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THE EFFICACY OF SACROILIAC ADJUSTMENTS VERSUS PUBIC SYMPHYSIS ADJUSTMENTS IN THE TREATMENT OF SACROILIAC JOINT DYSFUNCTION

A research dissertation presented to the Faculty of Health Sciences, University of Johannesburg, as partial fulfilment for the Masters Degree in Technology, Chiropractic by

Jasantha Naidoo

(Student number: 200601861)

Supervisor: __________________                         Date: _____________________

Dr. M. Moodley
DECLARATION

I, Jasantha Naidoo, declare that this dissertation is my own, unaided work. It is being submitted as partial fulfilment for the Masters Degree in Technology, in the program of Chiropractic, at the University of Johannesburg. It has not been submitted before for any degree or examination in any other University or Technikon.

_______________________
Jasantha Naidoo

On this day the ____ of the month of __________ 2014.
AFFIDAVIT

MASTER’S AND DOCTORAL STUDENTS

TO WHOM IT MAY CONCERN

This serves to confirm that I Jasantha Naidoo

ID number 8812120058086

Student number 200601861 enrolled student for the

Qualification MTech Chiropractic

Faculty of Health Sciences

Herewith declare that my academic work is in line with the Plagiarism Policy of the University of Johannesburg. I further declare that the work presented in the efficacy of sacroiliac joint adjustments versus pubic symphysis adjustments in the treatment of sacroiliac joint dysfunction (minor dissertation) is authentic and original, and that there is no copyright infringement in the work. I declare that no unethical research practices were used or material gained through dishonesty. I understand that plagiarism is a serious offence.

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ABSTRACT

Purpose: This study aims to compare sacroiliac joint adjustments versus pubic symphysis adjustments in the treatment of sacroiliac joint dysfunction with regards to pain and disability as well as alternative treatment approaches in treating sacroiliac joint dysfunction.

Method: This study was a comparative study that consisted of two groups of fifteen participants each. The participants were between the ages of eighteen and forty five with an equal male to female ratio. The potential participants were examined and accepted according to the inclusion and exclusion criteria for the study. The method of treatment that was administered was determined by group allocation. Group 1 received Chiropractic manipulative therapy delivered to the restricted sacroiliac joint and Group 2 received Chiropractic manipulative therapy delivered to the pubic symphysis.

Procedure: Treatment consisted of six treatment sessions with an additional follow up consultation over a three week period. Objective and subjective data was measured at the beginning of the 1st, 4th and 7th consultations. Subjective readings were taken from The Oswestry Pain and Disability Questionnaire as well as The Numerical Pain Rating Scale. Objective measurements were taken from The Orthopaedic Rating Scale. Analysis of the data collected throughout the study were performed by a statistician. The Chiropractic manipulative techniques used were based on restrictions identified during motion palpation and were applied at the first six consultations, with the seventh consultation consisting of data collection only.
**Results:** Clinically significant improvements in Group 1 and Group 2 were seen over the course of the study, however Group 2 performed better to a certain extent with regard to pain and disability. Statistically significant results were also noted in Group 1 and Group 2 over the course of the study with both Groups showing equal improvements and neither one showing superiority over the other.

**Conclusion:** The results show that both treatment protocols were effective in treating sacroiliac joint dysfunction with regard to pain and disability. Pubic symphysis adjustments proved to be preferential as it had a clinically greater improvement in treating sacroiliac dysfunction. However, when both groups are compared on a statistical level, sacroiliac joint adjustments and pubic symphysis adjustments were both as effective in the treatment of sacroiliac joint adjustments.
DEDICATION

To my Mum and Dad, I could never have done this without your faith, support and constant encouragement. Thank you for teaching me to believe in myself, in God and in my dreams. Thank you for helping to make me who I am, for showing me how to be strong, for giving me the courage to be weak and the strength to always strive for better as well as the wisdom to know when to turn away and when to charge ahead. I hope that this achievement will complete the dream that you both had for me all those many years ago when you chose to give me the best education you could. Both of you are my rocks and foundation.

To my brother, Keagan, thank you for always being there for me when things seemed to go wrong. Its that faith you have in me that makes our bond so great. Thank you for all late nights you stayed up to lend a hand as well as the unconditional love you have for me. Your passion for “doing what you love” flows through my veins and I am blessed to have your love and support.

To the love of my life, my best friend, my biggest fan and the person who has caught me everytime I fell. You never let go, Chris. Thank you for believing in my dream and sharing my passion of chiropractic. I am blessed to have someone like you in my life. Your support, patience and love kept me moving forward when I wasn’t sure I was.

Thank you to all my friends for sharing my happiness when starting this project and following with encouragement and support when it seemed to difficult to complete.
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To Dr Sharon Moonsamy, thank you for putting in voluntary hours to help me polish this piece into something presentable, for that I am very grateful. Through your kind words and willingness to always help, I realised I could be proud of all my efforts, regardless of the product.

To Dr Petra Gaylard, my statistician, thank you for all you hard work and going way above and beyond to help me. It is really appreciated.

To Laura Jessica Soal, thank you for assisting me in compiling the topic for this dissertation.

Lastly, to Adriaan Nel for taking time out to sit with me and sieve through all the statistics. Thank you, I am grateful to you.
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CHAPTER 1 - INTRODUCTION

1.1 The Problem Statement

Pain sited in the lumbar region of the spine can be attributed to many causes, and, in almost 80% of cases, they cannot be recognised with certainty. Nearly 80% of patients with low back pain are affected by simple, non-specific low back pain, which is either pain in the lower lumbar region or leg pain which is not related to an anatomical or functional abnormality and lacks any underlying malignant, neoplastic, infectious or inflammatory disease. It is highly probable that sacroiliac dysfunction exists and causes pain in the low back, therefore the possibility of pathological involvement of the sacroiliac joints must not be forgotten (Monticone, Barbarino, Testi, Arzano, Moschi, Negrini 2004).

Bernard and Kirkaldy-Willis (1987) conducted a study in which it was concluded that the sacroiliac joint was the primary source of back pain in 22.5% of 1293 patients presenting with back pain. At the beginning of the twentieth century, the sacroiliac joint was believed to be the most important source of low back pain (Weksler and Velan, 2007).

The uncertainty and lack of awareness of the sacroiliac joint as a pain generator in the course of the last century has, in various ways, played a part in the lack of diagnostic uncertainty and in turn led to only a few available treatment options when addressing this joint (Hansen and Helm, 2003). Numerous treatments have been applied by clinicians in the treatment of sacroiliac dysfunction, although research into their efficiency remains sparse and even fictional (Ferrante and King, 2001).

Chiropractic manipulative therapy, amounts to a series of manipulations commonly administered in the treatment of individuals with low back pain and
has been reported to be more effective than placebo or other interventions (Kamali and Shokri, 2012).

Chiropractic manipulative therapy has numerous effects on the human body: decrease in pain and muscle tension (Kiraldy-Willis and Cassidy, 1985), an increase in skin pain tolerance levels (Terrett and Vernon, 1984), as well as an increase in range of motion (Bergman, Peterson and Lawrence, 1993).

1.2 Aim

The aim of this study was to determine the most effective way of treating sacroiliac dysfunction by either using sacroiliac or pubic symphysis adjustments as well as assist interventional pain physicians to apply suitable treatment decisions and reasoning to their patients in pain. This study also aims to characterise the sacroiliac joint as a pain generator and investigate its contribution to low back pain.

1.3 Benefits of this study

The proposed benefits of this study were to identify the most effective treatment protocol for individuals suffering from sacroiliac dysfunction. The two posterior joints and the anterior pubic symphysis have been likened to an atypical motion segment with sacroiliac joint guiding the motion. Therefore this three joint complex is a closed kinetic chain with each articulation having interaction with each of the other joints in the pelvic ring (Gatterman, 2005).

The benefits of this study were also to encourage support or criticism of the results and outcome of the study as well as provide guidelines that may be applied by physicians. Such guidelines should however be judged within the holistic context of the skill and practice patterns currently administered by practitioners.
The following literature review will involve an in depth analysis into the anatomical structure of the sacroiliac joint as well as the pubic symphysis and its surrounding ligaments, innervations and blood supply. It will discuss the biomechanical changes that arise with dysfunction at the sacroiliac joint and pubic symphysis. The treatment procedure with regard to the adjustment techniques will also be explained.
CHAPTER 2 - LITERATURE REVIEW

2.1 Introduction

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

Low back pain is a significant health problem which has had a substantial impact on the quality of life and health care costs (Weiner and McCulloch, 2000).

Sacroiliac joint dysfunction is described as pain and a decreased mobility of the sacroiliac joint due to the mechanical disturbance of the sacroiliac joint (Cassidy and Burton, 1992). Despite the high incidence of low back pain being attributed to sacroiliac joint involvement (Kirkaldy-Willis and Burton, 1992), the sacroiliac joint is still frequently viewed as an “enigma” by medical practitioners (McCulloch and Transfeldt, 1997). Toussaint, Gawlik, Rehder and Ruther (1999), established that the prevalence of sacroiliac dysfunction in the general population lies anywhere between 19.3% and 47.9%.

Sacroiliac dysfunction is a well known contributor to low back pain. In osteopathic literature, it is proposed that one third of all low back pain cases arise from a sacroiliac joint disorder (Dejung, 1985).

Spinal manipulative therapy has been shown to be very effective in the treatment of sacroiliac dysfunction (Gatterman, Cooperstein, Lantz, Perle and Schneider, 2001).
Very little research has been done in the evaluation and comparison of different chiropractic techniques and the combination thereof, in the efficacy of treating sacroiliac dysfunction. The diversified side posture adjustment used on the sacroiliac joint alone is one of the most widely used techniques today (Christensen, Kerkoff and Kollach, 2000).

The following chapter aims to generate a clear understanding with regard to incidence, definition, diagnosis and treatment of sacroiliac dysfunction, as well as outline the appropriate and pertinent anatomy and biomechanics of the sacroiliac joint and pubic symphysis.

2.2 Incidence and Prevalence of Sacroiliac Dysfunction

The range of illness and morbidity that is associated with low back pain is broad. For much of the population, periods of back pain are self limited and usually settle without specific therapy. For other individuals however, back pain is repeated or chronic, leading to continuous pain which hinders employment and quality of life. Rarely will acute low back pain be a manifestation of serious medical illness of which includes malignancy, infection or other systemic diseases (Wheeler, Wiph, Staiger and Deyo, 2013).

Surveys that were conducted in Canada and Europe showed that the prevalence of low back pain is between 22 - 48% (Cassidy, Carroll and Côté, 1998). A survey conducted in North Carolina between 1992 - 2006 show that the prevalence of low back pain more than doubled from 4 - 10% in a 14 year period (Freburger, Holmes and Agans, 2009).
2.3 Anatomy of the Sacroiliac Joint

2.3.1 Introduction

The sacroiliac joint is formed by the articulation between the sacrum and the ilium. It is a synovial joint with the iliac surface being composed of thin fibro-cartilage. The articular surface of the sacrum is composed of hyaline cartilage (Kirkaldy-Willis and Burton, 1992). Therefore we can conclude that the sacroiliac joint is a diarthrodial joint with a joint capsule and synovial fluid. This joint starts its development around the 10th gestational week and is fully developed by the 16th week. The typical surface area of the sacroiliac joint is 1.5 cm at birth, approximately 7cm at puberty and usually 17.5 cm in the adult (Slipman, Whyte, Chow, Chou, Lenrow and Ellen, 2001). The two sacroiliac joints and the symphysis pubis connect the two iliac bones and the sacrum in order to form the bony pelvis, which in turn supports the abdomen and links the vertebral column to the lower limbs (Moore and Dalley, 2006).

The articulating surfaces differ with regard to male and female. In males the pelvis assumes more of an L-shape and in females, a C-shape (Moore and Dalley, 2006) (refer to table 2.1).
Table 2.1 Comparison of male and female pelves (Moore and Dalley, 2006)

<table>
<thead>
<tr>
<th>Bony Pelvis</th>
<th>Male</th>
<th>Female</th>
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<tr>
<td>General structure</td>
<td>Thick and Heavy</td>
<td>Thin and light</td>
</tr>
<tr>
<td>Greater pelvis (pelvis major)</td>
<td>Deep</td>
<td>Shallow</td>
</tr>
<tr>
<td>Lesser pelvis (pelvis minor)</td>
<td>Narrow and deep, tapering</td>
<td>Wide and shallow, cylindrical</td>
</tr>
<tr>
<td>Pelvic inlet (superior pelvic aperture)</td>
<td>Heart-shaped, narrow</td>
<td>Oval and rounded, wide</td>
</tr>
<tr>
<td>Pelvic outlet (inferior pelvic aperture)</td>
<td>Comparatively small</td>
<td>Comparatively large</td>
</tr>
<tr>
<td>Pubic arch and subpubic angle</td>
<td>Narrow (&lt;70°)</td>
<td>Wide (&gt;80°)</td>
</tr>
<tr>
<td>Obturator foramen</td>
<td>Round</td>
<td>Oval</td>
</tr>
<tr>
<td>Acetabulum</td>
<td>Large</td>
<td>Small</td>
</tr>
<tr>
<td>Greater sciatic notch</td>
<td>Narrow (&lt;70°), Inverted V</td>
<td>Almost 90°</td>
</tr>
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</table>
The sacroiliac joint is depicted as being auricular (refer to figure 2.1) in shape consisting of two arms. The short arm is situated posteriorly and in a cephalad direction when compared to the long arm, which is situated posterolaterally and in a caudal direction. It has also been said that the morphology of the sacroiliac joint is substantially inconsistent between individuals with respect to size, shape and contour of the joint (Hansen and Helm, 2003).

![Figure 2.1 The sacroiliac joint (Agur and Dalley, 2009)](image)

2.3.2 Anatomy of the sacrum

The sacrum is made up of five sacral vertebrae with special costal elements all fused together. The shape of the sacrum represents that of an inverted triangle, inclusive of a base, apex, pelvic and dorsal surfaces as well as two lateral surfaces, all of which is tunneled by a sacral canal (Coetzee, 1987).
The base of the sacrum is comprised of the superior surface of the S1 vertebra. The superior articular process of the S1 vertebra articulates with the inferior articular process of the L5 vertebra (Moore and Dalley, 2006).

The apex of the sacrum has a narrowed, tapered inferior edge with an oval facet for articulation with the coccyx (Coetzee, 1987).

The pelvic surface of the sacrum is smooth and concave and distinctly marked with four transverse lines (in the adult) which suggest where fusion of the sacral vertebra took place (Moore and Dalley, 2006).

During childhood, hyaline cartilage unites the individual sacral vertebra and they are separated by intervertebral discs. Union of the sacral vertebrae usually commences after twenty years of age, while most of the intervertebral discs remain unossified into middle life (Moore and Dalley, 2006).

The dorsal surface of the sacrum is rough and convex comprising of five prominent longitudinal ridges. The central ridge is termed the median crest and displays the fused rudimentary spinous processes of the superior three quarters of the sacrum as the S5 has no spinous processes (Moore and Dalley, 2006).

The intermediate sacral crests show the fused articular processes with the lateral sacral crests showing the transverse processes of the fused sacral vertebrae (Moore and Dalley, 2006) (refer to figure 2.2).
2.3.3 Anatomy of the ilium

The ilium, described as a wide, wing like structure and is the uppermost, superior part of the innominate bone. This part of the bone articulates with the pelvis and the spinal column through the sacrum (Moore and Dalley, 2006).

The most anterior and posterior aspects of the ilium demonstrate bony prominences termed the anterior superior iliac spine (ASIS) and the posterior superior iliac spine (PSIS) respectively. Located between the ASIS and PSIS is a long ridge of bone which serves as a chief source of muscular attachments known as the crest of the ilium (Cox, 1990). Moore and Dalley (2006), go on to explain that this crest follows the contour of the wing of the ilium. The iliac fossa is formed by the anteromedial, bowl-shaped surface of the ilium and on the posterior aspect, the sacropelvic surface of the ilium consists of an auricular surface termed the iliac tuberosity. The iliac tuberosity functions as a site for synovial and syndesmotic articulation with the sacrum respectively. While on the external
surface, the body of the ilium contributes to the formation of the acetabulum (Moore and Dalley, 2006) (refer to figures 2.3 and 2.4).

