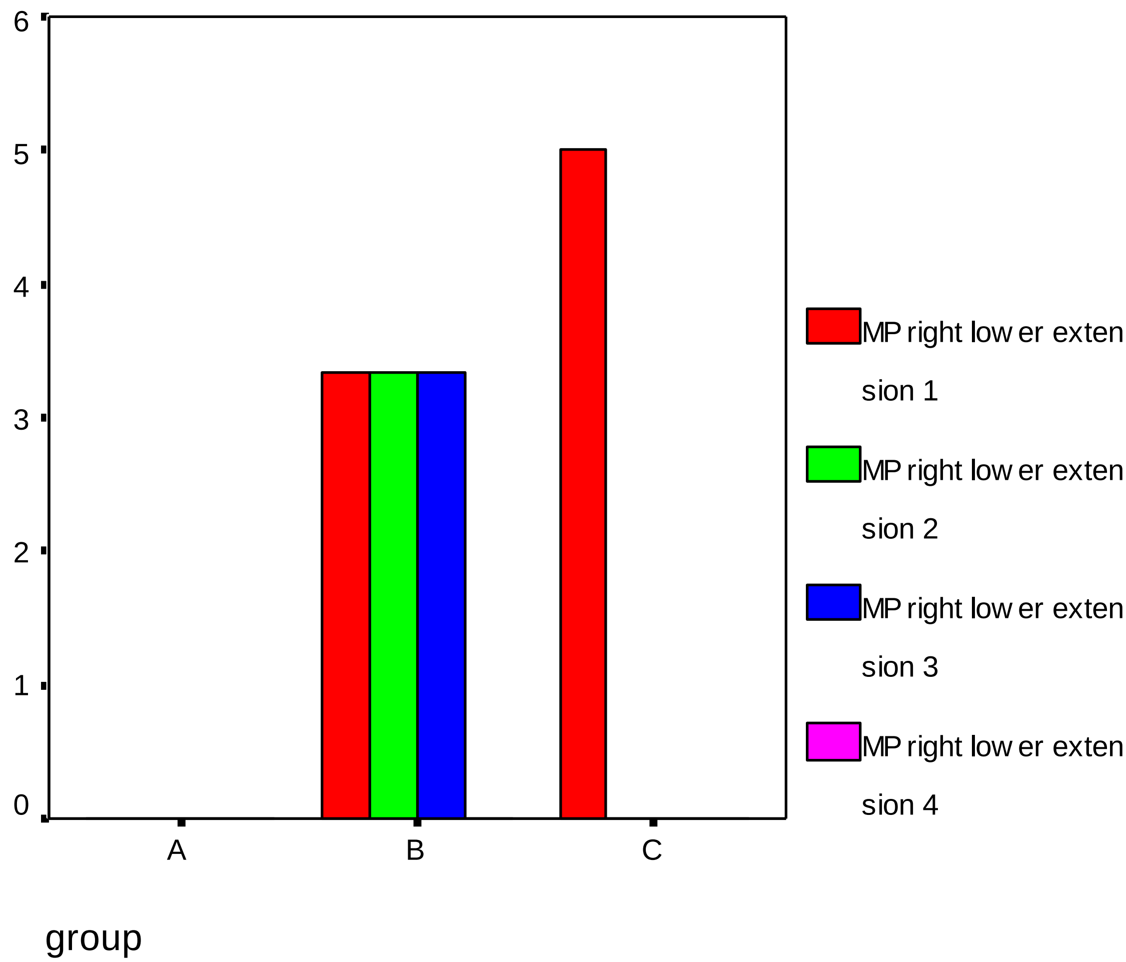

Figure 15: Proportion of positive subjects by group over time for right lower extension

4.6.1.5.1.5. 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 19: Within and between subject effects GEE for left upper flexion

Effect	Odds ratio	p-value
Time	0.24	<0.001
Group	0.85	0.602
Time*Group	1.78	<0.001

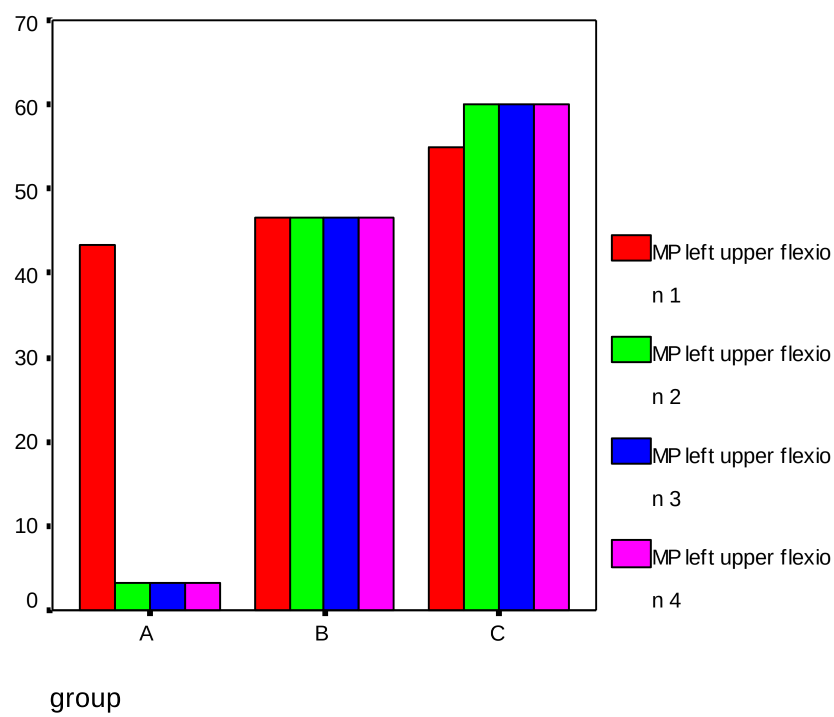

Figure 16: Proportion of positive subjects by group over time for left upper flexion

4.6.1.5.1.6. Left lower flexion:

No statistics could be computed for left lower flexion as there were no positive subjects in Group A at any time point (See Figure 17).

