The Effectiveness of Integrated Neuromuscular Inhibition Technique in the Treatment of Gluteus Medius Myofascial Pain and Dysfunction Syndrome

A dissertation submitted to the Faculty of Health Sciences, University of Johannesburg, in partial fulfilment of the requirements for the Masters degree in Technology in the program Chiropractic

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DECLARATION

I, Leah Ramsunder, do hereby declare that this dissertation is a representation of my own, unaided work. It is being submitted in partial fulfilment for the Degree of Masters Technology at the University of Johannesburg. It has not been submitted before for any degree or examination at any other University or Technikon.

_________________________________
Signature of Candidate

On this _______________ day of ___________________
DEDICATION

I dedicate this work to my husband who has been my pillar of strength for all these years. His constant love and support have given me the will to always do my best.

This is also dedicated to my parents for their wisdom and guidance through challenging times. Their encouragement has kept me focused on achieving my goals.
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ABSTRACT

The aim of this study was to compare the effectiveness of two different treatment methods for myofascial pain and dysfunction syndrome of the Gluteus Medius muscle. This was done in order to determine whether or not a combined treatment of the integrated neuromuscular inhibition technique (INIT) and sacroiliac joint (SIJ) adjustive therapy was more effective than the INIT applied in isolation, in the treatment of the Gluteus Medius myofascial pain and dysfunction syndrome (GMPD).

Participants were recruited using advertisement posters placed throughout the University of Johannesburg Doornfontein Campus and were treated at the University of Johannesburg Chiropractic Day Clinic.

Thirty participants, between the ages of eighteen and fifty years, who were suffering from lower back pain and presented with Gluteus Medius myofascial trigger points (TrPs) and an SIJ dysfunction were selected for the study. They were randomly assigned into one of two groups, consisting of fifteen subjects each, as they entered into the study. Group one received the INIT to the affected Gluteus Medius muscle. Group two received a combination of the INIT to the affected Gluteus Medius muscle and an SIJ adjustment. Patients attended four sessions over a period of eight days and were treated on all of these sessions.

Subjective and objective data were recorded on all sessions. Subjective data was recorded using the McGill Pain Questionnaire and the Numerical Pain Rating Scale. Objective data was recorded using the Universal Goniometer, to measure hip ranges of motion of the affected Gluteus Medius muscle, and the Wagner Pressure Algometer to measure pain-pressure threshold of the affected Gluteus Medius muscle TrPs. All of the data were statistically analyzed using Repeated Measures and Independent t-Tests. P-values were calculated to determine the statistical significance of the data.

The results of the study indicate that both treatment methods are effective in treating GMPD, however a combined treatment approach of INIT and SIJ adjustive therapy was more effective in achieving a greater therapeutic response compared to INIT alone.
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CHAPTER ONE - INTRODUCTION

Myofascial pain and dysfunction syndrome (MPDS) is regarded as a significant neuromusculoskeletal disorder that is commonly overlooked as a cause of disability and is poorly treated in clinical practice (Simons, 1981).

Early recognition and effective treatment is necessary to prevent the development of a perpetuating pain-spasm-pain cycle (Travell and Simons, 1998).

DeFranca and Levine (1996) state that joint dysfunction is strongly associated with the activation of myofascial TrPs. Myofascial TrPs can maintain stress on a joint and the abnormal sensory input from the dysfunctional joint can reflexly activate myofascial TrPs.

Comprehensive treatment of myofascial pain and dysfunction should be aimed at inactivating TrPs and restoring the affected muscle to its full range of motion (Simons, 1981).

The aim of this study was to determine the most effective treatment method for MPDS of the Gluteus Medius muscle by comparing the INIT with a combined treatment method of the INIT and SIJ adjustive therapy.

1.1 Hypothesis

Hypothesis 1 - INIT will be effective in treating GMMPDS.

Null Hypothesis 1 - INIT will not be effective in treating GMMPDS.

Hypothesis 2 - A combined treatment method of the INIT and SIJ adjustive therapy will be effective in treating GMMPDS.

Null Hypothesis 2 - A combined treatment method of INIT and SIJ adjustive therapy will not be effective in treating GMMPDS.
**Hypothesis 3** - INIT is a more effective treatment method compared to a combined treatment method of the INIT and SIJ adjustive therapy.

**Null Hypothesis 3** - INIT is not a more effective treatment method compared to a combined treatment method of the INIT and SIJ adjustive therapy.

**Hypothesis 4** - A combined treatment method of the INIT and SIJ adjustive therapy is a more effective treatment method compared to the INIT.