2.3.4 Anatomy of the ischium

The ischium consists of a body and a ramus. The body of the ischium helps contribute to the formation of the acetabulum, while the ramus helps in the formation of the obturator foramen. The ischial tuberosity represents the large posteroinferior protuberance on the ischium, while the ischial spine represents the small pointed posteromedial projection located near the junction of the ramus and body. A small concavity is also present between the ischial spine and ischial tuberosity termed the lesser sciatic foramen and the greater sciatic foramen is found superior to the ischial spine being formed by part of the ilium and is therefore the larger of the two concavities (Moore and Dalley, 2006) (refer to figures 2.3 and 2.4).

Figure 2.3 Lateral view of the pelvic bone demonstrating the ilium and ischium (Hansen, 2010)
2.3.5 Ligaments surrounding and supporting the sacroiliac joint

The sacroiliac joint is surrounded by a number of strong, stabilising ligaments. The ligaments that are directly linked to the sacroiliac joint include the posterior, anterior and interosseous ligaments. The capsular fibres of the sacroiliac joint blend anteriorly and posteriorly with a number of ligaments (Moore and Dalley, 2006) (refer to figures 2.5 and 2.6).

a. Posterior sacroiliac ligaments

The ligaments found on the posterior aspect of the sacroiliac joints are composed of short transverse fibres that attach the ilium to the first and second sacral tubercles. These tubercles are located on the lateral crest of the sacrum. The ligamentous fibres of the posterior sacroiliac ligaments are more vertically
orientated and attach the posterior iliac spines to the third and fourth sacral tubercles. The interosseous sacroiliac ligaments blend with the posterior sacroiliac ligaments. While the interosseous ligaments are short, they are exceptionally strong. These interossoeous ligaments are situated between the sacrum and iliac tuberosities (Moore and Dalley, 2006).

Kapandji (1974), discusses that both the posterior and interosseous sacroiliac ligaments aid in the transfer of weight and uphold the suspended position of the sacrum between the two iliac bones.

![Figure 2.5 Posterior sacroiliac ligaments (Hansen, 2010)](image-url)
b. Anterior sacroiliac ligaments

The ligaments found on the anterior aspect of the sacroiliac joint are composed of thin, wide transverse fibres which are located on the anterior and inferior abdominopelvic surfaces of the joint (Moore and Dalley, 2006). These ligaments are reinforced by fibrous expansions from the surrounding musculature which include the gluteus maximus, gluteus minimus, piriformis, quadratus lumborum, iliacus and erector spinae muscles (Levangie and Norkin, 2005). The anterior sacroiliac ligaments also resist superior and inferior translation of the sacrum and prevent sacroiliac joint separation (Cox, 1990).

Figure 2.6 Anterior sacroiliac ligaments (Hansen, 2010)
c. Accessory ligaments of the sacroiliac joint

The accessory ligaments of the sacroiliac joint strengthen and support the primary ligaments (Moore and Dalley, 2006).

The sacrospinous ligament runs from the lateral aspect of the coccyx and sacrum inferolaterally and affixes itself to the ischial spine. This ligament also helps to resist sacral nutation (Moore and Dalley, 2006).

The iliolumbar ligaments run from the iliac crest to the fifth lumbar vertebra transverse process. The lumbosacral ligament forms part of the iliolumbar ligament, and secures itself to the anterosuperior aspect of the sacrum and aids in resisting lateral movement and sacral nutation. The iliolumbar ligament also curbs any motion occurring between the lumbar spine and sacrum (Cox, 1990).

The sacrotuberous ligament originates at various sites including the posterior superior iliac spine, posterior inferior iliac spine, lateral sacral crest as well as the lateral margin of the coccyx and has its attachment at the ischial tuberosities. This ligament, like the ones mentioned above serves to resist sacral nutation (Moore and Dalley, 2006).

2.3.6 Blood supply and innervation of the sacroiliac joint

The blood supply to the sacroiliac joint seems to be derived from the; iliolumbar arteries, lateral sacral, superior gluteal and medial sacral artery (Hansen, 2010).

The nerve supply to the sacroiliac joint is derived from the sacral plexus, the superior gluteal nerve and the dorsal rami of S1 an S2 spinal nerves (Moore and Dalley, 2006). The musculature surrounding this joint provides non - specific innervating branches to this joint. The anterior ligaments as well as the joint capsule derive its innervation from L2- S2 spinal segments, whereas the posterior
ligaments and joint capsule derive their innervations from L4-S3 spinal segments (Chapman-Smith, 1993).

Placed within the joint capsule is a dense plexus of unmyelinated nerve fibres which is comparable to the nociceptive receptor system which is found in other synovial joints. Referral pain patterns linked to sacroiliac dysfunction are vast hence this wide assortment of segmental innervation to the joint may be the reason for such assortment patterns (Halderman, 2000).

2.3.7 Movements of the sacroiliac joint

Movement of the sacroiliac joint is greatly limited in contrast to other synovial joints (Gatterman, 2004). A study performed by Sturesson, Selvik and Uden (1989), state that maximal movement of the sacroiliac joint was 4° and the average movement was 2°. The chief function of this joint is stabilisation; therefore mobility is forfeited for stability (Levangie and Norkin, 2005).

Movement of the sacroiliac joint is age and sex dependant as well as on the degenerative condition of the joint surfaces (Gatterman, 2004). Irregular articular surfaces, with fibrillations, crevice developments and chondocyte clumping usually accompany advanced age, with all the above mentioned leading to degeneration within the joint. The vicious cycle continues as joint degeneration is supplemented by compensation of the surrounding stabilising structures producing hypertonic muscles, stiff and lengthened ligaments as well as altered biomechanical movement of the joint with pain being the outcome. With these changes the joint can no longer move as it should and functional mobility may be lost completely (Halderman, 2000).

Motion at the sacroiliac joint consists of 6° of freedom, of which is achieved by a coupled movement of rotation and translation. These movements are biggest in
the oblique sagittal plane, with the axis of rotation situated posterior to the joint and the pivot around the iliac tubercle (Gatterman, 2004) (refer to figure 2.7).

Figure 2.7 Axes and planes around which sacroiliac joint movement occurs (Schamberger, 2002)

Sacroiliac joint movements are characterised by nutation and counternutation. All the stresses placed on the ligaments of the sacroiliac joint are decreased with these movements as well as when considering the stability mechanism of this joint (Harrison, Harrison and Troyanovich 1997) (refer to figures 2.8 and 2.9).
When paying special attention to the sacrum and ilium during nutation, the sacral promontory tends to move in an anterior and inferior direction, while the sacral apex moves posteriorly in relation to the ilium. The features which limit excessive movement of the sacrum and the ilium involve the progression of increasing tension in the anterosuperior and anteroinferior bands of the anterior sacroiliac ligaments together with increasing tension developed in the accessory ligaments (Levangie and Norkin, 2005).

On the other hand, with counternutation, the opposite is true. In relation to the ilium, the sacral promontory moves in a posterior and superior direction, while the sacral apex moves anteriorly and inferiorly. The activity occurring with counternutation is checked by tension in the anterior and posterior sacroiliac ligaments (Kapandji, 1974).
Fig 2.9 (A) shows sacrum undergoing nutation with its articular surface gliding inferolaterally relative to the innominate

(B) shows the innominate rotating posteriorly with its articulating surface gliding anterosuperiorly relative to the sacrum (Lee, 1999)

2.3.8 Biomechanics of the sacroiliac joint

The pelvis acts as a central base which accepts and dissipates forces. Biomechanically, the sacroiliac joint conveys forces from the head and body, through the pelvis and then to the lower limbs (Levangie and Norkin, 2005). Schamberger (2002), states the following; movement around the different axes of the sacroiliac joint takes place during normal movement patterns involving the spine, pelvis and lower extremities all occurring through daily activities. The sacrum influences the pertinent movement of the ilia and vice versa. This occurs due to increasing tension in the connecting soft tissues, particularly the primary ligaments and muscles acting on the sacroiliac joints.
a. Trunk flexion in standing and sitting

In standing, flexion results in a synchronous forward rotation of the sacrum and the ilia in the sagittal plane, and this could possibly continue through full flexion (Kapandji, 1974). Flexion past 50 - 60 °, sees the ilia maintaining symmetrical forward rotation in most people, however in others, the sacrum will counter nutate and the base of the sacrum will move posteriorly and the apex (coccyx) will move anteriorly therefore decreasing the lumbosacral angle and in turn the lumbar lordosis (Schamberger, 2002).

In sitting, the primary movement is that of sacral counternutation due to the anterior rotation of the ilia. Counternutation amplifies the tension in the long dorsal sacroiliac ligament, hence resulting in posterior rotation of the ilia with additional trunk flexion (Schamberger, 2002) (refer to figure 2.10).

**Figure 2.10 Normal movement of the sacrum relative to the ilia. (A) Flexion past 45°: sacral counternutation, (B) Neutral (standing), (C) Extension: sacral nutation (Schamberger, 2002)**
b. Trunk extension in standing and sitting

In standing, extension causes the ilia to rotate in a posterior direction and the sacrum then undergoes nutation, hence increasing the lumosacral angle and in turn the lumbar lordosis (Schamberger, 2002).

Originally when seated, the ilia do not move when the spine extends and the sacrum nutates. Solely when nutation has taken up all the slack in the interossous and accessory ligaments as well as in the pelvic floor muscles additional extension will then produce anterior rotation of the ilia (Schamberger, 2002).

c. Standing or landing on one leg

With this movement, there is only ipsilateral movement of the sacroiliac joint that is consistent with that of upward translation of the ilium, which can occur with or without a component of anterior or posterior rotation, all of which will be relative to the sacrum (Schamberger, 2002).

d. Vertical forces on the sacrum

Strachan (1939), proposes that any force which is passed vertically downwards from the lumbar region will cause the sacrum to glide downward and flex, in other words counternutate. Therefore traction from above will produce extension and upward movement of the sacrum, which is nutation.

e. Ambulation

With ambulation, there is rotation of each ilium in the sagittal plane, namely anteriorly on the side of which hip extension occurs and posteriorly on the side of hip flexion. There is also rotation of the pelvis as a unity in the transverse plane, usually forward on the side of the leading lower extremity (Schamberger, 2002).
Furthermore, there is rotation of the pelvis as a whole in the frontal plane, with an upward movement on the weight bearing extremity and a downward movement on the non weight bearing extremity. Concurrent with the shift of the pelvis in these planes, the sacrum torques itself interchangeably to the left and the right around the vertical and oblique axes with each gait cycle. This movement is necessary because as the sacrum rotates to the left, it is accompanied by posterior rotation of the right innominate with the right leg swinging forward, which assists in securing the rigidity of the interosseous and accessory ligaments and in turn stabilising the right sacroiliac joint and making provision for heel strike and weight bearing on that side (Schamberger, 2002).

### 2.3.9 Kinetic function and stability

Normal kinetic function involves harmonious movement between the hip joints, lumbar spine and sacroiliac joints and depends on the existence of normal ranges of motion, adequate muscle function and stabilisation of various elements in a co-ordinated fashion (Gatterman, 2004). Panjabi’s conceptual model (1992), explains the stabilisation system of the entire musculoskeletal system and is beneficial in attempting to understand various factors which play a major role in stability of the sacroiliac joint.

The passive system depicts the osteoarticular ligamentous structures, which is explained as the support obtained from the shape of the sacroiliac joint, its ligaments and capsule (Panjabi, 1992).

The active system depicts the myofascial or contractile tissues which play a role in joint movement as well as act on the joint (Panjabi, 1992).

The control system depicts the central and peripheral nervous system that synchronise the network between the passive and active systems (Panjabi, 1992) (refer to figure 2.11).
Figure 2.11 Conceptual model illustrating the systems working together to provide stability (Panjabi, 1992)

When all these systems work together, the effect is minimal displacement of joint surfaces and nominal resistance; this is termed the “neutral zone” and thus denotes stability. If these systems do not work harmoniously with each other, the result is instability and abnormal displacement of joint surfaces around the neutral zone. Any loss in the contractibility of the capsule or ligaments produces a loss in the neutral zone leading to restriction in movement and stiffness within the joint (Schamberger, 2002).

2.3.10 Form and force closure of the sacroiliac joint

According to Diziogku and Lakshiminarayana (1984), form and force closure are well known terms within the concept of mechanics. The movement of a rigid body can be partly or fully avoided by contact with fixed surfaces. If such a contact is maintained by the action of various forces, such a preservation is termed force closure and van Wingerden, Vleeming, Buyruk and Raissadat (2004), suggests that the tautness of muscles and ligaments that cross the sacroiliac joint brings
about an increase in friction and therefore increase stiffness. It the contact is independent in maintaining itself without utilising the applied forces, then the term form closure is used, in other words, if the necessary contact is maintained, no matter what the applied forces may be, we have form closure (Diziogku and Lakshiminarayana, 1984) (refer to figure 2.12). Concurrent with van Wingerden et al., (2004), who says that various anatomical qualities will amplify the friction coefficient.

![Figure 2.12 Form and force closure (Vleeming, Snijders, Stoeckart and Mens, 1997)](image)

**Figure 2.12 Form and force closure (Vleeming, Snijders, Stoeckart and Mens, 1997)**

Form closure of the sacroiliac joint is obtained by the following:

The sacrum is referred to as a keystone in a Roman arch as the triangular shape of the sacrum fits perfectly between the two ilia. The two edges of the arch are united by the action of two ligaments namely the sacrotuberous and sacrospinalis as well as the coccygeus and piriformis muscles, so that the smooth surfaces of the sacroiliac joint are loaded only with compression forces and shear forces are minimised (Vleeming *et al.*, 1997) (refer to figure 2.13).
The vertical and anteroposterior translation is limited by the interlocking mechanism that the sacrum and ilia share with each other (Schamberger, 2002).

Due to the fact that the sacrum widens in an anterior direction, restrictions are set in place between the two innominate bones resulting in wedging occurring in an anteroposterior direction (Schamberger, 2002).

The increasing joint friction coefficient mentioned earlier and that usually occurs with age arises due to development of interlocking ridges and grooves, degeneration of the cartilage that covers the iliac surface of the joint and results in
the roughening of the joint surfaces along with the ligaments that have an effect on the sacroiliac joint (Vleeming et al., 1997).

Force closure of the sacroiliac joint stems from two sources:

The first being any functional force that causes nutation of the sacrum (refer to nutation). The tightening of the ligaments associated with nutation assists the force closure mechanism, in turn enhancing compression of the articular surfaces of the sacroiliac joint which improves the stability of the joint for the transfer of loads (Schamberger, 2002).

The second source begins with the contraction of the inner (multifidi, thoracic diaphragm, transverses abdominus and pelvic floor muscles) and outer (posterior oblique system which is made up of the latissimus dorsi by its attachment to the thoracolumbar fascia and to the contralateral gluteus maximus) myofascial units (Schamberger, 2002).

2.4 Anatomy of the Pubis

The pubis is described as being an angulated bone consisting of a superior pubic ramus which helps in the formation of the acetabulum and an inferior pubic ramus which forms the obturator foramen. The pubic crest is formed by a thickening on the anterior portion on the body of the pubis, with the pubic crest ending laterally as a prominent protuberance called the pubic tubercle. The lateral aspect of the superior pubic ramus depicts an oblique ridge called the pectin pubis. The ischiopubic rami located bilaterally contributes to the formation of the pubic arch (Moore and Dalley, 2006).

These rami meet to form the pubic symphysis, with the inferior angles forming the subpubic angle. The width of the subpubic angle is dependent on the distance between the left and right ischial tuberosities (Moore and Dalley, 2006).
2.4.1 Anatomy of the pubic symphysis

According to Kapandji (1974), the pubic symphysis is described as a secondary cartilaginous joint, lined axially by cartilage on the surface of the pubic bones and joined together by a fibro-cartilaginous joint.

The pubic symphysis is a strong midline unity between the pubic bones of the pelvis. The symphyseal quality of this joint was recognised as long ago as 1543 by Versalis (Becker, Woodley, Stringer, 2010).

Stranding (2008) and McMinn (1994), go on to describe this joint either as a secondary cartilaginous joint or a fibro-cartilaginous joint. The most recent gross anatomical investigation of the pubic symphysis was published almost 20 years ago by Gamble, Simmons and Freedman, (1986).

2.4.2 Articular surfaces of the pubis

The articular surfaces of the pubic bone can be described as being elliptical in shape, somewhat convex and obliquely orientated in the sagittal plane, and running posteroinferiorly in a craniocaudal direction (Becker et al., 2010).

The average length of the articular surface is approximately 30 - 35 mm and the average width measures 10 - 12mm. (Becker et al., 2010).

When looking at the articular surfaces from a posterior direction, the surfaces are parallel but diverge anteriorly, superiorly and inferiorly (Fick, 1904).