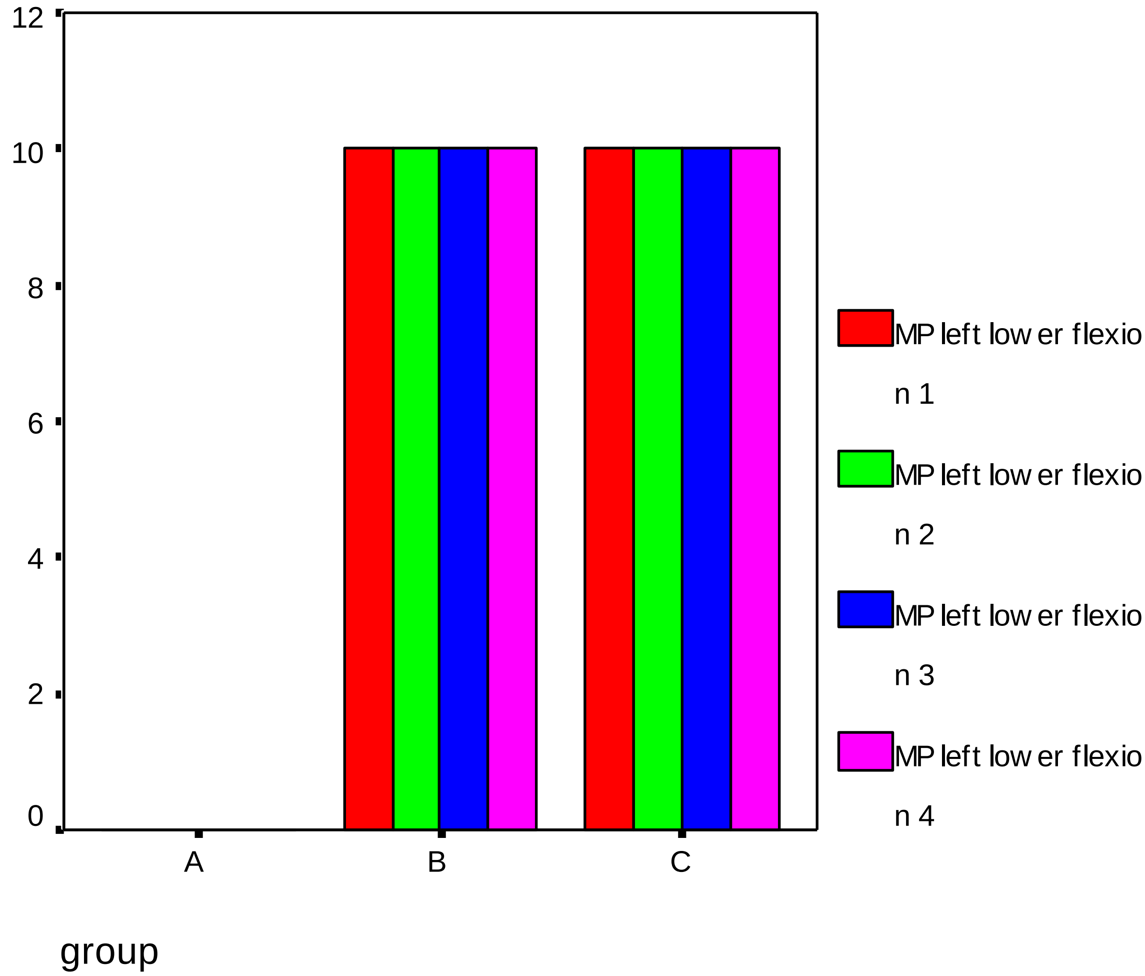

Figure 17: Proportion of positive subjects by group over time for left lower flexion

4.6.1.5.1.7. Left upper extension:

The percentage of positive subjects decreased dramatically in Group A and remained constant in the other two groups (Figure 18). Thus there was a significant treatment effect (p=0.004).

Table 20: Within and between subject effects GEE for left upper extension

Effect	Odds ratio	p-value
Time	0.08	0.006
Group	0.02	0.001
Time*Group	3.17	0.004

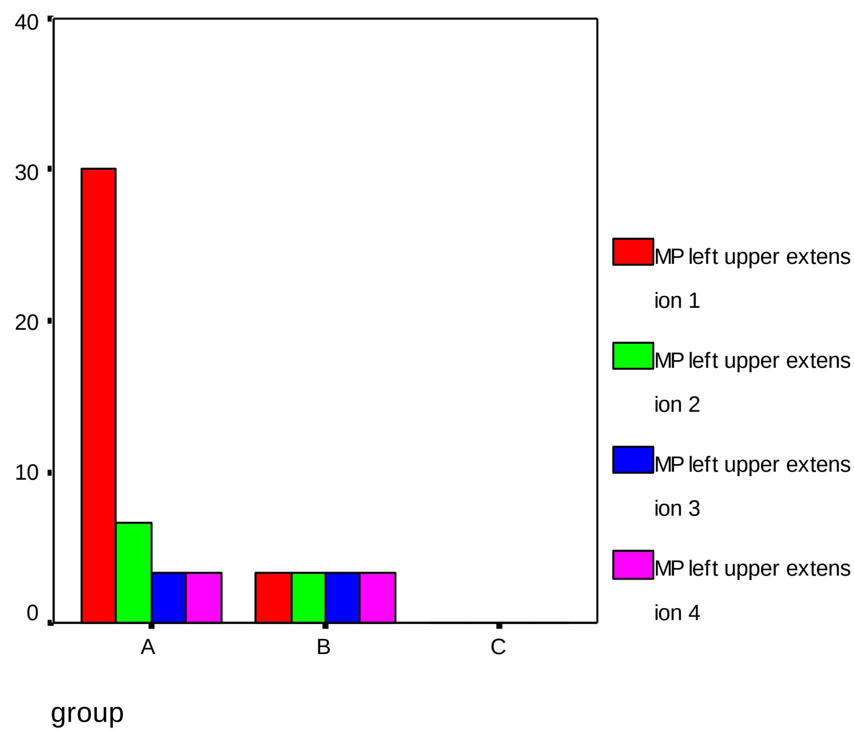

Figure 18: Proportion of positive subjects by group over time for left upper extension

4.6.1.5.1.8. Left lower extension

Statistics could not be computed for this outcome since there were no positive subjects in any of the groups at any time point.