**Null Hypothesis 4** - A combined treatment method of the INIT and SIJ adjustive therapy is not a more effective treatment method compared to the INIT.

### 1.2 Expected Outcome

It was expected that patients treated in Group 2, in which INIT and SIJ adjustments were used, would have an objective and subjective decrease in GMMPDS. This would prove that a combined treatment method of the INIT and SIJ adjustive therapy would be the most effective treatment method. This outcome was expected due to the fact that treatment was directed to both the dysfunctional muscle and the related dysfunctional joint that would reflexly activate one another.
CHAPTER TWO – LITERATURE REVIEW

2.1 The Gluteus Medius Muscle

2.1.1 Introduction

The muscular system accounts for the high prevalence of undiagnosed pain in the human body (Gatterman, 1990). Skeletal muscle constitutes forty percent or more of body weight (Mense, Simons and Russell, 2001) and any alteration in the normal muscle physiology due to repeated micro trauma and/or macro trauma leads to aberrations in the structure, function and metabolism which contributes to pain and dysfunction (King and Goddard, 1994).

2.1.2 The structure, innervation and function of the Gluteus Medius muscle

The Gluteus Medius muscle (Figure 2.1) is a thick, fan shaped skeletal muscle that lies deep to the gluteus maximus muscle and superficial to the gluteus minimus muscle. Proximally, it attaches to the external surface of the ilium, between the anterior and posterior gluteal lines, along the anterior three fourths of the iliac crest. Distally, it attaches via a broad tendon to the posterior superior angle and external surface of the greater trochanter of the femur (Moore and Dalley, 1992).

The superficial anterior fibers lie obliquely to the deep posterior fibers and may be separated or fused with the Piriformis muscle or the Gluteus Minimus muscle (Travell and Simons, 1997).

It is separated from the external surface of the greater trochanter by a trochanteric bursa that lies between the trochanteric attachments of the Gluteus Minimus proximally and the Gluteus Medius distally (Travell and Simons, 1997).

The Gluteus Medius muscle is innervated by the inferior branch of the superior gluteal nerve, which arises from the posterior divisions of the ventral rami of the fourth and fifth lumbar and first sacral spinal nerves (Moore and Dalley, 1992).
The main function of the most powerful abductor of the hip joint is to stabilize the pelvis during single limb stance and prevent lateral tilt of the pelvis towards the unsupported side (Conneely, Sullivan and Edmondston, 2006). The posterior fibers are activated following heel strike to help control load transfer from one lower limb to the other and the anterior fibers assist with internal rotation of the thigh during the walking stance phase (Nyland, Kuzemchek, Parks and Caborn, 2004).
2.2 The Sacroiliac Joint

2.2.1 Introduction

The SIJ is seen as a common but often overlooked site of dysfunction that causes lower back and leg pain (Cibulka and Koldehoff, 1999). It accounts for more than twenty percent of lower back pain (Cramer and Darby, 1995) and commonly occurs in conjunction with muscle dysfunction (Defranca and Levine, 1996).

2.2.2 Structure of the sacroiliac joint

The SIJ, as illustrated by Figure 2.2, is a diarthrodial joint having a joint cavity containing fluid, articular cartilage and a joint capsule lined with synovial membrane. It is formed by the articulation between the auricular surfaces of the lateral aspect of the sacrum and the medial aspect of the ilium. The anterior articulation is called the synovial SIJ and the posterior articulation is called the fibrous SIJ (Kendall, McGeary and Provance, 1993). The sacral articular surface has a longitudinal groove that extends from it’s superior end to it’s inferior end. The iliac articular surface has a corresponding longitudinal ridge. The depressed and elevated articular surfaces form a partial interlocking mechanism that stabilizes the joint and becomes more enhanced and irregular with age (Plaugher, 1993).

Figure 2.2 Bones of the Pelvis (Moore and Dalley, 1999)
The superior half of the auricular surface is orientated posterior superiorly and the inferior half is orientated posterior inferiorly. The joint can be further divided into anterior and posterior concavities. The anterior concavity is lined by an articular capsule. The posterior concavity is joined by fibrous attachments and has no articular capsule. It consists of three fossae: superior, middle and inferior. The axis of SIJ rotation is located at the middle fossa and it is around this fossa that the iliac ridge moves in the sacral groove (Cramer and Darby, 1995).

The paired posterior SIJs lie within the pelvic ring at an oblique angle to the sagittal plane and together with the anterior pubic symphysis, it forms a three joint complex that functions similar to the vertebral three joint complex. The pelvic three joint complex is biomechanically linked to the hip and dysfunction at one end can lead to compensatory changes in the other (Bergmann, Peterson and Lawrence, 1993).