The articular surfaces are covered by hyaline cartilage which varies from 1 - 3mm in thickness (Becker et al., 2010). Loeschcke (1912), went on to state that the thickness of this cartilage decreased with increasing age.
Becker et al., (2010), states that the subchondral bony exterior of these surfaces are irregular in the young adult, but become even and straighter around 30 years of age, while Todd (1930), adds that degenerative changes, including joint narrowing, subchondral sclerosis and irregularities begin around the sixth decade.

Bony fusion of the pubic symphysis has been seen and documented in some adult primates such as the red leaf baboon (*Presbytis Pubicunda*), but has not been observed in a healthy human adult (Tague, 1993).

### 2.4.3 Ligaments of the pubic symphysis

The fibro-cartilaginous nature of the pubic symphysis is reinforced by various ligaments that serve to protect the joint and prevent loss of disc integrity due to torsional forces. Due to the intertwining nature of these semi elastic fibres, they allow movement through compressive forces and aids in maintain joint integrity during strong shearing forces that come about with walking (Gatterman, 2004) (refer to figures 2.14 and 2.15).

#### a. Superior pubic ligament

The superior pubic ligament links the superior margins of the joint and is fixed to the pubic crest as far laterally as the pubic tubercles (Gamble et al., 1986). Becker et al., (2010), say that this ligament has connections with the interpubic disc, pectineal ligament, linea alba and the periosteum of the superior pubic ramus. The superior pubic ligament is composed of irregular fibrous tissue, which is suggestive of elastic fibres.

#### b. Inferior pubic ligament

The inferior pubic ligament, which is referred to as either the subpubic (Becker et al., 2010) or the arcute pubic ligament (Stranding, 2008), which creates an arch
extending over the inferior pubic rami. It is only the inferior fibres of this ligament that are attached to the inferior pubic rami as the short and transverse upper fibres blend with the interpubic disc and posterior pubic ligament (Becker et al., 2010). A small gap is seen amid the sharp inferior edge of this ligament and anterior margin of the perineal membrane through which the deep dorsal vein of the penis or clitoris emerges (Stranding, 2008).

![Figure 2.14 Anterior view of the ligaments of the pubic symphysis (Moore and Dalley, 2006)](image)

**Figure 2.14 Anterior view of the ligaments of the pubic symphysis (Moore and Dalley, 2006)**

c. Anterior pubic ligament

The anterior pubic ligament closes the joint anteriorly and blends with the periosteum laterally (Kapandji, 1974). This ligament has a thick resistant arrangement, second only to the interpubic disc; hence this ligament is important in maintaining stability of the pubic symphysis. This ligament is made up of many layers of collagen fibres that are orientated in different directions, the deeper layers are aligned in a transverse direction as opposed to the superficial layers which are obliquely orientated (Becker et al., 2010) and are interconnected with
the tendinous insertions of various muscles all of which include; rectus abdominus, oblique abdominal muscles and pyramidalis (Kapandji, 1974).

d. Posterior pubic ligament

According to Becker *et al.*, (2010) very little is known about the posterior pubic ligament, while Kapandji (1974), states that this ligament is a thin fibrous membrane continuous with the periostuem. Testut (1928), states the transverse fibres of this ligament blends with the superior pubic ligament superiorly and inferiorly, the oblique fibres intersect and unite with the inferior pubic ligaments.

2.4.4 Interpubic disc

A fibro-cartilaginous disc unites the two pubic bones in the midline, where this fibrocartilage is tailored to withstand both compressive and tensile forces (Benjamin and Evans, 1990). Last (1954), explains that the interpubic disc is a large mass of transverse fibres.

The interpubic disc is wedge shaped and its apex is directed posteriorly, with a tapered waist and is wider superiorly and inferiorly (Gamble *et al.*, 1986).

Many authors have commented on the similarities between the interpubic and intervertebral discs (Webber, 1830; Luschka, 1864; Fick, 1904; Testut, 1928). One of the similarities noted was that the interpubic disc has outer layers of obliquely orientated fibres which are thicker anteriorly, similar to that of the annulus fibrosis of an intervertebral disc (Luschka, 1864 and Fick, 1904). Da Rocha and Chopard (2004), also observed that the borders of the disc are fused to the ligaments surrounding the pubic symphysis.
2.4.5 Blood supply and innervation of the pubic symphysis

Becker et al., (2010), express that only a small amount of authors have explored the blood supply of the pubic symphysis and even a smaller amount the innervation. Fick (1904), reports that this joint is supplied by a pubic branch from the obturator artery and a branch of the inferior epigastric artery. Smaller, inconsistent contributions stem from branches of the external and internal pudendal arteries and the medial circumflex femoral artery.

The innervation to the pubic symphysis is described as originating from the genitofemoral and pudendal nerves and with branches from the ilioinguinal and iliohypogastric nerves (Becker et al., 2010).
2.4.6 Biomechanics of the pubic symphysis

The pubic symphysis is subjected to multiple forces during everyday activities. These forces incorporate those of traction especially on the inferior part of the joint and compression of the superior part of the joint when standing, compression during sitting activities, as well as shearing and compression during single leg stance (Meissener Fell and Wilk, 1996).

According to Becker et al., (2010), who states that given the location of the pubic symphysis, it is understandable that not many biomechanical studies have been carried out. Additionally, the lack of reliability in methodology makes it complicated to compare studies. Given the morphology of this joint, the extent of movement is small, with anteroposterior sagittal movements being similar in both sexes, around an average of 0.6 mm. In the supine position with the hips flexed at 90° with maximal abduction, the average lateral movement that occurs is that of 0.5 mm in males and 0.9 mm in females. Standing on alternate legs gives an average vertical movement on the contalateral side of 1 mm in males and 1.3 mm in nulliparous females and 2.1 mm in multiparous females, hence making this movement the maximumally observed symphyseal movement. Meissener et al., (1996), reckons that the forces needed to produce these movements at the pubic symphysis would be 120 newtons in a vertical direction and 68 newtons in a sagittal direction.

Walheim, Olerud and Ribbe (1984), reports that less than 1° of rotation takes place in the pubic symphysis in the coronal plane around a sagittal axis and in a sagittal plane around a horizontal axis.

On extracting evidence from these studies, in my opinion, it seems that a small magnitude of multidirectional movements can occur at the pubic symphysis.
2.5 Sacroiliac Dysfunction

2.5.1 Introduction

This condition is described as uncharacteristic and abnormal behaviour of the sacroiliac joint. The cause is not fully understood as the sacroiliac joint is a complex joint with minimal movement. Dysfunction within the sacroiliac joint causes a variety of symptoms depending on the severity ranging from low back pain, pain over the posterior aspect of the sacrum, pain referred into the groin area, hip, posterior thigh and calf and can even go as far as involving the foot and ankle. The pelvis can be restricted in two directions, specifically anterior and posterior. This will have an effect on the position of the sacrum depending on the listing of the restriction. Any joint within the human body has an individual unique arthrokinetic reflex, which explains why joint movement has an immediate effect on the surrounding musculature and will lead to muscle inhibition or muscle activation. In essence, an arthrokinetic reflex is described as an involuntary response by muscles which are responding to joint movement, resulting in reflexive firing of the muscle (Kirkaldy-Willis and Burton, 1992).

The pain caused is then attributed to an altered and imbalanced arthrokinetic reflex, which sets off a reflexive response from the surrounding musculature leading to muscle spasm (Kirkaldy-Willis and Burton, 1992).

2.5.2 Clinical presentation

Sacroiliac joint dysfunction presents as low back pain around the region of the posterior superior iliac spines and perhaps pain referring down the posterior aspect of the buttock, thigh, calf and possibly as low as the foot and ankle. Pain is more often than not described as being dull and achy in nature which is precipitated by movement and position (Kirkaldy-Willis and Burton, 1992). The pain may be sharp and shooting in nature or even intermittent and changes from
sharp and burning to dull and achy in nature to no pain at all (Kirkaldy-Willis and Burton, 1992).

2.5.3 Aetiology

The probable cause of sacroiliac dysfunction is variable. It may be age related due to the degenerative process that comes about with advancing age, especially when there is decreased movement and compensatory action is assumed. This causes a restriction within the sacroiliac joint. The cause could also be due to hypermobility of the sacroiliac joint as in the case of pregnancy when relaxin is released. Another possible cause is due to direct trauma to the joint or a fall onto the buttock or back. Lastly, sacroiliac joint dysfunction may be due to a possible leg length inequality which could be caused by polio myelitis, slipped capital femoral epiphysis or lumbar spine abnormalities, to mention a few (Vizniak and Carnes, 2010).

2.5.4 Treatment and management protocols

Bernard and Cassidy (1991), performed a study which demonstrated that side lying sacroiliac adjustments was an effective method in the treatment of sacroiliac dysfunction.

Soft tissue therapy namely massage therapy can be used to relieve associated muscle spasm. Interferential current (IFC), transcutaneous electrical nerve stimulation (TENS), ultrasound and cryotherapy may be valuable. Myofascial dry needling can also be used to alleviate muscle spasm. Home stretching exercises as well as strengthening may be beneficial and prolong the effects of treatment (Vizniak and Carnes, 2010).
2.6 The Chiropractic Theory

2.6.1 Definition of an adjustment

An adjustment is described as any chiropractic technique that is characterised by a controlled force, velocity, direction and leverage; which is focused on a specific joint or anatomical region to have an effect on the joint itself and neurophysical performance (Esposito and Philipson, 2005).

2.6.2 Vertebral sublaxation complex

The vertebral subluxation complex (VSC) encompasses five various components:

- Kinesiopathology transpires due to inadequate movement of a vertebral segment; atypical positioning of a specific segment or it may suggest a physical change in a specific segment such as degeneration.
- Neuropathy is described as the failure of a nerve to respond or to function appropriately due to an increased pressure being placed on a nerve when a segment is subluxated.
- Myopathology occurs due to malfunctioning of the protective covering of muscles. When a joint becomes restricted, there is often muscle spasm that occurs in order to prevent any further injury from occurring. Therefore any severe muscle spasm may cause a subluxation due to an alteration in biomechanics and in turn lead to compensatory mechanisms.
- Histopathology refers to a restricted vertebra and neurological involvement; it triggers changes within the surrounding soft tissue. Changes occur in the tendons, ligaments, blood supply and joint capsules.
- Biomechanical abnormalities then occur to due to changes occurring in all the other components of the vertebral subluxation complex (http://www.echiropractic.net). All chemical changes that take place, differ
depending on the location where the subluxation took place and the areas involved (http://www.echiropractic.net).

2.6.3 Effects of an adjustment

With a clear understanding of the components discussed within the vertebral subluxation complex, one can grasp that when a subluxation or restriction occurs within a joint, it is typically accompanied by muscle spasm, pain, altered biomechanics and either sympathetic hyperactivity or motor dysfunction (http://www.echiropractic.net).

The effects of an adjustment are as follows:

- Enhancement of the passive and active ranges of motion by restoring normal motion within a restricted joint and in turn facilitating the joint to achieve its biomechanical function
- An adjustment eases pain
- It reduces muscle spasm, tension as well as electrical activity
- It normalises previously irregular reflex responses
- It breaks down adhesions which has settled within the soft tissue and supporting structures
- It can lead to autonomic changes within blood flow and blood pressure as well as distal skin temperature changes and sudomotor changes (Esposito and Philipson, 2005).

2.6.4 Contraindications to chiropractic adjustments

The following list draws attention to the red flags and warning signs that contra-indicate chiropractic adjustments (Also see Appendix G):

- History of trauma and possibility of fracture or instability
- History of cancer or tumours
- Any arthritic or degenerative conditions
- Bone infection in the case of tuberculosis or osteomyelitis
- Neurological abnormalities for instance saddle anaesthesia
- Vascular diseases such as atherosclerosis (Gatterman, 1990).

A thorough history and examination will document and create awareness to any of these contra-indications

### 2.7 Link between the Sacroiliac Joint and Pubic Symphysis

Gatterman (2004), describes the spine as a ‘multilinked system that adapts to the complexity of motor and kinetic demands.’ He also explains how joints are free to move in open kinematic chains without producing movement at another joint, as opposed to closed kinematic chains where motion at one joint brings about movement at all other joints within that specific chain. He then goes on to state that the ‘pelvis is made up of three bony segments’ which are connected by the two sacroiliac joints and the pubic symphysis and therefore will function as a closed kinematic chain. A sacroiliac restriction at a point in this closed kinematic chain will affect the kinematics of the whole pelvis (Gatterman, 2004).

### 2.8 Conclusion

Due to limited research completed and reviewed on the pubic symphysis, no recent literature can be found therefore some of the literature utilised within this study is outdated.

In the forthcoming chapters, the methodology of the study will be discussed in detail as well as the results which will be demonstrated and explained. The results will also be discussed in order to conclude and establish whether the study has
been effective in the treatment of sacroiliac dysfunction by using either sacroiliac adjustments or pubic symphysis adjustments.
CHAPTER 3 – METHODOLOGY

3.1 Introduction

This chapter will describe and illustrate the way in which this research was structured and composed.

3.2 Participant Selection

Participants were recruited by means of word of mouth and advertisements (Appendix A) that were placed in and around the University of Johannesburg Chiropractic Clinic. Thirty participants were randomly selected from the general public. Race and gender were not significant aspects of the study and all participants had to be between the ages of 18 and 45 years. The participants had to present with low back pain over the sacroiliac joint region.

The participants were assessed for inclusion and exclusion criteria and were randomly allocated a place in one of the two groups. At the initial consultation, the study was briefly explained to them and the participant signed an information (Appendix B) and consent form (Appendix C). Each group contained a total of 15 participants. Group 1 was treated with side-lying sacroiliac adjustments only and Group 2 was treated with supine pubic symphysis adjustments only.

3.3 Selection Criteria

3.3.1 Inclusion criteria

To be included in the study, participants had to comply with the following:

- Participants only between the ages of 18 and 45 years old were accepted into the study in order to limit degeneration and complete fibrosis of the
sacroiliac joint (Hendler, Kozikowski and Morrison, 1995).

- Participants had to test positive for at least three out of the following five orthopaedic tests: Tenderness over the PSIS, positive Gaenslen’s test, Yeoman’s test and Patrick Faber’s test (Kirkaldy-Willis, Burton and Cassidy, 1992); and the Posterior shear test which was evaluated favourably by Laslett and Williams (1994) and Broadhurst and Bond (1998) for inter-examiner reliability, sensitivity and specificity (Appendix H).

- Other secondary, concomitant conditions associated with sacroiliac syndrome (e.g. other myofascial involvement and/or lumbar facet syndrome) do not exclude participants from the study, although these conditions are not treated.

- Participants had to have a restricted sacroiliac joint which was motion palpated using Gillet’s motion palpation technique (Appendix L).

3.3.2 Exclusion criteria

Participants were excluded if they presented with:

- Contra-indications to a chiropractic adjustment (Appendix G).

- Any sacroiliac joint pathology or arthritides associated with the sacroiliac joint.

- An adductor strain or have experienced previous adductor strains as it will adversely affect the outcome of the study. The manner in which this is achieved is due to the pubic attachment of the adductor group as well as adductor magnus which plays a role in sacroiliac joint arthrokinematics.
- A hamstring injury or have experienced previous hamstring injuries due to the fact that shortened hamstring muscles may limit sacroiliac joint mobility and therefore this may adversely affect the outcome of this study.

- Participants who are under the influence of analgesics such as Non-Steroidal Anti-Inflammatory Drugs (NSAIDS) or any other form of therapy that may interfere with the study.

3.4 Treatment Protocol

Each participant had seven consultations in a three week period. On the participant’s initial visit, they were screened for suitability to be accepted to partake in the study. A detailed case history (Appendix M) as well as physical examination (Appendix N) was performed. A lumbar spine regional examination was also performed (Appendix O) which included specific orthopaedic tests to screen the sacroiliac joint and identify sacroiliac dysfunction.

Once the assessment was completed, the participant had to acknowledge and sign the information form (Appendix B) and consent form (Appendix C). The Numerical Pain Rating Scale (Appendix D), The Oswestry Pain and Disability Questionnaire (Appendix E) and The Orthopaedic Rating Scale (Appendix F) were utilised as subjective and objective measurements respectively. The Orthopaedic Rating Scale (Appendix F) was used to screen the sacroiliac joint for sacroiliac dysfunction which consisted of testing four orthopaedic tests.