Discussion of motion palpation findings

Group A (treatment group) indicates that after the initial treatment, there was significant resolution of upper flexion as well as upper extension restrictions bilaterally. Time was not significant in the resolution of any of the restrictions, which points to the possibility of an underlying resolution taking place e.g. resolution of inflammatory products which normally take 72 hours to resolve (Vizniak, 2003).

In Group B (placebo group) the restrictions were maintained for all of the different restrictions except for right lower extension restrictions where there was a resolution of the restriction after 24 hours. This could be attributed to the natural resolution / natural history of the restriction / condition. Another factor could be the psychophysical touch effect, which was found by Ventegodt et al., (2004) to facilitate holistic healing when touch is combined with therapeutic work on mind and feelings. This psychophysical touch effect is also supported by Weze et al., (2005) whose study of healing by gentle touch, showed statistically significant improvements in both psychological and physical functioning, especially with regards to stress reduction and pain relief. Thus, although group B did not have active treatment with regards to the drop piece toggle recoil adjustment, they still had physical contact with the examiner.

In applying the placebo adjustment to group B, the force was directed through the femur instead of the sacroiliac joint as was done in the toggle recoil drop piece adjustment in group A. This is another possibility for the lack of improvement in group B.

Group C (control group) shows mixed results. There is a combination of improvement, regression and no effect for the different fixations. 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). Another explanation for the regression could be that the subjects became aware that they were in a placebo group and the Hawthorne effect that could have occurred as explained in 4.5.

4.6.1.5.2. Orthopedic tests

A discussion of the results of the orthopaedic tests will follow at the end of the **orthopaedic tests** section (4.6.1.5.2.8.).

4.6.1.5.2.1. Faber Right

A true positive test was indicated by a decrease in abduction as well as pain in the sacroiliac joint, indicating sacroiliac dysfunction (Magee 1997:473).

There was a significant treatment effect for this outcome (p<0.001). Figure 19 shows that the percentage of positive subjects in group A decreased over time while in the other groups, it was relatively constant.

Table 21: Within and between subject effects GEE for Faber right

Effect	Odds ratio	p-value
Time	0.46	<0.001
Group	0.79	0.421
Time*Group	1.34	<0.001

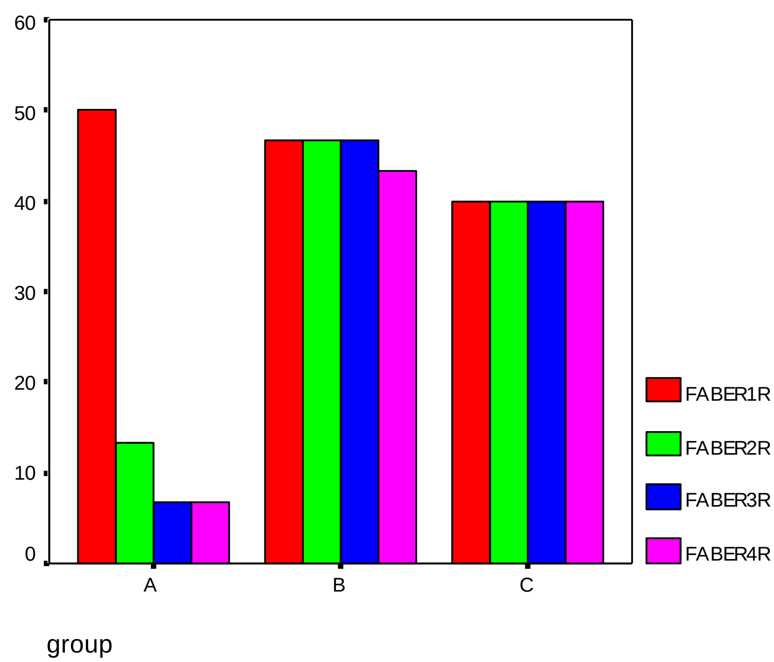

Figure 19: Proportion of positive subjects by group over time for Faber right

4.6.1.5.2.2. Faber left

A true positive test was indicated by a decrease in abduction as well as pain in the sacroiliac joint, indicating sacroiliac dysfunction (Magee 1997:473).

There was a significant benefit to treatment in Group A (p<0.001). Figure 20 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 22: Within and between subject effects GEE for Faber left

Effect	Odds ratio	p-value
Time	0.39	<0.001
Group	1.24	0.485
Time*Group	1.44	<0.001

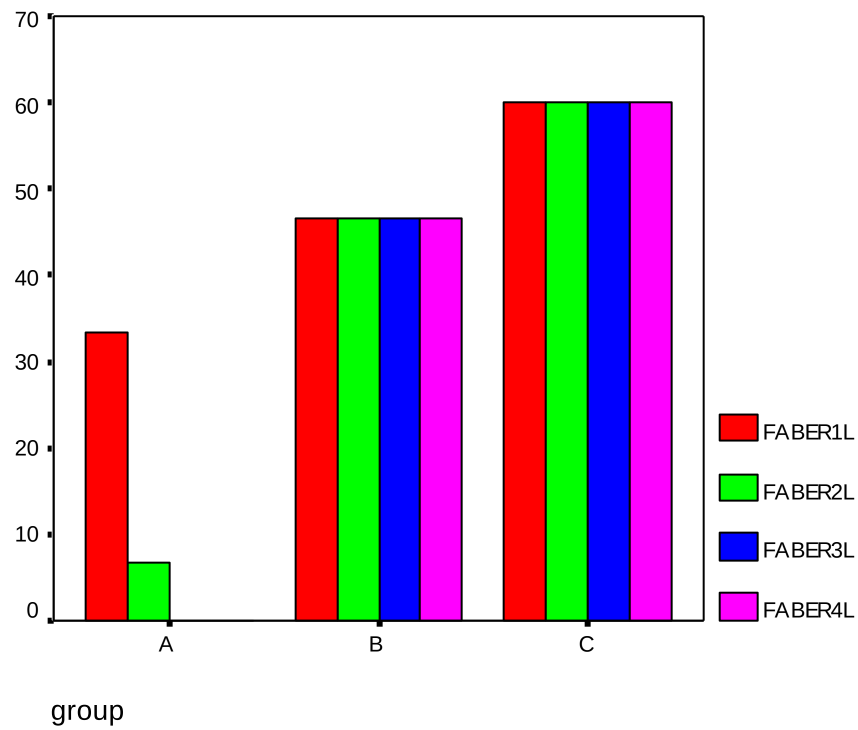

Figure 20: Proportion of positive subjects by group over time for Faber left

4.6.1.5.2.3. Gaenslens test right

A positive test was indicated by pain in the sacroiliac joint (Magee 1997:446).