2.2.2.1 Ligamentous structures

The ligamentous system of the SIJ offers resistance to motion that occurs around the joint. This aids in the effective functioning of the joint to buffer, absorb, direct and compensate for forces generated through the trunk with locomotion and weight bearing (Cramer and Darby, 1995). The combined activity of the associated ligaments and muscles is necessary for stability to be maintained.

Incompetence from either structure can lead to focal and symptomatic instability of the SIJ (Willard, 1996).

a) Articular capsule
The articular capsule is only located along the anterior surfaces of the sacral ala and ilium. The superior aspect of the capsule is formed by the caudal extension of the iliolumbar ligament and the inferior aspect blends with the sacrospinous ligament (Willard, 1996). It is lined internally with a synovial membrane and innervated with nociceptive and proprioceptive nerve endings (Cramer and Darby, 1995).

b) Capsular ligaments
The anterior sacroiliac (SI) ligament, as illustrated by Figure 2.3, extends from the anterior surfaces of the lateral edge of the sacrum to the auricular surface of the ilium (Bergmann et al., 1993). It fuses with the articular capsule and becomes increasingly thicker inferiorly. It is
especially well developed where it connects the second sacral segment to the lateral margin of the preauricular sulcus, at the level of the posterior superior iliac spine (Cox, 1990).

The posterior SI ligament consists of two distinct parts: short and long. The short posterior SI ligament extends horizontally from the S1 and S2 sacral tubercles and attaches to the posterior surfaces of the medial aspects of the iliac crest and iliac tuberosity. The long posterior SI ligament extends vertically from the PSIS and the S3 and S4 sacral tubercles along the posterior aspect of the SIJ and blends inferiorly with the sacrotuberous ligament (Cramer and Darby, 1995). The anterior and posterior SI ligaments function to counteract gravitational forces and prevent dislocation of the SIJ (Bergmann et al., 1993).

The interosseous SI ligament forms the main connection between the posterior surfaces of the sacrum and ilium. It limits posterior movement of the joint (Plaugher, 1993). It consists of superficial and deep layers. The superficial layer is membranous and covered by the posterior SI ligaments. The deep layer has a short, transversely orientated cranial band and a long, vertically orientated caudal band (Cox, 1990). The cranial band extends from the lateral sacral crest and attaches to the sacropelvic surface of the ilium. It prevents anterior tipping of the sacrum. The caudal band extends from the medial and lateral sacral crests and attaches to the PSIS. It pulls the sacrum superiorly (Willard, 1996).

c) Accessory sacroiliac ligaments

The sacrotuberous, sacrospinous and iliolumbar ligaments are anterior to the articular capsule of the SIJ, as illustrated by Figure 2.3.

The sacrotuberous ligament extends infero-laterally from the posterior inferior aspect of the sacrum to the anterior medial aspect of the ischial tuberosity (Cramer and Darby, 1995). It is continuous with the long head of the biceps femoris tendon (Bergman et al., 1993).

The triangular shaped sacrospinous ligament lies anterior to the sacrotuberous ligament and extends from the anterior surface of the lateral edges of the inferior aspect of the sacrum and the superior aspect of the coccyx to the ischial spine (Bergman et al., 1993). Together with the sacrotuberous ligament, it forms the lesser sciatic foramen (Cramer and Darby, 1995). The sacrotuberous ligament and the sacrospinous ligament prevent postero-superior movement of the coccyx when the sacrum moves antero-inferiorly (Cox, 1990).
The iliolumbar ligament extends from the transverse processes of L4 and L5 to the superomedial aspect of the iliac crest. It has vertical fibres that blend anteriorly with the anterior SI ligament and posteriorly with the posterior SI ligament (Plaugher, 1993). It is important in stabilizing the L5 on the sacral base (Kirkaldy-Willis and Bernard, 1999).

Figure 2.3 Ligaments of the Pelvis (Clemente, 1997)
2.2.3 Innervation of the sacroiliac joint

The innervation of the SIJ is derived mainly from the anterior and posterior rami of L2 through S2 nerve roots. The anterior aspect of the SIJ is innervated by the anterior primary division of L2 through S2 nerve roots (Bernard and Cassidy, 1991). The posterior aspect of the SIJ is innervated by the posterior division of S1 and S2 nerve roots (Kirkaldy-Willis and Bernard, 1999).

The articular capsule is richly innervated with nociceptive (pain receptors) and proprioceptive (position and sensation receptors) nerve endings. Neuroreceptors are derived from the dorsal and ventral rami as well as the recurrent meningeal nerve of each segmental spinal nerve (Bergmann et al., 1993).