Treatment, depending on which group the participant was in, was administrated at visits 1 to 6 whereas on the 7th visit, only measurements were taken. Subjective and objective measurements were taken on the 1st, 4th and 7th consultation.
3.5 Participant Examination

3.5.1. Motion palpation of the sacroiliac joint

When motion palpating the sacroiliac joint, Gillets motion palpation technique was used (Appendix L), the participant assumed a standing position, facing a wall and their hands supported by the wall. The examiner knelt behind the participant so that the eyes are level with the contact position. The examiner placed one thumb on the posterior superior iliac spine and the other thumb on the second sacral tubercle. The participant was instructed to flex one hip past 90°. While the examiner maintains careful contact, the thumb contacting the posterior superior iliac spine will drop inferiorly in relation to the second sacral tubercle with normal sacroiliac joint flexion. If the posterior superior iliac spine did not move inferiorly it will be noted that the respective side being tested had decreased flexion. Vice versa, with the examiner using the same contact points, the participant will be instructed to flex the opposite hip and while maintaining contact and the second sacral tubercle will drop inferiorly in normal sacroiliac joint extension. If the second sacral tubercle did not move inferiorly then the contacted side had decreased extension (Esposito and Philipson, 2005).

3.5.2 Orthopaedic tests to confirm sacroiliac joint dysfunction

Four orthopaedic tests were used and collated into the Orthopaedic Rating Scale and consisted of the following Posterior Shear (Laslett and Williams, 1994), which was used to assess for pain originating from the sacroiliac joint. The participant was in the supine position. The examiner stood on the tested side and flexed the participant’s hip and knee to 90°while reaching behind the participant with the other hand to contact the sacrum on the tested side. A posteriorly directed force was applied through the femur at varying degrees of abduction and adduction. A positive test was indicated by pain at the sacroiliac joint.
Patrick Faber test, Gaenslens test and Yeomans Test (Kirkaldy-Willis et al., 1992) were also used in order to establish a symptomatic sacroiliac joint (Appendix H). Patrick Faber test allowed for the participant to be in the supine position with the participants tested leg placed in the figure four position with the knee flexed and the ankle of the tested leg placed on the opposite knee. The hip was placed in flexion, abduction and external rotation. The examiner applied a posteriorly directed force against the medial aspect of the knee and the knee was directed to the table top. A positive test was indicated by groin pain or buttock pain as well as pain in the sacroiliac joint.

Figure 3.1 Posterior Shear Test (Broadhurst and Bond, 1998)

Figure 3.2 Patrick Faber Test (Broadhurst and Bond, 1998)
Gaenslens test was used to determine sacroiliac joint pathology. The participant was placed in the supine position while the non tested leg was kept in extension and the tested leg in maximal flexion. The examiners hand was placed on the anterior thigh of the non tested leg and the examiners other hand, on the knee of the tested leg in order to apply more flexion onto the tested leg. The extended leg is also placed off the table to achieve an increase in the flexion force. A positive would be indicated by pain produced in the lower back especially over the sacroiliac joint (Broadhurst and Bond, 1998).

![Gaenslens Test](image)

**Figure 3.3 Gaenslens Test (Broadhurst and Bond, 1998)**

Yeomans test served the purpose of assessing the sacroiliac joint for pain. The participant was placed in the supine position. The examiner flexes the participant’s knee to 90° and extends the same hip. Pain in the low back region, more specifically the sacroiliac joint indicates a positive test (Magee, 2008).
3.6 Treatment Techniques

3.6.1 Sacroiliac adjustments

Two adjustive techniques were used based on whether a flexion or extension restriction was found.

If a flexion restriction was found, the participant was placed in a side lying position. The participant was positioned with the lesion side up and hip flexion and adduction were used to open the posterior aspect of the sacroiliac joint. The researcher assumed a fencer stance position while facing in a cephalad direction. The contact point was on the inferolateral aspect of the posterior superior iliac spine nearest to the axis of the joint. The pelvis was stabilised by a thigh-to-thigh or hip-to-hip contact and the participant’s upper hip was flexed so as to achieve maximal tension in the sacroiliac joint. A short amplitude thrust was then delivered by the researchers body drop. The line of drive was posterior to anterior and in a slightly lateral to medial direction in the line of the sacroiliac joint (Esposito and Philipson, 2005) (Appendix I).
If an extension restriction was found, the participant was placed in a side lying position. The participant was positioned with the lesion side down. The superior hip, sacroiliac joint as well as the sacrum was in a fully flexed position thus creating extension on the lesioned side. The contact point was on the sacrum just inferomedial to the posterior superior iliac spine. A thigh contact was used to generate and control the amount of rotation and hip flexion. A short amplitude thrust was applied by the researchers body drop. The line of drive was posterior to anterior and slightly medial to lateral in the line of the sacroiliac joint (Esposito and Philipson, 2005) (Appendix J).

3.6.2 Pubic symphysis adjustment

The aim of this adjustment is to separate the pubic symphysis. The participant was in a supine position with both hips and knees flexed while maintaining contact with the bed by both feet. The researcher stood on either side of the bed facing cephalad. The researcher placed the heels of both hands on the lateral aspect of the participant’s knees. The participant was then asked to resist a constant adduction pressure and the researcher then quickly slides both hands of the participant’s knees thereby facilitating a reflex abduction- adduction to occur. The line of drive was in a medial to lateral direction (Esposito and Philipson, 2005) (Appendix K).

3.7 Data Collection and Interpretation

3.7.1 Subjective measurements

Subjective measurements were obtained on the participants 1st, 4th and 7th consultations. These measurements included the Numerical Pain Rating Scale (Appendix D) and The Oswestry Pain and Disability Questionnaire.

The Numerical Pain Rating Scale (Appendix D) involved the participant rating their pain on scale from 0 to 10, where 0 represented no pain and 10 represented
the worst pain they have ever experienced. The Numerical Pain Rating Scale is the most valid of all the pain scales, due to the practical application, responsiveness and sensitivity to the pain intensities (Bolton and Wilkinson, 1998).

The Oswestry Pain and Disability Questionnaire (Appendix E) was completed as accurately as possible by the participant. It consisted of 10 questions used to assess the type of disability the participant experienced encompassing pain intensity, personal care, lifting, walking, sitting, standing, sleeping, social life, travelling and degree of pain. Each section consists of 5 statements; each allocated a score between 0 (indicating no pain) and 5 (indicating maximum disability). The statements were marked according to rank. The final score is a mark out of 50, which was then converted to a percentage, indicating perceived disability at that instance. The overall goal was to assess the change in the participant’s condition over time (Fairbank and Pynsent, 2000).

Scoring was calculated as follows:

E.g.  \[
\text{Total score} = \frac{\text{Total score}}{\text{Max Score}} \times 100 = \%\]

0-20% Minimal Disability

20-40% Moderate Disability

40-60% Severe Disability

60-80% Crippled

80-100% Bed bound or exaggerating
This questionnaire and scoring system have been proven both valid and reliable (Gillard, 2005).

3.7.2 Objective Measurements

a. The Orthopaedic Rating Scale

Specific tests were performed to determine the presence of sacroiliac joint dysfunction. These specific tests included: Posterior Shear (Laslett and Williams, 1994), Patrick Faber test, Gaenslens test and Yeoman’s Test (Kirkaldy-Willis et al., 1992) (Appendix H).

Each of these tests were allocated a score when testing positive, with Posterior shear, which according to Laslett and Williams (1994) is a more sensitive test and therefore was allocated four points and the rest of the three remaining tests were each allocated two points. This scale is supported by the principle that the specificity of the diagnosis is improved when based on a combination of diagnostic tests (Griner, Mayewsky, Mushlin, Greenland, 1981).

Completion of the tests resulted in orthopaedic assessment rating out of 10. The participants that scored 6 or more out 10 were included in the study. A change in the participants score gave an indication of a change in the participant’s condition. The above rating scale was used by Shearer, Colloca and White (2005).

3.8 Statistical Analyses

Analyses of the data were done by Dr Petra Gaylard in order to establish if there was a significant change in the different readings with regard to the participant’s pain over the study period. The analysis was also used to ascertain the significance of the treatment protocol used, after taking cognisance of the data that was recorded on the participants 1st, 4th and 7th consultations. The analyses
included an inter-group as well as an intra-group analysis. Fisher’s exact test was used to analyse gender. The independent sample t-test was used to analyse The Owestry Pain and Disability Questionnaire. The Mann-Whitney-U test was used to for the analyses of age, The Numerical Pain Rating Scale and The Orthopaedic Rating Scale due to the non-normality of the data. The probability level (p-value) was set at 0.05 with results that showed to be statistically significant (at a 95% confidence interval) having a p-value of less than 0.05 ($p < 0.05$). If the results were deemed statistically insignificant then a p-value of more than 0.05 ($p > 0.05$) was observed.

### 3.9 Ethical Considerations

All participants that partook in this particular study were be requested to read and sign the information form (Appendix B) and consent form (Appendix C) specific to this study. The information form and consent form outlined the names of the researcher, purpose of the study and benefits of partaking in the study, participant assessment and treatment procedure. Any risks, benefits and discomforts pertaining to the treatments involved were explained and the participant’s safety was ensured (prevention of harm). The information form and consent form also explained that the participant’s privacy was to be protected as only the doctor, patient and clinician were allowed in the treatment room and that anonymity was ensured as the patient information was converted into data and therefore cannot be traced back to the individual. The form also stated that the standard doctor/patient confidentiality was to be adhered to at all times when compiling the research dissertation. The participants were informed that their participation was on a voluntary basis and that they were free to withdraw from the study at any stage. If the participant had any further questions, they were able to ask the researcher and contact details of the researcher and research supervisor were made available. The participants were required to sign the information and consent form, signifying that there was an understanding of all the requirements for this research study.
With regards to this particular study, the following considerations needed to be taken into account – there may be slight pain that may occur due to the sacroiliac or pubic adjustments. The participant could also experience slight stiffness due to the adjustments. It was explained that this however was a normal response to the treatment and the pain/stiffness would subside within 48 hours. The benefits were also explained which included a decrease in sacroiliac joint pain and discomfort which then would improve the participant’s quality of life.

Participants would be referred to the nearest medical facility if any complications arose from any component of the study that cannot be managed by the researcher or the supervising clinician at the Chiropractic Clinic where the study will be taking place.

If the participant wished to see the results of the study, they were made available to them.
CHAPTER 4 - RESULTS

4.1 Introduction

The results that were obtained during the clinical trials of the study are discussed in this chapter. All participants presented with sacroiliac joint dysfunction and were divided into two groups of fifteen participants each. Group 1 received sacroiliac joint adjustments and Group 2 received pubic symphysis joint adjustments. The results of each group were compared. Due to the small sample of the groups that were compared in this study, no assumptions can be made with regards to the population as a whole. The probability level (p-value) for all of the following tests was set at 0.05, and this indicates the level of significance of the results.

The analyses included the following:

- Demographic data consisting of age and gender ratios.
- Subjective measurements were represented by The Numerical Pain Rating Scale (NPRS) and The Oswestry Pain and Disability Questionnaire (OPDQ).
- Objective measurements were represented by the Orthopaedic Rating Scale (ORS).

Three measurements were taken:

- Before the 1st treatment (NPRS_1, OPDQ_1 and ORS_1). These are the baseline measurements.
- At the 4th visit, before treatment (NPRS_4, OPDQ_4 and ORS_4).
- At the 7th (last) visit, at which no treatment was given (NPRS_7, OPDQ_7 and ORS_7).
Data analyses were conducted by Dr Petra Gaylard.

The table below indicates the variables considered within this study and also shows no significant difference between each group at the commencement of treatment.

**Table 4.1 Indicates measurements at baseline showing no statistical significance**

<table>
<thead>
<tr>
<th>Variable</th>
<th>p-value for $H_0$: no significant difference between groups at start of treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>0.14</td>
</tr>
<tr>
<td>Age</td>
<td>0.46</td>
</tr>
<tr>
<td>NPRS_1</td>
<td>0.39</td>
</tr>
<tr>
<td>OPDQ_1</td>
<td>0.72</td>
</tr>
<tr>
<td>ORS_1</td>
<td>0.49</td>
</tr>
</tbody>
</table>

Table 4.1 above shows the results of the between group tests for age, gender as well as the measurements at baseline. The between group tests used were Fishers exact test for gender, the Mann-Whitney-U test for age, The Numerical Pain Rating Scale, The Oswestry Pain and Disability Questionnaire and The Orthopaedic Rating Scale due to the non-normality of the data.

It can be concluded that there were no significant differences between the two treatment groups before treatment with reference to gender and age, The Numerical Pain Rating Scale, The Oswestry Pain and Disability Questionnaire and The Orthopaedic Rating Scale measurements.
4.2 Demographic Data

4.2.1 Age distribution

The participants that were used in this research study were aged between 18 - 45 years of age. Participants in Group 1 ranged between the ages of 20.0 - 28.0 with a mean age of 25.5 years. Participants in Group 2 ranged between 23.0 - 45.0 with a mean of 27.5 years. The youngest participant was 20.0 years of age and the oldest participant was 45.0 years of age (refer to table 4.2).

The Mann-Whitney-U test was used to compare the age distribution of the participants and there was no significant difference between the two treatment groups with regard to age ($p=0.46$) so inter-group comparability for age was expressed.

4.2.2 Gender distribution

Group 1 consisted of 10 males and 5 female participants which amounted to a total of 15 participants with 66.7% males and 33.3% females whereas Group 2 consisted of 10 females and 5 males amounting to a total of 15 participants of which 33.3% were males and 66.6% females. Therefore both groups together gave a total of 30 participants (refer to table 4.2).

A Fishers exact test was used to compare gender distribution of the participants and there was no significant difference between the two treatment groups before treatment with regard to gender ($p=0.14$). Therefore inter-group gender comparability was expressed.
Table 4.2 illustrating age and gender distribution between Group 1 and Group 2

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of participants</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Mean age</td>
<td>25.5</td>
<td>27.5</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>1.9</td>
<td>5.3</td>
</tr>
<tr>
<td>Median</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Interquartile age</td>
<td>25 and 27 respectively</td>
<td>24 and 29 respectively</td>
</tr>
<tr>
<td>Male</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Female</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>

4.3 Subjective Data Analysis

Intragroup analysis was performed using the Friedman test. If the results showed to be statistically significant, then further intragroup analysis was performed using the Wilcoxon Signed Rank Test.

Intergroup analysis was performed using the Mann-Whitney test.
4.3.1 The Numerical Pain Rating Scale

Figure 4.1: Bar graph comparing mean Numerical Pain Rating Scale values

Figure 4.1 illustrates a bar graph comparing the mean Numerical Pain Rating Scale values of Group 1 and Group 2 measured at the 1st, 4th and 7th visits. The x axis shows the visits at which measurements were obtained. The y axis shows the score obtained on the NPRS on a scale from 1 to 10. The bar graph shows that the mean value of the Numerical Pain Rating Scale for Group 1 was 6.5 at the 1st visit, 5.2 at the 4th visit and 4.2 at the 7th visit. Group 1 showed an improved pain rating of 35.38% that was noted at the 7th visit compared to that of the 1st visit. The mean value of the Numerical Pain Rating Scale for Group 2 was 6.1 at the 1st visit, 4.7 at the 4th visit and 3.4 at the 7th visit. Group 2 showed an improved pain rating of 44.26% that was noted at the 7th visit compared to that of the 1st visit.

Intragroup analysis

Comparative intragroup analysis was performed using the Friedman test and the Wilcoxon Signed Ranks Test.
The non-parametric Friedman test showed that there was a statistically significant difference over time for Group 1 and Group 2 ($p=0.0001$).

The Wilcoxon Signed Ranks Test was used to determine if there were any changes in the Numerical Pain Rating Scale Scores within the groups, with respect to visit number. For Group 1, a statistically significant difference ($p=0.0015$) was found between visits 1 and 4, visits 4 and 7 ($p=0.0007$), as well as visits 1 and 7 ($p=0.0077$). For Group 2, a statistically significant difference was found between visits 1 and 4 ($p=0.0021$), visits 4 and 7 ($p=0.0010$), as well as visits 1 and 7 ($0.0015$).