For this outcome, there was a significant treatment effect (p = 0.001). Figure 21 shows that the proportion of positive subjects decreased at a faster rate in Group A than in the other two groups.

Table 23: Within and between subject effects GEE for Gaenslens right

Effect	Odds ratio	p-value
Time	0.25	0.001
Group	0.36	0.025
Time*Group	1.69	0.001

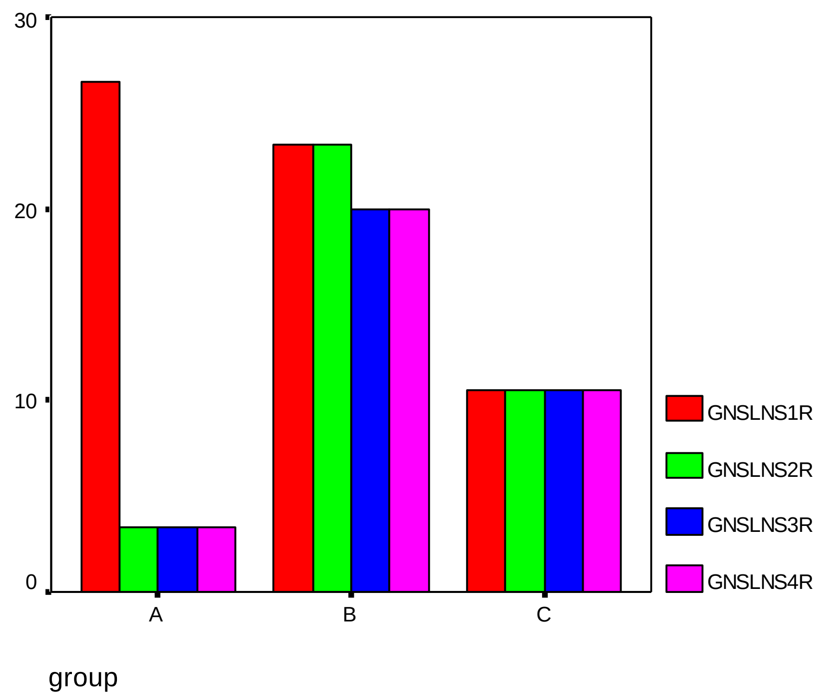

Figure 21: Proportion of positive subjects by group over time for Gaenslens right

4.6.1.5.2.4. Gaenslens left

A positive test was indicated by pain in the sacroiliac joint (Magee 1997:446).

This outcome showed a highly significant treatment effect (p<0.001). Figure 22 shows that the percentage of positives decreased over time in Group A, but not in the other two groups.

Table 24: Within and between subject effects GEE for Gaenslens left

Effect	Odds ratio	p-value
Time	0.46	0.001
Group	1.20	0.639
Time*Group	1.34	<0.001

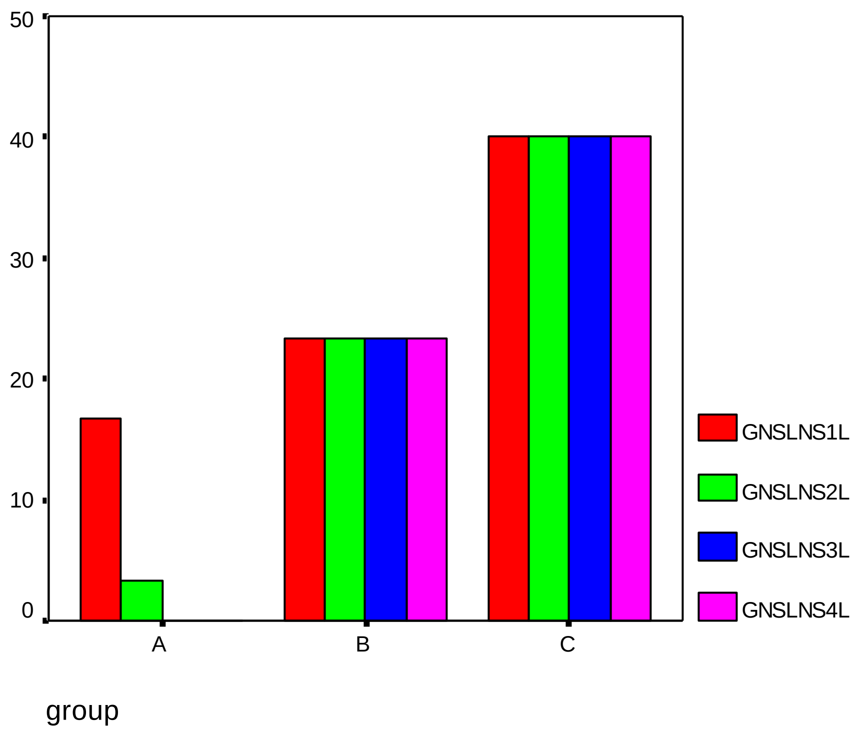

Figure 22: Proportion of positive subjects by group over time for Gaenslens left

4.6.1.5.2.5. Yeoman right

Pain in the sacroiliac joint indicated a positive test (Schaefer and Faye 1990:271).

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 23).