The sacrotuberous and sacrospinous ligaments are innervated by the posterior primary division of S1 and S3 nerve roots. The iliolumbar ligament is supplied by L1 fibres (Kirkaldy-Willis and Bernard, 1999).

2.2.4 Biomechanics

The SIJ allows for independent movement of the sacrum and ilium. It moves in a three dimensional manner which involves 3 degrees or less rotation with simultaneous 2 degrees or less translation (Harrison, Harrison and Troyanovich, 1997). Movement is initiated by muscles of the vertebral column, lower limbs and respiration, and is influenced by forces of gravity, ground reaction and muscle contraction (Cox, 1990).

When the vertebral column muscles initiate SIJ motion by postural changes (lying, standing and sitting) and motion of the vertebral column (flexion, extension, lateral flexion and rotation), the sacrum moves relative to the ilium and is referred to as nutation and counter-nutation (Cox, 1990).

Nutation occurs with forward flexion of the trunk when sitting or standing. The sacral base moves antero-inferiorly while the apex moves postero-superiorly. The PSIS simultaneously moves postero-infero-medially relative to the sacrum while the ischium moves antero-supero-
laterally. Counter nutation occurs with extension and results in the opposite motion (Plaugher, 1993).

When the lower limb muscles initiate SIJ motion by postural changes and motion of the hip joint (flexion, extension, abduction and adduction), the ilium moves relative to the sacrum. Hip flexion results in nutation while hip extension results in counter-nutation. Abduction and adduction results in gapping of the SIJ (Cox, 1990).

Respiration results in SIJ motion during inspiration and expiration. During inspiration, contraction of the erector spinae muscles and relaxation of the rectus abdominous muscles results in the supero-anterior movement of the posterior part of the pelvic ring and the postero-superior movement of the sacral base. Expiration results in the opposite motion (Cox, 1990).

Nutation and counter-nutation changes the antero-posterior diameter of the pelvic outlet. The pelvic outlet diameter increases during nutation and decreases during counter-nutation (Levangie and Norkin, 2001).

Rotation is another type of movement that occurs along a longitudinal axis that passes through the iliac ridge of the SIJ. Anterior pelvic rotation moves the PSIS supero-medially and posterior pelvic rotation moves the PSIS infero-laterally (Cramer and Darby, 1995).

A third type of SIJ motion occurs with lateral flexion and rotation of the vertebral column and is referred to as gapping. The iliac and sacral auricular surfaces move together and separate at different times at the anterior or posterior parts of the joint and at the superior or inferior margins (Bergmann et al., 1993).

The SIJ alters its structure according to demands of mobility and stability and the main function of movement in the SIJ is to convert the pelvis into a resilient and accommodating mechanism that is essential to static and dynamic weight bearing (Cramer and Darby, 1995).
2.2.5 Sacroiliac joint dysfunction

SIJ dysfunction is a condition that explains pain from a SIJ that presents without any demonstratable lesion but is presumed to have some type of biomechanical disorder that causes the pain. SIJ pain is recognized as spinal and referred lower limb pain arising from the SIJ (Dreyfuss, Michaelson, Pauza, McLarty and Bogduk, 1996).

2.2.5.1 Development and characteristics of sacroiliac joint dysfunction

SIJ dysfunction is caused by trauma and repeated minor forces. The SIJ is under greatest stress during sitting because the ground reaction force directly reaches the joint without going through any other joint (Cramer and Darby, 1995). The most common causes of dysfunction are: unilateral lower limb deficiency, muscle weakness or tightness and lower limb alignment problems (Kendall et al., 1993).

It occurs when the axis of rotation has shifted to either the superior or inferior aspect of the SIJ resulting in the abnormal motion of the joint. Total locking of the joint may occur in rare situations with no axis of rotation. SIJ motion mainly occurs in the sagittal plane and the resultant restricted motion is either a flexion or an extension fixation. Flexion fixation occurs when the PSIS is antero-superiorly fixated with the innominate bone and thus being fixated in flexion relative to the sacrum. Extension fixation occurs when the PSIS is postero-inferiorly fixated with the ipsilateral innominate bone and thus being fixated in extension relative to the sacrum (Gatterman, 1990).