**a. Group 1**

As noted in figure 4.1, and as mentioned above Group 1 had a mean value of 6.5 at the initial visit and a mean value of 5.2 at the 4th visit and at the 7th visit, a mean value of 4.2. The mean difference between the 1st and 4th visits for Group 1 was 1.3. This resulted in a median percentage improvement of 20.4%. The mean difference between the 4th and 7th visits was 1.0 which then resulted in a median percentage improvement of 19.2%. At the end of the study between the 1st visit and 7th visit, over this time frame, Group 1 had a mean difference of 2.3 and a 35.7% percentage improvement from the initial to the last visits. All the above mentioned intragroup analyses can be seen in table 4.3.
Table 4.3: Intragroup analyses for p value as well as mean values for Group 1 – The Numerical Pain Rating Scale

<table>
<thead>
<tr>
<th>Group 1</th>
<th>p value</th>
<th>Mean difference</th>
<th>Percentage difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st – 4th visit</td>
<td>0.0015</td>
<td>1.3</td>
<td>20.4%</td>
</tr>
<tr>
<td>4th – 7th visit</td>
<td>0.0077</td>
<td>1.0</td>
<td>19.2%</td>
</tr>
<tr>
<td>1st to 7th visit</td>
<td>0.0007</td>
<td>2.3</td>
<td>35.7%</td>
</tr>
</tbody>
</table>

b. Group 2

As noted in figure 4.1, and as mentioned above Group 2 had a mean value of 6.1 at the initial visit and a mean value of 4.7 at the 4th visit and at the 7th visit, a mean value of 3.4. The mean difference between the 1st and 4th visits for Group 2 was 1.3. This resulted in a median percentage improvement of 22.0%. The mean difference between the 4th and 7th visits was 1.3 which then resulted in a median percentage improvement of 28.2%. At the end of the study between the 1st visit and 7th visit, over this time frame, Group 2 had a mean difference of 2.7 and a 44.0% percentage improvement from the initial to the last visits. All the above mentioned intragroup analyses can be seen in table 4.4.
Table 4.4: Intragroup analyses for p value as well as mean values for Group 2 - The Numerical Pain Rating Scale

<table>
<thead>
<tr>
<th>Group 2</th>
<th>p value</th>
<th>Mean difference</th>
<th>Percentage difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; – 4&lt;sup&gt;th&lt;/sup&gt; visit</td>
<td>0.0021</td>
<td>1.3</td>
<td>22.0%</td>
</tr>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt; – 7&lt;sup&gt;th&lt;/sup&gt; visit</td>
<td>0.0015</td>
<td>1.3</td>
<td>28.2%</td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; to 7&lt;sup&gt;th&lt;/sup&gt; visit</td>
<td>0.0010</td>
<td>2.7</td>
<td>44.0%</td>
</tr>
</tbody>
</table>

Intergroup analysis

The Mann-Whitney test was used to compare the sampled data of Group 1 and Group 2. The test revealed that the groups were not statistically significant at visit 1 (p=0.72), visit 4 (p=0.27) and at visit 7 (p=0.27). This means that the groups started out comparable and they remained in the same manner throughout the study with no significant difference in improvement between them.
4.3.2 The Oswestry Pain and Disability Questionnaire

Figure 4.2 shows a bar graph comparing the mean Oswestry Pain and Disability Questionnaire scores of Group 1 and Group 2 at the 1st, 4th and 7th visits. The x axis represents the visits at which measurements were obtained. The y axis is represented by a percentage obtained for answering the questions in The Oswestry Pain and Disability Questionnaire. The mean Oswestry Pain and Disability Questionnaire scores for Group 1 was 13.9 at the 1st visit, 8.9 at the 4th visit and 4.9 at the 7th visit. Group 1 showed a 64.75% improvement at the 7th visit when compared to that of the 1st. The mean Oswestry Pain and Disability Questionnaire scores for Group 2 was 12.8 at the 1st visit, 6.4 at the 4th visit and 3.2 at the 7th visit. Group 2 showed a 75% improvement at the 7th visit when compared to that of the 1st visit.
Intragroup analysis

Comparative intragroup analysis was performed using the Friedman test and the Wilcoxon Signed Ranks Test.

The non-parametric Friedman test showed that there was a statistically significant difference over time for Group 1 and Group 2 ($p=0.0001$).

The Wilcoxon Signed Ranks Test was used to determine if there were any changes in The Numerical Pain Rating Scale Scores within the groups, with respect to visit number. For Group 1, a statistically significant difference was found between visits 1 and 4 ($p=0.0031$), visits 4 and 7 ($p=0.025$), as well as visits 1 and 7 ($p=0.0013$). For Group 2, a statistically significant difference ($p=0.0076$) was found between visits 1 and 4 ($p=0.0058$), visits 4 and 7, as well as visits 1 and 7 ($p=0.0007$).

a. Group 1

As noted in figure 4.2, and as mentioned above Group 1 had a mean value of 13.9 at the initial visit and a mean value of 8.9 at the 4th visit and at the 7th visit, a mean value of 4.9. The mean difference between the 1st and 4th visits for Group 1 was 4.9. This resulted in a median percentage improvement of 35.6%. The mean difference between the 4th and 7th visits was 4.0 which then resulted in a median percentage improvement of 44.8%. At the end of the study between the 1st visit and 7th visit, over this time frame, Group 1 had a mean difference of 8.9 and a 64.4% percentage improvement from the initial to the last visits. All the above mentioned intragroup analyses can be seen in table 4.5.
Table 4.5: Intragroup analyses for p value as well as mean values for Group 1 – The Owestry Pain and Disability Questionnaire

<table>
<thead>
<tr>
<th>Group 1</th>
<th>p value</th>
<th>Mean difference</th>
<th>Percentage difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st – 4th visit</td>
<td>0.0031</td>
<td>4.9</td>
<td>35.6%</td>
</tr>
<tr>
<td>4th – 7th visit</td>
<td>0.025</td>
<td>4.0</td>
<td>44.8%</td>
</tr>
<tr>
<td>1st to 7th visit</td>
<td>0.0013</td>
<td>8.9</td>
<td>64.4%</td>
</tr>
</tbody>
</table>

b. Group 2

As noted in figure 4.2, and as mentioned above Group 2 had a mean value of 12.8 at the initial visit and a mean value of 6.4 at the 4th visit and at the 7th visit, a mean value of 3.2. The mean difference between the 1st and 4th visits for Group 2 was 6.4. This resulted in a median percentage improvement of 50.0%. The mean difference between the 4th and 7th visits was 3.2 which then resulted in a median percentage improvement of 50.0%. At the end of the study between the 1st visit and 7th visit, over this time frame, Group 2 had a mean difference of 9.6 and a 75.0% percentage improvement from the initial to the last visits. All the above mentioned intragroup analyses can be seen in table 4.6.
Table 4.6: Intragroup analyses for p value as well as mean values for Group 2 - The Owestry Pain and Disability Questionnaire

<table>
<thead>
<tr>
<th>Group 2</th>
<th>p value</th>
<th>Mean difference</th>
<th>Percentage difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st – 4th visit</td>
<td>0.0076</td>
<td>6.4</td>
<td>50.0%</td>
</tr>
<tr>
<td>4th – 7th visit</td>
<td>0.0058</td>
<td>3.2</td>
<td>50.0%</td>
</tr>
<tr>
<td>1st to 7th visit</td>
<td>0.0007</td>
<td>9.6</td>
<td>75.0%</td>
</tr>
</tbody>
</table>

Intergroup analysis

The Mann-Whitney test was used to compare the sampled data of Group 1 and Group 2. The test revealed that the groups were not statistically significant at visit 1 (p=0.29), visit 4 (p=0.46) and visit 7 (p=0.27). This means that the groups started out comparable and they remained in the same manner throughout the study with no significant difference in improvement between them.

4.4 Objective Data Analysis

Intragroup analysis was performed using the Friedman test. If the results showed to be statistically significant, then further intragroup analysis was performed using the Wilcoxon Signed Rank Test.

Intergroup analysis was performed using the Mann-Whitney test.
4.4.1 The Orthopaedic Rating Scale

Figure 4.3: Bar graph comparing mean Orthopaedic Rating Scale values

Figure 4.3 illustrates a bar graph showing the mean Orthopaedic Rating Scale values of Group 1 and Group 2 at the 1st, 4th and 7th visits. The x axis represents again as mentioned before the visits at which measurements were obtained. The y axis represents a score out of 10 which correlates to how the points were allocated for the specific orthopaedic tests tested and a score out of 10 was obtained. Group 1 had a mean value of 8.9 at the 1st visit, 7.3 at the 4th visit and 6.5 at the 7th visit. Group 2 showed an improvement of 26.9% at the 7th visit compared to that of the 1st visit. Group 2 had a mean value of 9.2 at the 1st visit, 7.7 at the 4th visit and 6.5 at the 7th visit. Group 2 showed an improvement of 29.0% at the 7th visit compared to that of the 1st visit.

Intragroup analysis

Comparative intragroup analysis was performed using the Friedman test and the Wilcoxon Signed Ranks Test.
The non-parametric Friedman test revealed a statistically significant difference over time in Group 1 \((p=0.0002)\) and Group 2 \((p=0.0001)\).

The Wilcoxon Signed Ranks Test was used to determine if there were any changes in orthopaedic rating scale within the groups, with respect to visit number. For Group 1, a statistically significant difference was found between visits 1 and 4 \((p=0.011)\), no statistically significant difference between visits 4 and 7 \((p=0.058)\) and a statistically significant difference was found between visits 1 and 7 \((p=0.0022)\). For Group 2, a statistically significant difference was found between visits 1 and 4 \((p=0.012)\), visits 4 and 7 \((p=0.028)\), as well as visits 1 and 7 \((p=0.0015)\).

a. Group 1

As noted in figure 4.3, and as mentioned above Group 1 had a mean value of 8.9 at the initial visit and a mean value of 7.3 at the 4\(^{th}\) visit and at the 7\(^{th}\) visit, a mean value of 6.5. The mean difference between the 1\(^{st}\) and 4\(^{th}\) visits for Group 1 was 1.6. This resulted in a median percentage improvement of 17.9\%. The mean difference between the 4\(^{th}\) and 7\(^{th}\) visits was 0.8 which then resulted in a median percentage improvement of 10.9\%. At the end of the study between the 1\(^{st}\) visit and 7\(^{th}\) visit, over this time frame, Group 1 had a mean difference of 2.4 and a 26.9\% percentage improvement from the initial to the last visits. All the above mentioned intragroup analyses can be seen in table 4.7.
Table 4.7: Intragroup analyses for p value as well as mean values for Group 1 – The Orthopaedic Rating Scale

<table>
<thead>
<tr>
<th>Group 1</th>
<th>p value</th>
<th>Mean difference</th>
<th>Percentage difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st – 4th visit</td>
<td>0.011</td>
<td>1.6</td>
<td>17.9%</td>
</tr>
<tr>
<td>4th – 7th visit</td>
<td>0.058</td>
<td>0.8</td>
<td>10.9%</td>
</tr>
<tr>
<td>1st to 7th visit</td>
<td>0.0022</td>
<td>2.4</td>
<td>26.9%</td>
</tr>
</tbody>
</table>

b. Group 2

As noted in figure 4.3, and as mentioned above, Group 2 had a mean value of 9.2 at the initial visit and a mean value of 7.7 at the fourth visit and at the 7th visit, a mean value of 6.5. The mean difference between the 1st and 4th visits for Group 2 was 1.5. This resulted in a median percentage improvement of 15.9%. The mean difference between the 4th and 7th visits was 1.2 which then resulted in a median percentage improvement of 15.5%. At the end of the study between the 1st visit and 7th visit, over this time frame, Group 2 had a mean difference of 2.7 and a 29.0% percentage improvement from the initial to the last visits. All the above mentioned intragroup analyses can be seen in table 4.8.
### Table 4.8: Intragroup analyses for p value as well as mean values for Group 2 - The Orthopaedic Rating Scale

<table>
<thead>
<tr>
<th>Group 2</th>
<th>p value</th>
<th>Mean difference</th>
<th>Percentage difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st – 4th visit</td>
<td>0.0076</td>
<td>1.5</td>
<td>15.9%</td>
</tr>
<tr>
<td>4th – 7th visit</td>
<td>0.0058</td>
<td>1.2</td>
<td>15.5%</td>
</tr>
<tr>
<td>1st to 7th visit</td>
<td>0.0007</td>
<td>2.7</td>
<td>29.0%</td>
</tr>
</tbody>
</table>

**Intergroup analysis**

The Mann-Whitney test was used to compare the sampled data of Group 1 and Group 2. The test revealed that the groups were not statistically significant at visits 1 (p=0.53), 4 (p=0.70) and 7 (p=0.93). This means that the groups started out comparable and they remained in the same manner throughout the study with no significant difference in improvement between them.

### 4.5 Conclusion

The purpose of this chapter was to indicate which statistical analyses were utilised and conducted on the research data. The next chapter will give insight on the findings thereof.
CHAPTER 5 - DISCUSSION

5.1 Introduction

The main purpose of this study was to recognise the efficacy of two different treatment protocols on participants presenting with sacroiliac dysfunction. The aims were directed at evaluating whether there was one treatment approach that would be preferred or favoured.

The statistical analyses was aimed at measuring significant changes occurring between the 1\textsuperscript{st} and 4\textsuperscript{th} visits, the 4\textsuperscript{th} and 7\textsuperscript{th} visits and the 1\textsuperscript{st} and 7\textsuperscript{th} visits between two study groups. Statistical analyses were performed by Dr Petra Gaylard. With reference to the results collected in Chapter 4, Chapter 5 aims to examine and discuss the likely explanations for the results, drawing from the literature discussed in Chapter 2.

This study aims to answer the following questions:

- Were there any significant differences between the treatment groups prior to treatment with reference to age, gender, NPRS\textsubscript{1}, OPDQ\textsubscript{1} and ORS\textsubscript{1}?
- For the Groups 1 and 2 individually, was there a change in NPRS, OPDQ or ORS from measurements 1 to 4, 1 to 7 or 4 to 7?
- Was there a difference between Groups 1 and 2 in the change in NPRS, OPDQ or ORS from measurements 1 to 4, 1 to 7, or 4 to 7?

5.2 Demographic Data

Participants in Group 1 and Group 2 were similarly aged as noted in Chapter 4.2.1. The Mann-Whitney-U test validates that there were no significant differences between the participants groups and intergroup comparability was
confirmed. Selection of participants within a certain age category and with similar ages allowed for comparability, which in theory should have all had similar outcomes. The sacroiliac joint experiences age related changes, which begins at puberty and will persist throughout the rest of one’s life. Rapid changes tend to occur around the 3rd and 4th decade of life until the 6th decade. The iliac surface of this joint becomes rougher and encrusted by fibrous plaques as well as comprising of an increase in surface irregularity and formation of crevices within the joint (Cohen and Steven, 2005).

The gender distribution is demonstrated in chapter 4.2.2. Inter-group gender comparability was expressed through the use of Fishers exact test, demonstrating that there were no significant differences between the participant groups therefore; gender had minimal, if any influence on the results. Fibrous adhesions, yet more common in older specimens, have been documented in younger male specimens but to a lesser degree. Bony ankylosis is rare, but para-articular syntosis has been seen as a frequent finding in both sexes over the age of 50 (Schamberger, 2002). The oldest participant in this study is 45 years of age so it is safe to assume that no degenerative conditions would have played a role with regard to gender in this study.

It must be noted at the outset that the sample size is small, and the power of the study (the chance of detecting a significant difference if there is one) is likely to be low. Sample size estimation was based on the most important research question, namely whether there is a significant difference in the change in one of the outcome measurements between groups.
5.3 Analyses of Subjective Data

5.3.1 Statistical and clinical results of The Numerical Pain Rating Scale and The Oswestry Pain and Disability Questionnaire

In order to examine and discuss the findings of The Numerical Pain Rating Scale and The Oswestry Pain and Disability Questionnaire, the study was divided into two separate analyses. They are described as an intragroup analyses entity and an intergroup entity. A direct comparison of the two different treatment protocols can then be made.

Based on the mean values obtained, Group 1 and Group 2 both showed clinical improvement over time; however Group 2 showed a greater clinical improvement over time. In spite of this, this improvement is not significant enough to result in a big enough difference in order for one to state that one treatment protocol may be better than the other.

a. Intragroup Analyses

Group 1

With regards to The Numerical Pain Rating Scale, the Friedman test revealed that from the 1\(^{st}\) visit to the 7\(^{th}\) visit, Group 1 proved to have statistical significance with regard to pain perception (\(p=0.0001\)). The Wilcoxon Signed Rank test revealed a statistical significance from the 1\(^{st}\) to the 4\(^{th}\) visits (\(p=0.0015\)) and the 4\(^{th}\) visit to the 7\(^{th}\) (\(p=0.0077\)) as well as the 1\(^{st}\) to 7\(^{th}\) visits (\(p=0.0007\)). The subjective outcome measurements show that it is beneficial to utilise sacroiliac joint adjustments in the treatment of sacroiliac dysfunction as there was a 37.5% decrease in pain perception when comparing the beginning of the study to the end. This is seen in table 4.3.