Table 25: Within and between subject effects GEE for Yeoman right

Effect	Odds ratio	p-value
Time	0.37	<0.001
Group	0.66	0.198
Time*Group	1.46	<0.001

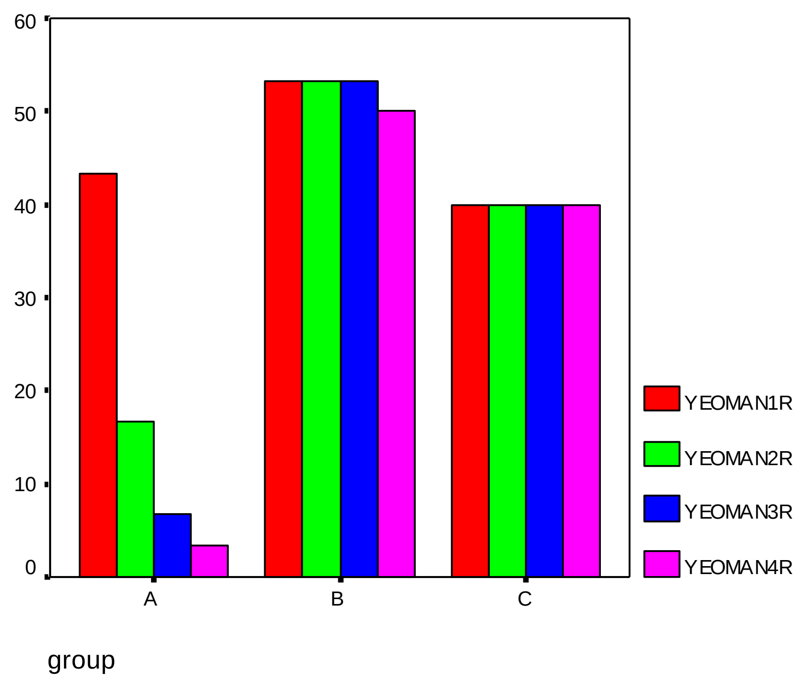

Figure 23: Proportion of positive subjects by group over time for Yeoman right

4.6.1.5.2.6. Yeoman left

Pain in the sacroiliac joint indicated a positive test (Schaefer and Faye 1990:271).

There was a highly significant treatment effect for Yeoman left test (p<0.001). Figure 24 shows that the percentage of positive subjects decreased in Group A but not in the other two placebo groups.

Table 26: Within and between subject effects GEE for Yeoman left

Effect	Odds ratio	p-value
Time	0.52	<0.001
Group	1.16	0.630
Time*Group	1.30	<0.001

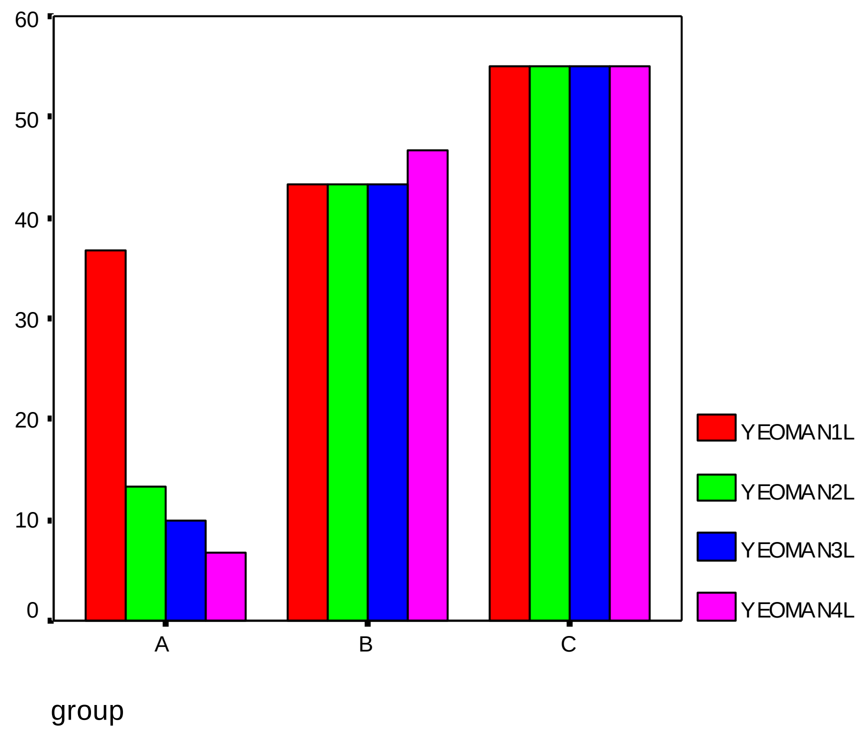

Figure 24: Proportion of positive subjects by group over time for Yeoman left

4.6.1.5.2.7. Shear Right

A positive test was indicated by pain over the sacroiliac joint (Laslett and Williams 1994).

A significant treatment effect was found for this outcome ($p = 0.001$). Group A subjects became less positive over time than those in the other groups (Figure 25).

Table 27: Within and between subject effects GEE for Shear right

Effect	Odds ratio	p-value
Time	0.46	<0.001
Group	0.42	0.045
Time*Group	1.36	0.001

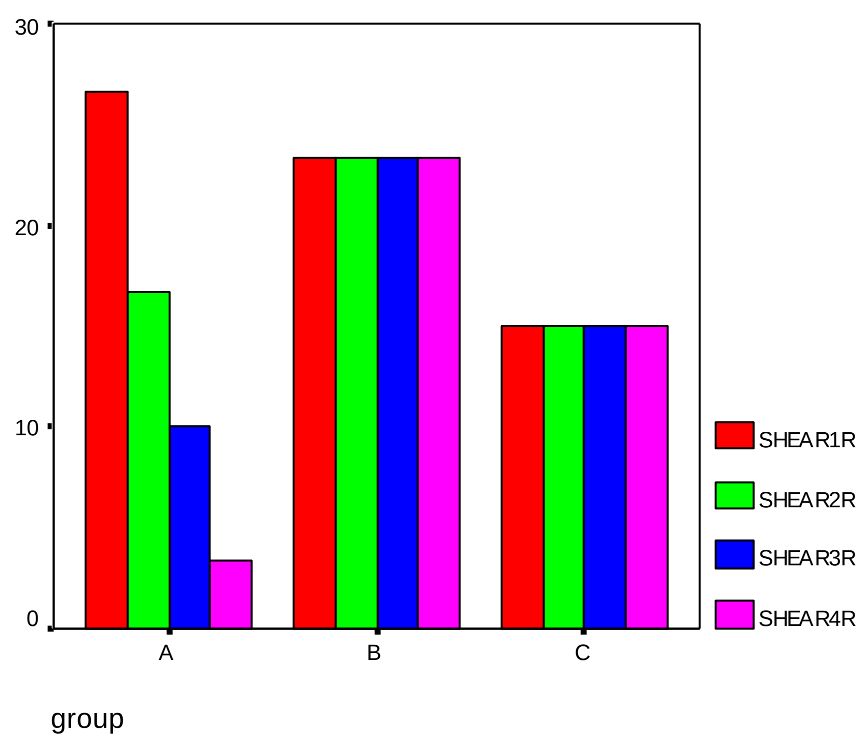

Figure 25: Proportion of positive subjects by group over time for Shear right

4.6.1.5.2.8. Shear left

A positive test was indicated by pain over the sacroiliac joint (Laslett and Williams 1994).