Flexion and extension fixations alter the position of the lower limb. Flexion fixation of the SIJ causes the ipsilateral leg to appear shorter and the contralateral leg to appear longer. Extension fixation of the SIJ causes the ipsilateral leg to appear longer and the contralateral leg to appear shorter. Functional leg length inequality is considered to be a significant sign of SIJ dysfunction (Bergmann et al., 1993).
2.3 Myofascial Pain and Dysfunction Syndrome

MPDS is a regionalized pain syndrome which is characterized by discrete TrP nodules that occur in taut bands of skeletal muscle (Schneider, 1995). The prevalence, severity and duration of MPDS suggests that it is an important cause of regional pain in clinical practice (Skootsky, Jaeger and Robert, 1989).

2.3.1 Myofascial trigger points

2.3.1.1 Introduction

A myofascial TrP is a cluster of electrically active loci which are associated with a contraction knot and a dysfunctional motor end plate in skeletal muscle. This localized fibrosis presents clinically as a focus of hyperirritability that is associated with a hypersensitive palpable nodule in a taut band of skeletal muscle that can give rise to autonomic, motor and sensory phenomena (Travell and Simons, 1998).

TrPs may occur in skeletal muscles and their tendons, joint ligaments, capsules, the periosteum and skin (Baldry, 1993). They occur most frequently in postural muscles and may exist as a single TrP or as multiple TrPs (Rachlin, 1994). They cause persistent, debilitating and limiting pain that can be constant or periodic (Bruce, 1995).

2.3.1.2 The mechanism of myofascial trigger point development

Myofascial TrPs may develop in response to multiple factors in any skeletal muscle that is acutely or chronically strained by micro- or macro trauma (refer to Figure 2.4).

This strain results in the disruption of the sarcoplasmic reticulum and the release of free calcium ions into the sarcoplasm (Rachlin, 1994). The free calcium ions stimulate the actin-myosin sliding mechanism in the presence of adenosine triphosphate (ATP), resulting in increased metabolic activity. The impaired ability of the sarcoplasmic reticulum to remove free calcium ions from the sarcoplasm leads to sustained contractile activity of the sarcomere. Reduced blood flow results in decreased oxygen and nutrition supplied to the injured area (Mense et al., 2001).
Increased metabolic demands increase the release of serotonin, histamine, kinins and prostaglandins. These substances heighten the sensitivity and firing of the groups III and IV muscle nociceptors causing local and referred pain (Travell and Simons, 1998).

The combination of decreased blood flow, decreased ATP-calcium pump action and free calcium and ATP interaction results in a self perpetuating cycle of increased muscle activity that leads to localized fibrosis within a muscle that is painful, resists stretching, has a decreased range of motion and general dysfunction (Gatterman, 1990).

Figure 2.4 Pathophysiology of Myofascial Pain Syndromes (Rachlin, 1994)
2.3.1.3 Classification of myofascial trigger points

A myofascial TrP is classified as either active or latent (Travell and Simons, 1998).

An active myofascial TrP’s nociceptors have been sufficiently activated and sensitized resulting in a trigger point that is always tender and spontaneously causes pain in the weakened muscle. It produces referred motor, sensory and sometimes autonomic phenomena in its pain reference zone when palpated (Baldry, 1993).

There are three types of active myofascial TrPs:

- Primary myofascial TrPs are central TrPs that are activated by acute or chronic overload of the muscle in which it occurs. It develops independently of TrP activity in another muscle (Travell and Simons, 1998).
- Secondary myofascial TrPs develop in response to stress and muscle spasm in synergistic or antagonistic muscles of the muscle that contains the primary myofascial TrP (Rachlin, 1994).
- Satellite myofascial TrPs develop in muscles that are situated in the pain reference zone of a primary myofascial TrP occurring in another muscle (Baldry, 2001).

A latent myofascial TrP’s nociceptors have been activated and sensitized to a limited extent resulting in a TrP that causes motor dysfunction but is asymptomatic with respect to spontaneous pain. It only produces pain when palpated (Baldry, 2001).

2.3.1.4 Diagnosis of myofascial trigger points

According to Mense et al (2001), a patient can be diagnosed with myofascial TrPs based on the following symptoms and physical findings:

a) Symptoms

- A history of sudden onset following acute muscle overload or a history of gradual onset with chronic muscle overload.
- Spontaneous pain and referred pain patterns produced by an active myofascial TrP or pain produced by palpation of a latent TrP that is characteristics of the affected muscle.
• Autonomic disturbances such as abnormal sweating, persistent lacrimation, coryza, excessive salvation and altered pilomotor responses.
• Motor disturbances such as weakness, decreased endurance and spasm of the affected muscle.
• Disturbed sleeping patterns due to increased pain sensitivity.

b) Physical findings
• Full stretch range of motion of the affected muscle is prevented by pain.
• Strength and endurance of the affected muscle is decreased.
• Increased pain when a muscle with active myofascial TrPs is strongly contracted against fixed resistance.
• Restricted passive range of motion in muscles with active myofascial TrPs.
• A taut band of muscle fibers is palpable in the affected muscle.
• A tender hypersensitive nodule that is characteristic of a myofascial TrP can be localized in the taut band.
• Digital pressure applied to the myofascial TrP elicits localized pain and/or referred pain pattern that is characteristic of the affected muscle.
• Snapping palpation of the myofascial TrP elicits a local twitch response of the taut band fibers.