With regard to the Oswestry Pain and Disability Questionnaire the Friedman test revealed that from the 1\(^{st}\) visit to the 7\(^{th}\) visit, Group 1 proved to have statistical
significance with regard to disability and pain as the p-values were below 0.05 ($p=0.0001$). There was also a statistically significant improvement with regard to the Wilcoxon Signed Rank test which revealed the following significant p-values: from the 1st visit to the 4th visit ($p=0.0031$), the 4th visit to the 7th ($p=0.025$) as well as the 1st visit to the 7th visit ($p=0.0013$). These results demonstrated that using sacroiliac adjustments in the treatment of sacroiliac dysfunction had a positive effect over time, with a decrease in pain and disability of 64.4% when comparing the beginning of the study to the end. This can be seen in table 4.5.

These results indicate that sacroiliac adjustments were effective in treating a sacroiliac dysfunction.

**Group 2**

With regards to The Numerical Pain Rating Scale, the Friedman test revealed that from the 1st visit to the 7th visit, Group 1 proved to have statistical significance with regard to pain perception ($p= 0.0001$). The Wilcoxon Signed Rank test revealed a statistical significance from the 1st to the 4th visit ($p=0.0021$) and the 4th visit to the 7th ($p=0.0015$) as well as the 1st to 7th visits ($p=0.0010$). The subjective outcome measurements show that it is beneficial to utilise pubic symphysis joint adjustments in the treatment of sacroiliac dysfunction as there was a 44.0% decrease in pain perception when comparing the beginning of the study to the end. This is seen in table 4.4.

With regard to the Oswestry Pain and Disability Questionnaire the Friedman test revealed that from the 1st visit to the 7th, Group 1 proved to have statistical significance with regard to disability and pain as the p-values were below 0.05 ($p=0.0000$). There was also a statistically significant improvement with regard to the Wilcoxon Signed Rank test which revealed the following significant p-values: from the 1st visit to the 4th visit ($p=0.0076$), the 4th visit to the 7th ($p=0.058$) as well as the 1st visit to the 7th ($p=0.0007$). These results demonstrated that using pubic symphysis joint adjustments in the treatment of sacroiliac dysfunction had a
positive effect over time, with a decrease in pain and disability of \textbf{75.0\%} when comparing the beginning of the study to the end. This can be seen in table 4.6.

These results indicate that pubic symphysis joint adjustments were effective in treating a sacroiliac dysfunction.

\textbf{b. Intergroup Analyses}

Intergroup analyses for The Numerical Pain Rating Scale compared measurements on the 1\textsuperscript{st}, 4\textsuperscript{th} and 7\textsuperscript{th} visits between Group 1 and Group 2. It resulted in p-values of \textbf{0.72} for the 1\textsuperscript{st} visit, \textbf{0.27} for the 4\textsuperscript{th} visit and \textbf{0.27} for the 7\textsuperscript{th} visit. This proves that there was no statistical significance between treatment groups with regard to pain perception.

Similarly with The Oswestry Pain and Disability questionnaire, the intergroup analyses compared measurements on the 1\textsuperscript{st}, 4\textsuperscript{th} and 7\textsuperscript{th} treatment visits between Group 1 and Group 2. This yielded p-values of \textbf{0.29} on the 1\textsuperscript{st} visit, \textbf{0.46} on the 4\textsuperscript{th} visit and \textbf{0.27} on the 7\textsuperscript{th} visit. This shows that there was no statistical significance between the two treatment groups with regard to pain and disability.

\textbf{5.3.2 Summary of subjective data}

Both groups showed a statistical significance within their individual treatment groups; however this was not the case between each group. This reveals that sacroiliac joint adjustments or pubic symphysis adjustments offers no additional benefit as compared to using an isolated adjustment in the treatment if sacroiliac joint dysfunction.

The benefits of a chiropractic adjustment have been mentioned in 2.6.3, we are also aware that the sacroiliac joint is innervated by mechanoreceptors and nociceptors as stated earlier. These benefits are considered to have an association
with mechanosensitive afferent stimulation which may result in pain modulation as proposed by Melzack and Walls’ ‘pain gate mechanism’ (Melzack and Wall, 1965). Therefore mechanosensitive stimulation causes presynaptic inhibition of nociceptor afferent transmission in subsequent pain relief. This could possibly be the reason for the decrease in the pain perception experienced by the participants of both groups.

When seen on a psychological level, therapist - patient relationships may alter various emotional responses in patients, thereby generating pain modulation regardless of the treatment which may be administered. Therefore, if we take nothing away from what a chiropractic adjustment can do, it could be said that creating a relationship with the participants over a 3 week period could have had a subconscious effect on the subjective perception of pain thereby facilitating their decrease in pain scores.

Sacroiliac joint dysfunction is typically associated with restricted mobility of the sacrum on the ilium (Grgic, 2005) and is also characterised by unilateral sacroiliac joint pain which is often made worse with prolonged standing or sitting, walking or even ascending stairs (Herling and Kessler, 2005). All this, plays a considerable role in daily life activities. Spinal manipulation therapy helps to reinstate joint motion that was lost (DeFranca and Levine, 1996), and generates a reflex reduction in pain, hinders disability and muscle hypertonicity (Gatterman, 2005). The return of normal joint biomechanics and consequent resolution in pain could have played a role in the overall improvement in daily activities, as measured and displayed in The Oswestry Pain and Disability Questionnaire.

Furthermore, if a chiropractic adjustment is delivered to a zygapophyseal joint, it will stretch the involved joint capsule which will in turn stimulate mechanoreceptors. This again will cause presynaptic inhibition of nociceptive afferents and reduce pain perception (Chapman and Smith, 2000). Therefore if we have established from the above that pain perception has decreased, the
participant will not guard movements to that extent of which they had been experiencing and daily life activities should in essence become easier.

Therefore if all the above is accounted for, it is clear to see that if there is a change on a biomechanical level, where a chiropractic manipulation restores normal joint function and on neurological level, where the stimulation of mechanoreceptors decrease pain. Then from this we can possibly say that normal movement will occur due to the decrease in pain (Bergmann and Peterson, 2002).

Drawing on information stated above, it is clear to see that both groups showed a statistically significant decrease in The Numerical Pain Rating Scale as well as The Oswestry Pain and Disability Questionnaire within their allocated groups, however there was no statistical decrease between Group 1 and Group 2 with regard to these two measurements which is in accordance with a study performed by Kamali and Shokri, (2012) who state that by using the Wilcoxon Signed Rank test, they found no significant differences in The Oswestry Pain Disability Questionnaire nor pain change scores between the two groups. The positive finding in this study is concurrent with the findings of other studies (Osterbauer, 1993, Galm, 1998, Shearer, 2005, Cleland, 2009), although to the author's knowledge, there is no similar study comparing sacroiliac joint adjustments to pubic symphysis adjustments for treating sacroiliac joint dysfunction.

5.4 Analyses of the Objective Data

5.4.1 Statistical and clinical results of The Orthopaedic Rating Scale

Based on the mean values obtained, Group 1 and Group 2 both showed clinical improvement over time; however Group 2 showed a greater clinical improvement over time. In spite of this, the improvement is not significant enough to result in a big enough difference in order for one to state that one treatment protocol may be better than the other.
a. Intragroup Analyses

Group 1

With regards to The Orthopaedic Rating Scale, the Friedman test revealed that from the 1\textsuperscript{st} treatment to the 7\textsuperscript{th} visit, Group 1 proved to have statistical significance with regard to pain perception ($p= \textit{0.0002}$) and the Wilcoxon Signed Rank test revealed a statistical significance from the 1\textsuperscript{st} to the 4\textsuperscript{th} visits ($p=\textit{0.0011}$) and no statistical significance from the 4\textsuperscript{th} visit to the 7\textsuperscript{th} ($p=\textit{0.058}$) and then again a statistical significant $p$ value from the 1\textsuperscript{st} to 7\textsuperscript{th} visits ($p=\textit{0.0022}$). It is also evident that there was a $26.9\%$ improvement when comparing the beginning of the study to the end. This is observed in table 4.7.

Group 2

With regards to The Orthopaedic Rating Scale, the Friedman test revealed that from the 1\textsuperscript{st} visit to the 7\textsuperscript{th} visit, Group 2 proved to have statistical significance with regard to pain perception ($p= \textit{0.0001}$). The Wilcoxon Signed Rank test revealed a statistical significance from the 1\textsuperscript{st} to the 4\textsuperscript{th} visits ($p=\textit{0.012}$) and the 4\textsuperscript{th} visit to the 7\textsuperscript{th} ($p=\textit{0.028}$) as well as the 1\textsuperscript{st} to 7\textsuperscript{th} visit ($p=\textit{0.0015}$). We also see a $29.0\%$ improvement in measurements when comparing the measurements obtained at the beginning to those obtained at the end.

Participant’s objective outcome measurements improved significantly with the exception of the 4\textsuperscript{th} and 7\textsuperscript{th} visit for Group 1 which was only marginally significant. Besides that, one sees that all the other measurements within both groups improved.
b. Intergroup Analyses

Intergroup analyses for ORS compared measurements on the 1\textsuperscript{st}, 4\textsuperscript{th} and 7\textsuperscript{th} visits between Group 1 and Group 2. It resulted in p-values of 0.53 for the 1\textsuperscript{st} visit, 0.70 for the 4\textsuperscript{th} visit and 0.93 for the 7\textsuperscript{th} visit. This shows there was no statistical difference between the two groups at the end of the study.

5.4.2 Summary of objective data

Although the sacroiliac joint is frequently considered as a generator of low back pain, its anatomical location makes assessment of this joint difficult. The lack of a “gold standard” also leads to difficult confirmation of sacroiliac joint dysfunction. Nevertheless numerous sacroiliac joint tests have been described (Cibulka, Delitto and Koldehoff, 1999).

Laslett and Williams (1994) established that most individual tests for sacroiliac joint dysfunction display inadequate inter-tester reliability. Clinician’s seldom utilise one test in order to determine the presence of sacroiliac joint dysfunction. However when grouping a number of tests together and then finding at least three out of four positive tests (as used in this study) to determine the presence of a sacroiliac joint dysfunction, excellent (inter-rater) reliability was recorded. Through research, stimulation of the sacroiliac joint has been found to initiate neuromuscular responses in the gluteus maximus, quadratus lumborum and multifidi muscles. This activation of certain muscular systems aids in providing stability to the sacroiliac joint and lumbar spine. Therefore due to the above, sensitisation of sacroiliac joint nociceptive afferents does not only contribute to low back pain but also affects the biomechanics of the sacroiliac joint via the reflexogenic activation of the trunk as well as the gluteal muscles. This all then leads to restricted sacroiliac joint motion and encourages an inflammatory response within this joint (Shearer et al., 2005), which in essence could have contributed to the positive objective findings in this patient population.
Laslett, Young, Aprill and McDonald, (2001), state that reasonably large forces are needed to ensure that the structures of the sacroiliac joint are adequately stressed. The techniques are simple, although lack of a sufficient force of application may produce false negatives. Inappropriate hand placement on the relevant structures often produce discordant pain responses and could be another source of error producing false positives. The above mentioned could very well be a reason for the insignificant intergroup results or for the insignificant intragroup result seen from visit four to seven. In addition to that Levin and Strenstrom, (2001), explain that in different clinical situations, if one performs a test on one side it may produce pain on the opposite side and may be improperly considered on the researcher’s part. This should also be taken into account with regard to this study. Levin and Strenstrom, (2001), also state that any variability in the force applied and the time interval force can also play a part with regard to the results of provocation tests.

The nerve supply to the iliolumbar ligament may come from the dorsal branches of S1- S4, bypassing the gluteus maximus and then coursing between the superficial and deep ligament bands, but not from the lumbosacral trunk or obturator nerve. Neighbouring trunks may then supply the sacrospinous and sacrotuberos ligaments (Berthelot, Labat, LeGoff, Govin and Mangors, 2004). As we have noted in 2.3.7 there is very little mobility within the sacroiliac joint and therefore ligaments may possibly come under stress with extreme movements and this could yield false positives and negatives which could affect the outcome of this objective measure.

5.5 Conclusion

The results of this study thus showed that both sacroiliac joint adjustments and pubic symphysis adjustments were effective in treating sacroiliac joint dysfunction. It is the author’s opinion that chiropractors tend to only focus on the sacroiliac joint when treating a sacroiliac dysfunction and never the pubic symphysis, when the pubic symphysis forms part of the three joint complex of the
pelvis. This study demonstrates that neither one is more effective in the treatment of sacroiliac dysfunction and therefore allows practitioners to select either technique, considered within the context of the individual practitioners skills and practice patterns.
CHAPTER 6 - CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The aim of this study was to determine the most effective way of treating a sacroiliac joint dysfunction by utilising either a pubic symphysis adjustment or a sacroiliac joint adjustment.

Drawing on the results obtained from the study, there were not many statistically significant findings. This means that the improvement within the groups were not distinct enough to make one group more significantly superior than the other, however there was an overall clinical improvement in the groups with regard to objective and subjective measurements.

It is imperative to remember that the sacrum is mechanically associated with the spine and pelvis together with the pubic symphysis, hence this complex should be considered as a mechanical unit. Involvement of any one of the above mentioned structures affects the positioning and movement of the other (Hertling and Kessler, 2005).

The reasoning behind finding no significant difference could be explained by Korr’s theory of joint fixation which states that when a chiropractic adjustment assists in the restoration of normal joint biomechanics, there is stretching of the hypertonic muscles responsible for the restricted movement. This in turn leads to prompt stretching of the muscle spindles producing a vast barrage of afferent impulses to the central nervous system which decreases the effects of the gamma efferent’s leading to a normalisation in the gamma pain and hence restoring the muscle to its ordinary tonus (Blunt, 1995). Another valid reasoning behind the results obtained in this study is that monitoring variations in sacroiliac joint biomechanics has certain limitations when viewed from a qualitative perspective.
The results of this study showed that chiropractic care including sacroiliac adjustments or pubic symphysis adjustments were associated with a positive effect in the treatment of sacroiliac joint dysfunction in this patient population. Even though group one did not exhibit a greater effect over group two in either subjective (self perceived) or objective findings as hypothesised, this study found that both chiropractic adjustment regimens has an equal effect in the treatment of a sacroiliac joint dysfunction.

The results of this study could strengthen the argument for using a combination of assessment tools when diagnosing sacroiliac joint dysfunction.

6.2 Recommendations

The following recommendations may result in forthcoming studies of this nature to be more statistically as well as clinically significant:

- Due to the small size of the sample group, the probability of the results being significant is highly diminished as opposed to a larger sample size. Dr Petra Gaylard recommends that if the independent t-test is to be used then a sample size of 128 (64 per group) should be utilised and if the Mann-Whitney-U test (the non-parametric equivalent of the t-test) is used, the sample size required would be 134 (67 per group).

- Gender and age specific studies will reduce variables and could possibly allow for a greater understanding of different treatment methods.

- The use of a control group, because this study did not include a control group, the natural history of sacroiliac joint dysfunction could not be fully investigated, and this progression would be best seen in a group receiving placebo treatment.
- Long term follow up consultations would aid in understanding the efficacy as well as the cost effectiveness that could be seen in the treatment of sacroiliac joint dysfunction with regard to chiropractic treatment.

- Longer treatment period with follow up treatments will help in not only determining the immediate effect of treatment but also the long term effect as well.

- As previous research shows that the incidence of dysfunction on the left sacroiliac joint in right handed people, it would be interesting to test if the hand dominance of participants correlated to the opposite sacroiliac joint being affected.
REFERENCES


APPENDIX A: ADVERTISEMENT

Do you suffer with lower back pain?

If you are between the ages of 18 and 45 years old you may take part in a research study aimed at trying to relieve your back pain!

Come and visit me in the University of Johannesburg Chiropractic Day Clinic on Doornfontein Campus: Gate 7, Sherwell Road, Doornfontein

If you are interested please call:
Jasantha Naidoo 0715151212
or the UJ Chiropractic Clinic:
011 559 6493

"NOTHING CHANGES UNTIL SOMETHING MOVES"
My name is Jasantha Naidoo and I am doing my Master’s Degree at the University of Johannesburg. I would like to invite you to consider participating in my research study entitled “The efficacy of sacroiliac adjustments versus pubic symphysis adjustments in the treatment of sacroiliac dysfunction”.
Before agreeing to participate, it is important that you read and understand the following explanation of the purpose of the study, the study procedures, benefits, risks, discomforts, and precautions as well as the alternative procedures that are available to you, and your right to withdraw from the study at any time.