There was no statistical evidence of a treatment effect for this outcome (p = 0.115). Figure 26 shows that the proportion of positives decreased in Group A and not in the other two groups. However, the prevalence of positivism for this outcome was low and this may be the reason for the interaction not reaching statistical significance.

Table 28: Within and between subject effects GEE for Shear left

Effect	Odds ratio	p-value
Time	0.58	0.107
Group	0.78	0.679
Time*Group	1.23	0.115

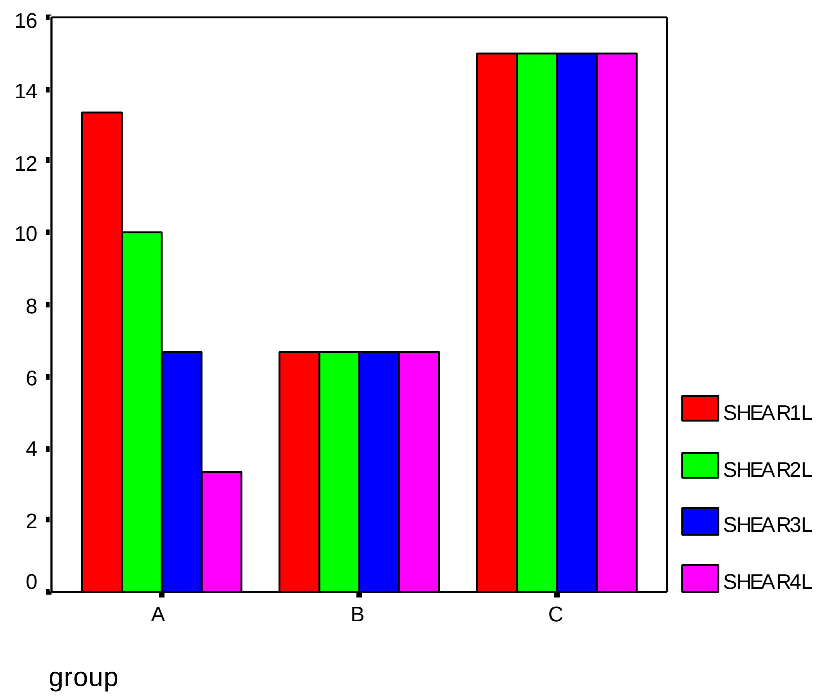

Figure 26: Proportion of positive subjects by group over time for shear left

Discussion of Orthopaedic tests

Group A (treatment group) showed significant improvement for all the orthopaedic tests, but that time was not significant, could point to the underlying resolution of e.g. inflammation as explained in 4.6.1.5.1.8.

In addition, the initial improvement could be as a result of the mechanical restoration of the sacroiliac joint and re-alignment of the joint surfaces, resulting in restoration of normal movement and muscle relaxation.

Mense, Gatterman and Goe (Leach 1994: 103 - 104) states that an excess stimulation of the nociceptors, by means of the inflammation and inflammatory products built up, occurs during the pathogenesis of the sacroiliac dysfunction. The adjustment of the sacroiliac joint and resultant depolarisation of the hyperpolarised segments of the spinal cord has been suggested as a mechanism in the normalisation of the pathological neural pathways (Patterson and Steinmetz, 1986 in Leach, 1994: 101). This would then facilitate the relaxation of all tissues that were previously irritated. This results in a resolution of the dysfunction and aids in allowing for resolution of the inflammatory processes.

In group B (placebo group) some of the subjects improved and some regressed further within the 24 hours after the initial placebo adjustment. This can be attributed to the natural resolution or aggravation of the sacroiliac dysfunction. The psychophysical touch effect, as well as the area the force was directed at (as explained in 4.6.1.5.1.8) was also to be considered.

All the orthopaedic tests results remained constant in the group C (control group), which indicates that no resolution of the dysfunction occurred.

4.6.2. Intra-group correlation analysis - Quantitative outcomes

Table 29: Spearman's correlation between change in inclinometer, algometer and NRS measurements in Group A

		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 NRS
change in active internal left	Correlation Coefficient	1.000	.261	.057	-.195	-.077	-.048	.020	-.559(**)	-.324	-.046
	Sig. (2-tailed)	.	.164	.766	.301	.687	.803	.915	.001	.081	.808
change in active external left	Correlation Coefficient	.261	1.000	-.279	.277	.177	-.044	-.257	-.047	-.042	-.126
	Sig. (2-tailed)	.164	.	.135	.139	.349	.818	.170	.807	.826	.506
change in passive internal left	Correlation Coefficient	.057	-.279	1.000	-.004	-.087	-.238	.085	.132	-.020	-.197
	Sig. (2-tailed)	.766	.135	.	.982	.647	.205	.656	.485	.917	.297
change in passive external left	Correlation Coefficient	-.195	.277	-.004	1.000	-.081	-.164	-.340	.107	.610(**)	.193
	Sig. (2-tailed)	.301	.139	.982	.	.669	.388	.066	.575	.000	.308
change in active internal right	Correlation Coefficient	-.077	.177	-.087	-.081	1.000	.228	.196	.291	.105	-.321
	Sig. (2-tailed)	.687	.349	.647	.669	.	.226	.299	.119	.580	.084
change in active external right	Correlation Coefficient	-.048	-.044	-.238	-.164	.228	1.000	.071	.073	-.167	.202
	Sig. (2-tailed)	.803	.818	.205	.388	.226	.	.711	.701	.378	.285
change in passive internal right	Correlation Coefficient	.020	-.257	.085	-.340	.196	.071	1.000	-.249	.012	-.454(*)
	Sig. (2-tailed)	.915	.170	.656	.066	.299	.711	.	.185	.951	.012
change in passive external right	Correlation Coefficient	-.559(**)	-.047	.132	.107	.291	.073	-.249	1.000	.209	.132
	Sig. (2-tailed)	.001	.807	.485	.575	.119	.701	.185	.	.269	.487
change in algometer	Correlation Coefficient	-.324	-.042	-.020	.610(**)	.105	-.167	.012	.209	1.000	.047
	Sig. (2-tailed)	.081	.826	.917	.000	.580	.378	.951	.269	.	.807
change in NRS	Correlation Coefficient	-.046	-.126	-.197	.193	-.321	.202	-.454(*)	.132	.047	1.000
	Sig. (2-tailed)	.808	.506	.297	.308	.084	.285	.012	.487	.807	.