2.3.1.5 Aggravating and perpetuating factors of myofascial trigger points

According to Travell and Simons (1998), myofascial TrPs can be aggravated by:

• Strenuous use of the muscle especially in the shortened position.
• Passive stretching of the muscle.
• Pressure on the myofascial TrP.
• Placing the affected muscle in a shortened position for a prolonged period.
• Sustained contraction of the affected muscle.
• Exposure to a cold draft especially when the affected muscle is fatigued.
• Cold, damp weather, viral infections and periods of increased nervous tension.
Travell and Simons (1998) state that existing myofascial TrPs can be perpetuated by:

a) **Structural inadequacies**
   - Lower extremity length inequality.
   - A small hemipelvis.
   - Short upper arms.
   - Short first and long second metatarsal.

b) **Postural stresses**
   - Misfitting furniture.
   - Poor posture.
   - Immobility.
   - Repetitive movement overload.
   - Prolonged constricting pressure on a muscle.

c) **Nutritional deficiencies**
   - Thiamine.
   - Pyridoxine.
   - Cobalamin and folic acid.
   - Ascorbic acid.
   - Dietary mineral and trace elements especially iron, calcium, potassium and magnesium.

e) **Metabolic and endocrine inadequacies**
   - Hypometabolism.
   - Hypoglycemia.
   - Hyperuricemia.

f) **Psychological factors**
   - Depression.
   - Anxiety and tension.
   - Sick behaviour.
g) Chronic infection and infestations
- Viral disease.
- Bacterial infection.
- Fish tapeworm, giardiasis and amebiasis infestations.

h) Other factors
- Allergic rhinitis.
- Impaired sleep.
- Nerve impingement.

2.3.1.6 Relief of myofascial trigger point pain

Mense et al (2001), state that myofascial TrP pain can be relieved by:

- A brief period of rest.
- Slow, passive stretch of the affected muscle, especially when the patient is seated in a warm bath or water shower.
- Application of moist heat over the myofascial TrP.
- Short period of light activity.
- Specific myofascial therapies such as spray and stretch, voluntary contraction and release methods, TrP pressure release and injection, stripping massage, myofascial release therapies and therapeutic modalities.

2.3.2 Gluteus Medius myofascial pain and dysfunction syndrome

2.3.2.1 Activation and perpetuation of Gluteus Medius myofascial trigger points

Travell and Simons (1998) state that Gluteus Medius myofascial TrPs are likely to be activated and perpetuated by:

- Sudden falls.
- Sports injuries.
- Running.
- Aerobics.
- Weight bearing on only one lower extremity for a prolonged period.
- Injection to the muscle.
- Lower extremity length inequality.
- Morton foot structure.
- SIJ dysfunction.
- Prolonged hip flexion.
- Sustained pressure on the trigger point by sitting on a credit card filled wallet.

### 2.3.2.2 The location and referred pain pattern of Gluteus Medius myofascial trigger points

The three Gluteus Medius myofascial TrPs, as illustrate by Figure 2.5, are concentrated along and below the iliac crest with pain being referred to the immediate vicinity of the muscle (Travell and Simons, 1997).

![Figure 2.5 Trigger Point Location and Referred Pain Pattern of the Gluteus Medius Muscle (Travell and Simons, 1997)](image)
• TrP 1 (posterior) lies deep to the Gluteus Maximus near the SIJ. It refers pain mainly along the posterior iliac crest, to the SIJ over the ipsilateral sacrum and a greater part of the buttock.
• TrP 2 (middle) is centered just below the length of the iliac crest. It refers pain to the midgluteal region, and postero-laterally into the upper thigh.
• TrP 3 (anterior) is located near the ASIS just below the iliac crest. It refers pain mainly along the iliac crest, lowest lumbar region and laterally over the sacrum.