This information leaflet is to help you to decide if you would like to participate. You need to understand what is involved before you agree to take part in this study. You may find that this form may contain words that you do not understand. If you have any questions, do not hesitate to ask me. You may also take home a copy of this form before signing the consent form to think about or discuss with family or friends before making your decision.

**Purpose of the study**

The study will compare sacroiliac adjustments with pubic symphysis adjustments and will determine which will be more effective in the treatment of sacroiliac dysfunction.

**Procedure**

Should you decide to partake in this study you will first be screened for what we call “inclusion and exclusion criteria”. The inclusion criteria for this study is that participants have to be between the ages of 18 and 45 years of age. You have to experience pain when doing three out of the five tests that I will be testing for. The exclusion criteria for this study is that you cannot have any contra-indications to a chiropractic adjustment (Appendix G).

I would especially like you to note that you may not participate in another research study, nor take any medications that may influence the outcomes of this study. Not all medications may be a problem, so please be open with me regarding any medication or supplements you are using. Also, please be open with me
regarding your health history, since you may otherwise harm yourself by participating in this study.

After screening you will be randomly allocated to either group 1 or group 2, and will receive either of the two adjustments corresponding with the group you are in. At the 7th and final visit no treatment will take place only measurements.

Thirty participants will participate in this study and it will only be performed in South Africa. The entire study, including all treatments will take place at the University of Johannesburg’s Chiropractic day clinic. The total amount of time required for your participation in this study will be of seven treatments. You will be asked to visit me seven times over a three week period during the study.

Spinal manipulation is a standard procedure that is performed as part of a routine chiropractic treatment and may present slight discomfort. You may or may not hear a popping sound associated to the treatment. If you do hear this sound it is completely normal.

As this study is untested there may be other risks or side effects which are unforeseen or unknown. You should immediately contact me if any side effects occur throughout your participation in this study.

As your participation in this study is entirely voluntary you can decline to participate, or stop at any time, without stating any reason. Your withdrawal will not affect your access to other medical care. If you decide not to take part in this study you may still receive the best current care, from your usual practitioner, this may or may not include this study treatment.
If it is deemed to be in your best interest, I retain the right to withdraw you from the study. Injuries that result in damage to bone, ligaments or other soft tissue would be contraindicated to this type of treatment. If you get diagnosed by another medical practitioner during this trial for any medical condition that was not stated in your original history please notify me. Some conditions may be contraindicated to this treatment. Also, should you fall pregnant during the study the possible associated ligament laxity would mean you would need to withdraw from this study.

This study protocol has been submitted to the University of Johannesburg’s Academic Ethics Committee and written approval has been granted by that committee. The study has been structured in accordance with the Declaration of Helsinki of 2008, which deals with the recommendations guiding doctors in biomedical research involving human participants.

Confidentiality

All information obtained during the course of this study will be kept strictly confidential. Recorded data used for the statistical analysis by STATKON will not include any information that identifies you as a participant in this study. Data that may be reported in scientific journals will not include any information that identifies you as a participant in this study.

Any information uncovered regarding your test results or state of health as a result of your participation in this study will be held in strict confidence. You will be informed of any finding of importance to your health or continued participation in this study but this information will not be disclosed to any third party without your written consent. The only exception to this rule will be cases of communicable diseases are a legal duty of notification of the Department of
Health exists. In this case, you will be informed of my intent to disclose such information.

Thank you for taking the time to read this form and consider participation in this study.

Should you have any concerns or queries regarding the current study, the following persons may be contacted.

Researcher: _______________ Name: Jasantha Naidoo Telephone number: 071 515 1212

Supervisor: _______________ Name: Dr M. Moodley Telephone number: 011 559 6266

UJ Ethics clearance number: HDC69-01-2013
APPENDIX C: CONSENT FORM

DEPARTMENT OF CHIROPRACTIC

Date: _________________

CONSENT FORM

Dear participant

Before signing this consent form please take your time and read the information form.

Personal doctor/specialist notification option

Please indicate below, whether you want me to notify your personal doctor or your specialist of your participation in this study:
• YES, I want you to inform my personal doctor/specialist of my participation in this study
• NO, I do not want you to inform my personal doctor/specialist of my participation in this study
• I do not have a personal doctor/specialist

Do you have any questions related to this study?

INFORMED CONSENT

• I hereby confirm that I have been informed by the researcher, Jasantha Naidoo about the nature, conduct, benefits and risks of this study titled, the efficacy of sacroiliac adjustments versus pubic symphysis adjustments in the treatment of sacroiliac dysfunction.
• I have also received, read and understood the above written information (participant information leaflet) regarding this study
• I am aware that the results of this study, including personal details regarding my sex, age, date of birth, and diagnosis will be anonymously processed into a study report
• In view of the requirements of research, I agree that the data collected during this study can be processed
• I may, at any stage, without prejudice, withdraw my consent and participation in this study
• I have had sufficient opportunity to ask questions and (of my own free will) I declare myself prepared to participate in this study.
### Signed Participant

<table>
<thead>
<tr>
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### Signed Researcher

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<td></td>
<td>Date and time</td>
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</table>

[University of Johannesburg logo]
APPENDIX D: NUMERICAL PAIN RATING SCALE


File number: _______________________

Place a mark on the pain scale below that represents your pain at this point in time. On a scale of 0 to 10, 0 means “no pain” and 10 means the “worst possible pain”. The middle of the scale describes “moderate pain”. A two or three rating would be “mild pain” and a rating of seven or higher would indicate “severe pain”.

1. Date: ________________

<table>
<thead>
<tr>
<th>No pain</th>
<th>Moderate pain</th>
<th>Worst pain</th>
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2. Date: ________________

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<tbody>
<tr>
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3. Date: ________________

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<tr>
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<th>Worst pain</th>
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<tbody>
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</tbody>
</table>
APPENDIX E: OSWESTRY PAIN AND DISABILITY QUESTIONNAIRE

Oswestry Low Back Pain and Disability Questionnaire (Fairbank and Pynsent, 2000).

Date: ______________________________
File number: ________________________

PLEASE READ

This questionnaire has been designed to give the researcher information as to how your back pain has affected your ability to manage in everyday life. Please answer every section and mark in each section ONE BOX that applies to you. We realize you may consider that two of the statements in any one section relate to you, but please just mark one box that most closely describes your problem.

SECTION 1: PAIN INTENSITY

□ I can tolerate the pain I have without having to use pain killers.
□ The pain is bad but I manage without taking pain killers.
□ Pain killers give complete relief from pain.
□ Pain killers give moderate relief from pain.
□ Pain killers give very little relief from pain.
□ Pain killers have no effect on the pain.

SECTION 2: PERSONAL CARE (WASHING, DRESSING ETC.)

□ I can look after myself normally without causing extra pain.
□ I can look after myself normally but it causes extra pain.
□ It is painful to look after myself and I am slow and careful.
□ I need some help but manage most of my personal care.
□ I need help every day in most aspects of self-care.
□ I do not get dressed; I wash with difficulty; and I stay in bed.
SECTION 3: LIFTING
☐ I can lift heavy weights without extra pain.
☐ I can lift heavy weights but it gives extra pain.
☐ Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently positioned (e.g. on a table).
☐ Pain prevents me from lifting heavy weights but I can manage light to medium weights if they are conveniently positioned.
☐ I can lift only very light weights.
☐ I cannot lift or carry anything at all.

SECTION 4: WALKING
☐ I can walk as far as I wish.
☐ Pain prevents me walking more than 1 km.
☐ Pain prevents me walking more than 0.5 km.
☐ Pain prevents me walking more than 0.25 km.
☐ I can only walk using a stick or crutches.
☐ I am in bed or in a chair most of every day.

SECTION 5: SITTING
☐ I can sit in any chair as long as I like.
☐ I can only sit in my favorite chair as long as I like.
☐ Pain prevents me sitting more than 1 hour.
☐ Pain prevents me from sitting more than 30 minutes.
☐ Pain prevents me from sitting more than 10 minutes.
☐ Pain prevents me from sitting at all.

SECTION 6: STANDING
(REMEMBER, STANDING IS NOT WALKING.)
☐ I can stand as long as I want without extra pain.
☐ I can stand as long as I want but it gives me extra pain.
☐ Pain prevents me from standing for more than 1 hour.
☐ Pain prevents me from standing for more than 30 minutes.
☐ Pain prevents me from standing for more than 10 minutes.
☐ Pain prevents me from standing at all.
SECTION 7: SLEEPING
☐ Pain does not prevent me from sleeping well.
☐ I can sleep well only by taking tablets.
☐ Even when I take tablets I have less than 6 hours sleep.
☐ Even when I take tablets I have less than 4 hours sleep.
☐ Even when I take tablets I have less than 2 hours of sleep.
☐ Pain prevents me from sleeping at all.

SECTION 8: SEX LIFE
☐ My sex life is normal and causes no extra pain.
☐ My sex life is normal but causes some extra pain.
☐ My sex life is nearly normal but is very painful.
☐ My sex life is severely restricted by pain.
☐ My sex life is nearly absent because of pain.
☐ Pain prevents any sex life at all.

SECTION 9: SOCIAL LIFE
☐ My social life is normal and gives me no extra pain.
☐ My social life is normal but increases the degree of pain.
☐ Pain has no significant effect on my social life apart from limiting energetic interests (dancing, etc).
☐ Pain has restricted my social life and I do not go out as often.
☐ Pain has restricted my social life to my home.
☐ I have no social life because of pain.

SECTION 10: TRAVELING
☐ I can travel anywhere without extra pain.
☐ I can travel anywhere but it gives me extra pain.
☐ Pain is bad but I manage journeys over 2 hours.
☐ Pain restricts me to journeys of less than 1 hour.
☐ Pain restricts me to short necessary journeys under 30 minutes.
☐ Pain prevents me from traveling except to the doctor or hospital.
**APPENDIX F: ORTHOPAEDIC RATING SCALE** (Shearer, Colloca and White, 2004)

**Sacroiliac Orthopaedic Rating Scale**

<table>
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<th>4&lt;sup&gt;th&lt;/sup&gt; Consultation</th>
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<td>Gaenslen’s Test (2)</td>
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<tr>
<td>Yeoman’s Test (2)</td>
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<td></td>
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<td>Patrick Faber (2)</td>
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<td><strong>Total</strong></td>
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APPENDIX G: EXCLUSION CRITERIA

Contra-indications to Spinal Manipulative Therapy (Gatterman, 2004)

1. Vascular complications

- Vertebral-basilar insufficiency
- Atherosclerosis of major blood vessels
- Aneurysms

2. Tumours

- Lung
- Thyroid
- Prostate
- Breast
- Bone

3. Bone infections

- Tuberculosis
- Bacterial infection (osteomyelitis)

4. Traumatic injuries

- Fractures
- Joint instability or hypermobility
- Severe sprains or strains
- Unstable spondylolisthesis

5. Arthritis

- Ankylosing spondylitis
- Rheumatoid arthritis
- Psoriatic arthritis
- Reiter’s syndrome
• Osteoarthritis (unstable or late stage)
• Uncoarthrosis

6. Psychological considerations

• Malingering
• Hysteria
• Hypochondriasis
• Pain intolerance

7. Metabolic disorders

• Clotting disorders
• Osteopenia (osteoporosis, osteomalacia)

8. Neurological complications

• Sacral nerve root involvement from medial or massive disc protrusion
• Disc lesions (advancing neurological deficits)
• Space-occupying lesions
APPENDIX H: ORTHOPAEDIC TESTS

FABER (Patrick’s) Test: (Broadhurst, N & Bond, M. 1998)
Purpose:
To assess for the sacroiliac joint or hip joint being the source of the patients pain.
Test position:
Supine
Performing the test:

The patients tested leg in placed in a “figure-4” position, where the knee is flexed and the ankle is placed on the opposite knee. The hip is placed in flexion, abduction and external rotation (which where the name FABER comes from). The examiner applies a posteriorly-directed force against the medial knee of the bent leg towards the table top. A positive test occurs when groin pain or buttock pain is produced. Due to forces going through the hip joint the patient may experience pain if pathology is located in the hip as well.
**Gaenslen Test: (Broadhurst, N & Bond, M. 1998)**

**Purpose:**
To assess for pain originating from the sacroiliac joint.

**Test position:**
Supine

**Performing the test:**

The non-tested leg is kept in extension, while the tested leg is placed in maximal flexion. The examiner places one hand on the anterior thigh of the non-tested leg and the other hand on the knee of the tested leg to apply a flexion or pressure (alternate position is on posterior thigh, proximal to knee, for patients that have knee pathology). The extended leg may also be placed off the table to create a greater force. A positive test occurs if it produces lower back pain.

---

**Yeoman’s Test: (Magee, D.J., 2008)**

**Purpose:**
To test for sacroiliac joint involvement more specifically if the pain is in the sacroiliac region, it may be related to anterior sacroiliac ligament pathology.

**Test position:**
Prone

**Performing the test:**

The examiner flexes the patient’s knee to 90° and extends the same hip. A reporting of pain is considered a positive sign.
Posterior Shear test: (Broadhurst, N & Bond, M. 1998)

Purpose:
To assess for pain originating from the sacroiliac joint.

Test position:
Supine

Performing the test:

The examiner is standing on the tested side. The examiner reaches around, behind the patient and places a hand to stabilise the sacrum from the opposite side. The examiner uses his/her other hand to produce posteriorly directed forces through the femur at varying angles of abduction and adduction. The test is positive if pain in the buttock region is produced. Due to the forces going through the hip joint as well, the patient may experience pain if pathology is located in the hip as well.
APPENDIX I: ADJUSTMENT TECHNIQUE FOR FLEXION RESTRICTION OF THE SACROILIAC JOINT (Esposito and Philipson, 2005)

Sacroiliac: BLR, Pisiform contact, Flexion

**Structural:**
- P-A, I-S and slightly L-M along the SI joint line.

**Static:** LAS ilium, RAS ilium

**Motion:** S.I. flexion

**HVLA**
- Short lever
- Slow passive recoil

**LOC**
- P-A, I-S and slightly L-M along the SI joint line.

**Primary aim**
- To create sacroiliac joint gapping/rippling at a point of maximum joint flexion very close to the joints central axis.

**Mechanics**
- The Pt is positioned with the lesion side up and using some hip flexion and adduction to open the posterior aspect of the SI joint. The lever is very close to the joint's axis of motion and therefore rotation of the ilium is insignificant. It primarily creates a joint tripping at a position of end range loading.

**Position**
- Pt: Standard lumbar roll position with lesion side up.
- Dr: Fencers stance facing cephalad and across with feet facing parallel to the spine and body weight slightly caudad and above the 1º.

**Contact**
- SCP
- 1º: On the lateral and inferior aspect of the PSIS close to the joints axis.
- 2º: Cephalad hand on the Pt's uppermost shoulder pushing in a superior direction.

**Adjustment**
- TS
  - Taken in the direction of LOC.
- Prepare
  1. The Pt is placed in a BLR position, the Dr stands in front of the Pt at the level of the pelvis. The pelvis is stabilised in such a way so that there is no anterior roll. Most commonly this is achieved with a thigh-to-thigh or hip-to-hip stabilisation. The Pt's upper hip is flexed to a position whereby maximal tension is achieved in a position of SI joint flexion.
  2. The Pt spine is in neutral but rolled as a unit anteriorly to facilitate the 1º.
  3. The 2º is placed and fixed with a slight I-S pressure.
  4. The Drs centre of gravity is over the middle of the pisiform contact. Slack is taken up in the direction of the LOC with the Dr moving his/her body weight as a unit over the 1º.

**Thrust**
- A short amplitude HVLA thrust is applied with the 1º in the LOC facilitated by the Drs body drop.
Comments

The Pt is stabilised so that no lumbar movement occurs and to maximise the efficiency of the thrust into the sacroiliac joint.
The 1st is maintained whilst body drop is applied and there is no break at the elbow or shoulder during the thrust.
The forces used in this adjustment can be increased by using a combination of a slightly more superior component in the body drop and increasing the amount of the patient's upper hip flexion in the lumbar roll position during the thrust.
APPENDIX J: ADJUSTMENT TECHNIQUE FOR EXTENSION RESTRICTION OF THE SACROILIAC JOINT (Esposito and Philipson, 2005)

**Sacroiliac: BLR, Pisiform contact, Extension**

**Structural:**

Static: LPI illum, RPI illum  
Motion: S.I. extension restriction

**HVLA**  
Short lever  
Slow passive recoil

**LOC**  
P-A, I-S, M-L. This will follow the plane of the SI joint.

**Primary aim**  
To create joint gapping / tripping at the point of maximal joint extension very close to the joint’s central axis.