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

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

Table 30: Significant correlations for group A.

Motion 1	Relation	Motion 2	Value	Explanation
active internal left	_	Passive external right	.001	No explanation of the relationship between these 2 movements exists as the relationship infers that there is increased hip active internal rotation (left) which implies that there is increased function of the iliopsoas, when compared to the changes in the contralateral piriformis which is indicated to decrease implying an increase in the tonicity of the contralateral iliopsoas. From the following discussion it is hypothesised that the iliopsoas muscles are affected equally and therefore an inverse relationship cannot at this stage be explained.
passive external left	+	Algometer	.000	Korr (in Leach 1994:98) states that restoration of the joint movement will result in associated muscle relaxation. This results in: 1. An increase in the stimulation of the mechanoreceptors in and around the joint. This stimulation allows for increased type A (large) fiber stimulation, which is thought to activate the gate control theory decreasing pain. 2. This mechanical overriding of the pain fibers may also have been enhanced by the psychophysical effect of touch, which would also stimulate these receptors.
passive internal right	_	NRS	.012	The same principle as the point above is applicable.

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).

Table 32: Significant correlations for group B.

Motion 1	Relation	Motion 2	Value	Explanation
active internal left	+	passive internal left	.007	1. With the drop table section, the iliopsoas muscle will be stretched irrespective of the patient positioning. This sudden stretch on the iliopsoas muscle causes resultant muscle relaxation (agonists and antagonists) which allows for increased movement actively and passively due to the fact that the muscle has returned to its normal physiological state (post relaxation), allowing for the muscle to achieve maximum contraction ability. 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.
active external left	+	passive external left	.030	Refer to explanation 1. and 2. above.
	_	active internal right	.012	
passive external left	+	active internal right	.001	Refer to explanation 1. and 2. above.
	+	active external right	.018	
	+	passive internal right	.003	
	+	passive external right	.009	
active internal right	+	passive internal right	.030	Explanation 1. and 2. above can be applied for the increased ROM.
	+	algometer	.022	The associated increase with respect to the algometer may be due to the natural history of resolution of the dysfunction.
active external right	+	passive external right	.001	Refer to explanation 1. and 2. above. For the change in NRS, refer to the points 1. and 2. in table 30 above.
	_	current NRS	.002	
passive internal right	+	passive external right	.003	Refer to explanation 1. and 2. above. For the change in NRS, refer to the points 1. and 2. in table 30 above.
	_	current NRS	.023	
algometer	_	current NRS	.027	Refer to the points 1. and 2. in table 30 above.

Table 33: 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).

Table 34: Significant correlations for group C.

Motion 1	Relation	Motion 2	Value	Explanation
active external left	_	passive internal right	.049	No explanation of the relationship between these 2 movements exists as the relationship infers that there is increased hip active external rotation (left) which implies that there is increased function of the piriformis, when compared to the changes in the contralateral iliopsoas which is indicated to decrease implying an increase in the tonicity of the contralateral piriformis. From the following discussion it is hypothesised that the iliopsoas muscles are affected equally and therefore an inverse relationship cannot at this stage be explained.
active internal right	+	passive internal left	.002	1. With the drop table section, the iliopsoas muscle will be stretched irrespective of the patient positioning. This sudden stretch on the iliopsoas muscle causes resultant muscle relaxation (agonists and antagonists) which allows for increased movement actively and passively due to the fact that the muscle has returned to its normal physiological state (post relaxation), allowing for the muscle to achieve maximum contraction ability. 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.
	+	passive external left	.023	
active internal right	+	passive external right	.042	Refer to points 1. and 2. above.

4.7. Summary

This study found that treatment received in Group A lead to significantly improved recovery according to almost all of the outcomes measured. In the one outcome where no significant treatment effect was found, a trend towards a better recovery in Group A was demonstrated but due to small numbers with the outcome this was not statistically significant. 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.

In respect of the hypotheses stated at the outset of the study:

- Hypothesis one: Patients receiving the toggle recoil drop piece adjustment will improve significantly in terms of objective clinical findings, when compared to the placebo group.

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

- Hypothesis two: Patients receiving the toggle recoil drop piece adjustment will improve significantly in terms of subjective clinical findings, when compared to the placebo group.

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

- Hypothesis three: Patients receiving the toggle recoil drop piece adjustment 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 dysfunction.

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

- Hypothesis four: Patients receiving the toggle recoil drop piece adjustment will improve significantly in terms of objective clinical findings, when compared to the control placebo group.

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

- Hypothesis five: Patients receiving the toggle recoil drop piece adjustment will improve significantly in terms of subjective clinical findings, when compared to the control placebo group.

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

- Hypothesis six: Patients receiving the toggle recoil drop piece adjustment 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 dysfunction.

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

- Hypothesis seven: Patients receiving the placebo and control placebo intervention will show no significant improvement or difference between the two groups in terms of objective clinical findings.

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

- Hypothesis eight: Patients receiving the placebo and control placebo intervention will show no significant improvement or difference between the two groups in terms of subjective clinical findings.

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

- Hypothesis nine: 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 dysfunction.