2.3.2.3 Signs and symptoms of Gluteus Medius myofascial trigger points

According to Travell and Simons (1997), a patient with Gluteus Medius myofascial TrPs will present with the following signs and symptoms:

• The patient tends to weight bear predominantly on one leg in order to relieve tension caused by lower extremity length inequality.
• The patient may have an uncorrected Morton foot structure.
• Hip abduction is restricted in the involved side.
• Pain is present on walking.
• Difficulty sleeping on the involved side or when lying on the back.
• Discomfort when seated in a slumped position.
2.4 The Link between Myofascial Pain and Dysfunction Syndrome and Joint Dysfunction

Musculoskeletal pain syndromes are caused by a combination of articular and muscular dysfunction (Schneider, 1995).

Figure 2.6 The Relationship between Muscle and Joint Dysfunction (Knutson and Owen, 2003)
According to Knutson and Owen (2003), a muscle may develop hypertonicity in response to several pathological injuries. Active muscle contractions occur due to a flexor reflex reaction and results in restricted motion of the joint that the muscle is related to. Sustained reaction stimulates groups III and IV nociceptors that then perpetuates the contractions resulting in muscle stiffness, pain and ischemia. The muscular imbalance results in abnormal joint motion and the impaired dysfunctional joint causes reflexogenic muscular responses (DeFranca and Levine, 1996).
2.5 Integrated Neuromuscular Inhibition Technique

2.5.1 Introduction

Soft tissue therapies have a positive therapeutic effect on acute and chronic musculoskeletal conditions (Lederman, 2005). Muscle energy techniques utilize isometric and isolytic contractions whereas neuromuscular techniques utilize the manual application of pressure to treat muscular dysfunctions (Chaitow, 1996). A combination of the two techniques produces a synergistic therapeutic effect on muscular dysfunctions and the combined technique is called Integrated Neuromuscular Inhibition Technique (Chaitow, 1998).

2.5.2 The effect of integrated neuromuscular inhibition technique on muscle tone and myofascial trigger points

The INIT involves the application of three techniques: ischaemic compression with positional release, isometric and isolytic contraction.

a) Ischaemic compression

The barrier phenomenon is common to the muscular skeletal system and plays an important role in ischaemic compression. A normal soft tissue barrier is soft and resilient. A pathological barrier is restrictive and signifies the contractured sarcomeres of the myofascial TrP. Ischaemic compression by digital pressure engages the pathological barrier until muscle tension is released. Pressure is then increased until no further pathological barriers are encountered, resulting in the release of muscle tension and the return of the sarcomere towards their normal length (Janada, 1996). When pressure is released there is an influx of blood flow through the TrP and metabolic substances are flushed out. Nerve endings are desensitized and myofascial TrP irritability and pain are reduced (Simons, 1989).

b) Positional release

The affected muscle is passively placed in an exaggerated position of it’s shortened state. This position of least tension lies between the restrictive and physiological barriers. Maximum relaxation of the affected muscle occurs and manual therapy can be applied with less discomfort to the patient resulting in the reduction of excessive muscle tone (Chaitow, 2002).
c) **Isometric contraction**

This is defined as an increase in muscular force without change in the muscle length. The affected muscle contracts until it reaches the restrictive barrier, resistance is then applied to prevent further movement. Within the muscle, the actin-myosin sliding mechanism is activated but the tensile force produced is not used to further contract the muscle but instead it is used to contract the elastic structures and insertion points of the muscle (Mense et al., 2001).

d) **Isolytic contraction**

This is defined as muscular force resisting muscle lengthening by external forces. The affected muscle is lengthened until it reaches the restrictive barrier, resistance is then applied to prevent further movement. Within the muscle fibers, the actin-myosin sliding mechanism is activated but the tensile force produced is less than that causing lengthening (Mense et al., 2001).

INIT involves a series of incremental releases that are effective in lengthening the contractured sarcomeres, deactivating myofascial TrPs, reducing the hypersensitivity of pain producing nerve endings and relieving the tautness of muscle fibers that cause increased muscle tension (Chaitow, 1996).
2.6 Spinal Adjustment

2.6.1 Introduction

According to Kirkadly-Willis and Bernard (1999), an adjustment is defined as a highly skilled manual procedure carried out by a sudden brief thrust delivered at the physiological limit of range of motion but within the boundaries of the joints anatomic integrity. Adjustive treatment is regarded as an important factor in the rehabilitation of passive motion of joints and soft tissues, particularly muscles in spasm and with TrPs (Janada, 1996).

2.6.2 The effects of an adjustment

According to Gatterman (1990), an adjustment is a controlled high-velocity, low-amplitude mechanical force that produces physical and neurophysiological effects when applied to a dysfunctional joint.

The physical effects are:
- Separation of articular surfaces as the elastic barrier is overcome.
- Breaking of interarticular adhesions.
- Cavitation.
- Joint and muscle mechanoreceptor stimulation.
- Increase in active and passive range of motion.