**Mechanics**  
The Pt is positioned with the lesion side down which locks the ilium against the couch. The adjustment is achieved with a tripping thrust of the 1º. The setup position and 2º creates the pretension of maximum SI extension. This is achieved by fully flexing the up side hip, SI and sacrum which creates extension in the lesion side down SI joint.

**Position**  
Pt: Standard lumbar roll position with lesion side down.  
Dr: Standing at the side of the couch facing across the Pt and cephalad at the level of the lesion.

**Contact**  
SCP: Sacrum, just medial and inferior to the PSIS.  
1º: The Drs caudad pisiform is used with wrist comfortably extended and slightly ulnar deviated.  
2º: Cephalad hand on the Pts uppermost shoulder pushing in a superior direction.

**Modify**  
A straight leg (Pt) position can be used where the Dr straddles a straight limb rather than holding the knee bent. This makes use of the hamstring tension as the hip is flexed to create more upper SI flexion. During the thrust a cephalad movement of the Dr will push the hip and therefore the upper SI into further flexion.

**Adjustment**  
TS: Taken in the direction of the LOC.

**Prepare**  
1. The Pt is rolled forward until contact is made comfortably at the thighs. The thigh contact is used to create and control the amount of rotation and hip flexion. There is relatively more forward roll of the Pt compared to the pisiform flexion thrust (facilitates the LOC and assists SI pretension).  
2. Take up counter pressure between anterior rotation of pelvis created by the thigh contact and posterior pressure on the shoulder. The upper hip, SI and sacrum are taken into full flexion.
3. The Drs centre of gravity is over the middle of the pisiform contact. Slack is taken up in the direction of the LOC with the Dr moving 1° and body weight as a unit above the SCP.

**Thrust**
A short amplitude HVLA thrust is applied with the 1° in the LOC facilitated by the Drs body drop.

**Comments**
Pre-tension is obtained by the setup position of the 2°. The 1° acts as a tripping or cavitating facilitator by gapping the joint. The adjustment primarily works because of the joint being positioned as far as possible into extension before the thrust is applied. The Pt weight on the ilium also helps to flare the posterior aspect of the joint which assists the cavitation.

The forces used in this adjustment can be increased by using a combination of a slightly more superior component in the body drop and increasing the amount of the patient’s upper hip flexion in the lumbar roll position during the thrust.
APPENDIX K: PUBIC SYMPHYSIS ADJUSTMENT TECHNIQUE (Esposito and Philipson, 2005)

**Static: Multidirectional**

**Loc:** M-L

**Primary aim:** To separate the pubic symphysis.

**Mechanics:** The Pt resists a constant adduction pressure which is applied by both contacts. The pressure is suddenly released which activates rapid contraction of hip adductors due to the stretch reflex. This adducts the hip but also has the effect of separating the pubic symphysis.

**Position**

**Pt:** Supine with both knees and hip flexed, the heels must be close to the perineum with the toes pointing distally.

**Dr:** Standing on either side of the couch facing cephalad.

**Contact**

1. *1st & 2nd* Drs heel of hand on the lateral aspect of the Pt's knees.

**Adjustment**

**Prepare**

1. Positions and contacts taken as above
2. Dr lightly contacts Pt's feet with flexed leg to stop them from sliding inferorly.
3. Dr moves body to midline of couch. There is no abduction of the thighs.

**Thrust**

The Pt tries to abduct his thighs with the Dr applying resistance. The Dr suddenly slides the hands off the knee allowing a reflex abduction/
Listing: Multidirectional
Reflex contraction of the adductor muscles creates separation of the pubic symphysis.
APPENDIX L: MOTION PALPATION OF THE SACROILIAC JOINT (Esposito and Philipson, 2005)

Gillet’s test (segmental ROM palpation)

**PP**
Standing while holding on to something for support

**DP**
Kneeling behind Pt so that eyes are level with contacts

**Contacts**
- SCP: PSIS
- 1° Thumb
- 2° Thumb on 2nd sacral tubercle

**Procedure**
- **Phase I:** Instruct the Pt to flex one hip past 90°. Maintain careful contact with the PSIS of the H/L side. The thumb contacting the H/L PSIS will drop inferiorly in relation to the 2nd sacral tubercle with normal SI flexion. Have the Pt return the foot to the ground.
- **Phase II:** With the same contact points, have the Pt flex the opposite hip (past 90°). Maintain the contact point but this time, watch what happens to the thumb contacting the 2nd sacral tubercle. In normal SI extension, the 2nd sacral tubercle drops inferiorly.

**Interpretation**
- **Phase I:** If the PSIS does not move inferiorly (or if it is decreased from that of the C/L side), it is understood that side has decreased flexion.
- **Phase II:** If the 2nd sacral tubercle does not or has decreased inferior movement, it is determined that the contact side has decreased extension.

**Dynamic Listing**
- **Phase I:** Flexion restriction on the contact side
- **Phase II:** Extension restriction on the contact side
APPENDIX M: CASE HISTORY

UNIVERSITY OF JOHANNESBURG
CHIROPRACTIC DAY CLINIC

CASE HISTORY

Date: ______________

Patient: ___________________________ File No: __________

Age: ____  Sex: _______  Occupation: ________________

Student: __________________________ Signature: __________

Complies with Inclusion criteria of the research:

Clinician: ________________________
Signature: _______________________

Examination:

Previous: UJ  Current: UJ
Other

X-ray Studies:

Previous: UJ  Current: UJ
Other

Clinical Path. Lab:

Previous: UJ  Current: UJ
Other

Case status:

PTT:  Conditional:  Signed off:  Final sign out:

Recommendations:
Students case history

1. Source of history:

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

3. Present illness:
   - Location
   - Onset
   - Duration
   - Frequency
   - Pain (character)
   - Progression
   - Aggravating factors
   - Relieving factors
   - Associated Sx’s and Sg’s
   - Previous occurrences
   - Past treatment and outcome
4. **Other complaints:**

5. **Past history**
   - General health status
   - Childhood illnesses
   - Adult illnesses
   - Psychiatric illnesses
   - Accidents/injuries
   - Surgery
   - Hospitalisation

6. **Current health status and lifestyle**
   - Allergies
   - Immunizations
   - Screening tests
   - Environmental hazards
   - Safety measures
   - Exercise and leisure
   - Sleep patterns
   - Diet
   - Current medication
   - Tobacco
   - Alcohol
   - Social drugs
7. Family history:
   Immediate family:
   
   Cause of death
   DM
   Heart disease
   TB
   HBP
   Stroke
   Kidney disease
   CA
   Arthritis
   Anaemia
   Headaches
   Thyroid disease
   Epilepsy
   Mental illness
   Alcoholism
   Drug addiction
   Other

8. Psychosocial history:
   Home situation
   Daily life
   Important experiences
   Religious beliefs

9. Review of systems:
   General
   Skin
   Head
Eyes
Ears
Nose/sinuses
Mouth/throat
Neck
Breasts
Respiratory
Cardiac
Gastro-intestinal
Urinary
Genital
Vascular
Musculoskeletal
Neurologic
Haematologic
Endocrine
Psychiatric
APPENDIX N: PHYSICAL EXAM

UNIVERSITY OF JOHANNESBURG
CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

(NOTE: only if Cervical Spine Regional is complete)

Underline abnormal findings in RED.                      Date: ________________

Patient: ____________________  File No: ________________

Clinician: ____________________  Signature: ________________

Student: ____________________  Signature: ________________

Height: _______  Weight: _______  Temp: _______

Rates: Heart: _______  Pulse: _______  Respiration: _______

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<th>Arms:</th>
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<th>R</th>
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<tbody>
<tr>
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<td>Legs:</td>
<td>L</td>
<td>R</td>
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General Appearance:

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
STANDING EXAMINATION

1. Minor’s sign
2. Skin changes
3. Posture: Erect
   Adam’s
4. Ranges of motion (Thoracolumbar Spine)
   T/L spine: Flexion: 90° (fingers to floor)
   Extension: 50°
   R. lat. flex: 30° (fingers down leg)
   L. lat. flex: 30° (fingers down leg)
   Rot. to R: 35°
   Rot. to L: 35°

/ = pain-free limitation  // = painful limitation

5. Romberg’s sign
6. Pronator drift
7. Trendelenburg’s sign
8. Gait: - rhythm
   - balance
   - pendulousness
   - on toes
   - on heels
   - tandem
9. Half squat
10. Scapular winging
11. Muscle tone
12. Spasticity/Rigidity
13. Shoulder: skin
    symmetry
    ROM - glenohumeral
    - scapulo-thoracic
    - acromioclavicular
    - elbow
    - wrist
14. Chest measurement:
   - inspiration
   - expiration

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15. Visual acuity

16. Breast examination:
   Inspection:
   - skin
   - size
   - contour
   - nipples
   - arms overhead
   - hands against hips
   - leaning forward

   Palpation
   - axillary lymph nodes
   - breast incl. tail

**SEATED EXAMINATION**

1. Spinal posture
2. Head
   - hair
   - scalp
   - skull
   - face
   - skin

3. Eyes:
   Observation
   - conjunctiva
   - sclera
   - eyebrows
   - eyelids
   - lacrimal glands
   - nasolacrimal duct
   - position and alignment
   - corneas and lenses
   - corneal reflex
   - ocular movement

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   - visual fields
   - accommodation
   - Opthalmoscopic
   - Examination
     - iris
     - pupils
     - red reflex
     - optic disc
     - vessels
     - general background
4. Ears:
   • Inspection
     - auricle
     - ear canal
     - drum

   • auditory acuity
   • Weber test
   • Rinne test

5. Nose:
   • External
   • Internal
     - septum
     - turbinates
     - olfaction

6. Sinuses (frontal & maxillary):
   - tenderness
   - transillumination

7. Mouth and pharynx:
   • lips
   • buccal mucosa
   • gums and teeth
   • roof
   • tongue
     - inspection
     - movement
     - taste
     - palpation

   • pharynx
     - CN X
     - inspection

   • carotid arteries (thrills, bruit)
   • Cranial Nerves
     - CN V
     - CN VII
     - CN VIII (nystagmus)
     - CN IX
     - CN XI
     - CN X11

8. Peripheral vasculature:
   • Inspection
     - skin
     - nail beds
     - pigmentation
     - hair loss
• Palpation
  - pulses:
    - femoral
    - dorsalis pedis
    - popliteal
    - radial
    - post. Tibial
    - brachial
  - lymph nodes
    - epitrochlear
    - femoral (horizontal & vertical)
  - temperature (feet and legs)

• Manual compression test
• Retrograde filling (Tredelenburg) test
• Arterial insufficiency test

10. Musculoskeletal:
   (i) ROM
   • hip

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• knee
• ankle

(ii) leg length

• Co-ordination
  - point to point
  - dysdiachokinesia

9. TMJ
• Inspection
  - ROM
  - deviation
• Palpation
  - crepitus
  - tenderness
10. Thorax
   • Inspection
     - skin
     - shape
     - respiratory distress
     - rhythm (respiratory)
     - depth (respiratory)
     - effort (respiratory)
     - intercostal/supraclavicular retraction
   • Palpation
     - tenderness
     - masses
     - respiratory expansion
     - tactile fremitus
   • Percussion
     - lungs (posterior)
     - diaphragmatic excursion
     - kidney punch
   • Auscultation
     (i) breath sounds
     - vesicular
     - bronchial
     (ii) adventitious sounds
     - crackles (rales)
     - wheezes (rhonchi)
     - rubs
     (iii) voice sounds
     - broncophony
     - whispered pectoriloquy
     - egophony
   • Cardiovascular
     - auscultation (aortic murmurs)
     - Allen’s test

**SUPINE EXAMINATION**

1. JVP
2. PMI
3. Auscultation heart
   (L. lat. Recumbent)
4. respiratory excursion
5. percussion chest
   (anterior)
6. breast palpation
7. Abdominal Examination
   • Inspection
     - skin
     - umbilicus
     - contour
     - peristalsis
     - pulsations
     - hernias (umbilical/incisional)
• Auscultation - bowel sound
  - bruit

• Percussion - general
  - liver
  - spleen

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

• Acute abdomen - where pain began and now
  - cough
  - tenderness
  - guarding/rigidity
  - rebound tenderness
  - rovsing’s sign
  - psoas sign
  - obturator sign
  - cutaneous hyperaesthesia
  - rectal exam
  - Murphy’s sign

**MENTAL STATUS**

(i) Appearance and behaviour - level of consciousness
  - posture and motor behaviour
  - dress, grooming, personal hygiene
  - facial expression
  - affect

(ii) Speed and language - quantity
  - rate
  - volume
  - fluency
  - aphasia (pm)

(ii) Mood

(v) Memory and attention • orientation (time, place, person)
  • remote memory
(vi) Higher cognitive functions

- recent memory
- new learning ability
- information and vocabulary
- (general and specialised knowledge)
- abstract thinking

### NEUROLOGICAL EXAMINATION (LUMBAR SPINE)

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APPENDIX O: LUMBAR SPINE REGIONAL EXAMINATION

UNIVERSITY OF JOHANNESBURG
CHIROPRACTIC DAY CLINIC

REGIONAL EXAMINATION
LUMBAR SPINE AND PELVIS

Date: ____________________
Patient: ____________________ File No: ____________________
Clinician: ____________________ Signature: ____________________
Student: ____________________ Signature: ____________________

STANDING

1. BODY TYPE
2. POSTURE
3. OBSERVATION: -
   • Muscle Tone
   • Bony + Soft Tissue Contours
   • Skin
   • Scars
   • Discolouration
   • Step deformity

4. SPECIAL TESTS
   • Schober’s Test
   • Spinoal Percussion
   • Treadmill
   • Minor’s Sign
   • Quick Test
   • Trendelenburg Test
5. RANGE OF MOTION

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

// = Painful limitation
/= Pain free limitation

6. GAIT

- Rhythm, pendulousness
- On Toes (S1)
- On Heels (L4, 5)
- Halt Squat on one leg (L2, 3, 4)
- Tandem Walking

7. MOTION PALPATION – sacroiliac joints

B. SITTING

01. SPECIAL TESTS

- Tripod Test
- Kemp’s Test
- Valsalva Manoeuvre
2. MOTION PALPATION

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C. SUPINE

01. OBSERVATION

- Hair, Skin, Nails
- Fasciculations

2. PULSES

- Femoral
- Popliteal
- DorsalisPedis
- Posterior Tibial

3. MUSCLE CIRCUMFERENCE

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5. ABDOMINAL EXAMINATION

- Observation
- Abdominal Reflexes
- Auscultation Abdomen and Groin
- Palpation Abdomen and Groin

Comments: _____________________________________________________

NEUROLOGICAL EXAMINATION

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7. **SPECIAL TESTS**

- SLR
- WLR
- Braggard's
- Bowstring
- Sciatic Notch Pressure
- Sign of the Buttock
- Bilateral SLR
- Patrick Faber
- Gaenslen's Test
- Gapping Test
- "Squish" Test
- Gluteus Maximus Stretch
- Thomas' Test
- Rectus Femoris Contracture Test
- Hip Medial Rotation
- Psoas Test

**LATERAL RECUMBENT**

- Sacroiliac Compression
- Ober's Test
- Femoral Nerve Stretch Test
- Myotomes: - QuadratusLumborum Strength
- - Gluteus Medius Strength
**PRONE**

- Facet joint challenge
- Myofascial Trigger points:
  - Quadratus Lumborum
  - Gluteus Medius
  - Gluteus Maximus
  - Piriformis
  - Tensor Fascia Lata
  - Hamstrings
- Skin Rolling
- Erichsen's Test
- Sacroiliac Tenderness
- Pheasant's Test
- Gluteal Skyline
- Myotomes:
  - Gluteus Maximus strength

**NON-ORGANIC SIGNS**

- Pin-point pain
- Axial Compression
- Trunk Rotation
- Burn’s Bench Test
- Flip Test
- Hoover's Test
- Ankle Dorsiflexion Test
- Pin-point pain
### APPENDIX P : SOAP NOTE

#### Research

**CHIROPRACTIC DAY CLINIC**

**SOAP NOTE:**

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**A:**

**P:**

**Comments:**

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**Comments:**