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

- Hypothesis ten: There will be no psychophysical touch effect in the treatment of sacroiliac dysfunction 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

CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

The aim of this study was to determine the effect of a toggle recoil drop piece adjustment technique in the treatment of sacroiliac dysfunction in terms of objective and subjective measures.

After analysing all the results, it was found that there was a significant improvement with respect to all subjective (sacroiliac range of motion, hip range of motion, algometer and orthopedic tests) and objective measures (NRS), after a single toggle recoil drop piece adjustment.

With respect to groups B and C, there were no significant improvements in any of the subjective or objective measures. This indicates the absence of any mechanical effect. However, regard was given to placebo or psychophysical effects in any improvement that did occur.

It would seem, based on this research, that a toggle recoil drop piece adjustment is effective for the treatment of sacroiliac dysfunction when applied in terms of the technique.

5.2. Recommendations

Due to the fact that the sample size was relatively small, added to which, there has been no similar research found in this particular area, it is suggested that this research is a pilot study. Therefore, further studies should use a larger sample size, which would strengthen the conclusions made in this study. It would also ensure that subtle changes in the objective data be ascertained.

To ensure more statistically significant results and homogeneity within the sample group, it is recommended that stratification be included in future studies. For example stratification could be employed with respect to the severity of complaint, race and type of motion palpation findings.

Placebo patients should be placed in the 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.

As a pilot study the subjects only received one adjustment. As seen in chapter 4, some of the restrictions were not completely resolved after the initial treatment. Therefore it is suggested that a follow up study should include a treatment protocol of more than one adjustment.

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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
< Hospitalisations

6. Current health status and life-style:

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

7. Immediate Family Medical History:

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

8. Psychosocial history:

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

9. Review of Systems:

< General

< Skin

< Head

< Eyes

< Ears

< Nose/Sinuses

< Mouth/Throat

< Neck

< Breasts

< Respiratory

< Cardiac

< Gastro-intestinal

< Urinary

< Genital

< Vascular

< Musculoskeletal

< Neurologic

< Haematologic

< Endocrine

< Psychiatric

Appendix B:

Physical

Durban Institute of Technology

PHYSICAL EXAMINATION: SENIOR

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:_____________
_____

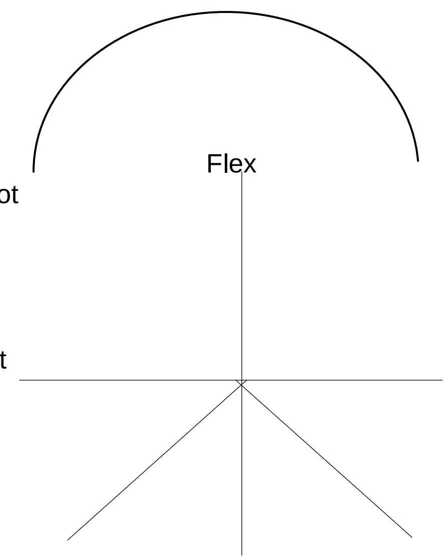
STANDING:

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

DURBAN INSTITUTE OF TECHNOLOGY

Patient Name: ***File #:*** ***Page:***

Date: ***Visit:*** ***Intern:***
Attending Clinician: ***Signature:***

S: ***Numerical Pain Rating Scale (Patient)*** ***Intern Rating***
Least 0 1 2 3 4 5 6 7 8 9 10 Worst

A:

0:

P:

E:

Special attention to: ***Next appointment:***

Date: ***Visit:*** ***Intern:***
Attending Clinician: ***Signature:***

S: ***Numerical Pain Rating Scale (Patient)*** ***Intern Rating***
Least 0 1 2 3 4 5 6 7 8 9 10 Worst

A:

O:

P:

E:

Special attention to: ***Next appointment:***

Date: ***Visit:*** ***Intern:***
Attending Clinician: ***Signature***

S: ***Numerical Pain Rating Scale (Patient)*** ***Intern Rating***
Least 0 1 2 3 4 5 6 7 8 9 10 Worst

A:

O:

P:

E:

Special attention to: ***Next appointment:***

Patient Name: ***File #:*** ***Page:***

Date: ***Visit:*** ***Intern:***
Attending Clinician: ***Signature:***

S: ***Numerical Pain Rating Scale (Patient)*** ***Intern Rating***
Least 0 1 2 3 4 5 6 7 8 9 10 Worst

A:

0:

P:

E:

Special attention to: ***Next appointment:***

Date: ***Visit:*** ***Intern:***
Attending Clinician: ***Signature:***

S: ***Numerical Pain Rating Scale (Patient)*** ***Intern Rating***
Least 0 1 2 3 4 5 6 7 8 9 10 Worst

A:

O:

P:

E:

Special attention to: ***Next appointment:***

Date: ***Visit:*** ***Intern:***
Attending Clinician: ***Signature***

S: ***Numerical Pain Rating Scale (Patient)*** ***Intern Rating*** ***Least*** ***0 1 2 3 4 5 6 7 8 9 10*** ***Worst*** ☐	***A:***
O:	***P:*** ***E:***
Special attention to:	***Next appointment:***

Appendix E:

Advertisement

<u>Do you suffer from</u>

LOW BACK PAIN?

<u>Are you between 20 and 55 years of age</u>

<u>**If you do, you may qualify for**</u>
<u>FREE **Chiropractic treatment at the DIT chiropractic day clinic.**</u>

For further information
Contact: Ronél

Tel: 031 204 2205

Appendix F:

Informed consent form

INFORMED CONSENT FORM
(To be completed by patient / subject)

Date	**:**
Title of research project	**:** The efficacy of a toggle recoil drop piece adjustment technique in the treatment of sacroiliac dysfunction.
Name of supervisor	**:** Dr.C.Korporaal
Tel	**:** (031) 2042611
Name of research student	**:** Ronél Jacobs
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 toggle recoil drop piece adjustment technique in the treatment of sacroiliac dysfunction.

Supervisors: Dr C. Korporaal (031-2042205)

Research student: Ronél Jacobs (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 dysfunction).

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 as well as 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 dysfunction.
- 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 found above.

Thank you for your participation.

____

Ronél Jacobs
(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 ____________

Was the adjustment comfortable? ☐ Yes ☐ No

If No, describe
the discomfort:

Period of time that the patient has had low back pain