The neurophysiological effects are:
- Pain Inhibition.
- Muscle relaxation.
- Stimulation of the autonomic nervous system.

Spinal structures are densely populated with neuroreceptors that are responsive to mechanical, inflammatory and temperature changes. A fixated or dysfunctional joint stimulates neuroreceptors within spinal and paraspinal tissues. The impulses transmitted via large myelinated fibers that compete with impulses transmitted via smaller myelinated fibers from adjacent tissues (Kirkaldy-Willis and Bernard, 1999). Central reflex pathways and specific
somato-sensory reflexes are stimulated resulting in somatovisceral responses in sympathetic and parasympathetic nerves or in somato-somatic responses that lead to muscle spasm (Halderman, 2000).

An adjustment stimulates spinal and paraspinal receptors and increases the input of impulses. The spinal pain gating mechanism is inhibited resulting in the decrease of pain transmission. Stretching of joint capsules reflexly inhibit facilitated motoneuron pools responsible for muscle excitability and spasm (Bergmann et al., 1993).
CHAPTER THREE - METHODOLOGY

3.1 Introduction

This chapter describes the manner in which this research was constructed and conducted. It explains the method of patient selection, measurements used, treatment procedure and the statistical analysis of the data collected.

3.2 Study Design

3.2.1 Aims

The aim of this study was to determine the most effective treatment method for myofascial pain and dysfunction syndrome of the Gluteus Medius muscle by comparing the INIT with a combined treatment method of the INIT and SIJ adjustive therapy.

3.2.2 Sample group selection criteria

Participants were recruited by advertisement posters (Appendix A) placed in and around the University of Johannesburg Doornfontein Campus.

Participants between the ages of 18 and 50 years who were suffering from lower back pain for a duration of four weeks or longer and presented with Gluteus Medius myofascial TrPs and an ipsilateral SIJ dysfunction were eligible for the study.

Participants who presented to the Chiropractic Day Clinic in response to the advertisements were assessed to determine if they were viable for the study. This consisted of a brief history, a myofascial TrP examination of the Gluteus Medius muscle and motion palpation of the SIJs.
3.2.2.1 Inclusion criteria

Participants were included based on the following criteria:

- Participants had to be between the ages of 18 and 50 years.
- Participants had to have lower back pain for a duration of four weeks or longer.
- Participants had to have active or latent Gluteus Medius myofascial TrPs.
- Participants had to have a SIJ dysfunction on the ipsilateral side of the involved Gluteus Medius muscle.

3.2.2.2 Exclusion criteria

Participants were excluded based on the following criteria:

- Hip joint pathology.
- Recent major trauma to the lumbar spine and/or pelvis.
- Recent surgery to the lumbar spine and/or pelvis.
- Skin conditions localized to the lumbar spine and/or pelvis.
- Contra-indications to spinal adjustive therapy (refer to Table 3.1).

Table 3.1 Contra-indications to Spinal Manipulation (Gatterman, 1990)

<table>
<thead>
<tr>
<th>Vascular complications</th>
<th>Atherosclerosis of major blood vessels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vertebral basilar insufficiency</td>
</tr>
<tr>
<td></td>
<td>Aneurysm</td>
</tr>
<tr>
<td>Tumors</td>
<td>Metastatic</td>
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<tr>
<td>Bone infections</td>
<td>Tuberculosis</td>
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<tr>
<td></td>
<td>Osteomyelitis</td>
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<tr>
<td>Metabolic disorders</td>
<td>Clotting disorders</td>
</tr>
<tr>
<td></td>
<td>Osteopaenia</td>
</tr>
</tbody>
</table>
Table 3.1 (continued)

| Traumatic injuries                                    | • Fractures            |
|                                                     | • Severe sprains or strains |
|                                                     | • Joint instability or hypermobility |
|                                                     | • Unstable spondylolisthesis |
| Arthritic conditions                                | • Rheumatoid arthritis |
|                                                     | • Ankylosing spondylitis |
|                                                     | • Psoriatic arthritis |
|                                                     | • Unstable or late stage osteoarthritis |
| Neurological complications                          | • Disc lesions         |
|                                                     | • Space occupying lesions |
| Psychological considerations                        | • Hysteria             |
|                                                     | • Malingering          |
|                                                     | • Hypochondriasis      |

3.2.3 Patient consent

Participants that met all the inclusion criteria were required to fill in a subject information and consent form (Appendix B). This stated all the relevant information about the study as well as the purpose and benefits of the study. The form informed patients about their anonymity and confidentiality. It also informed patients about their voluntary participation and their freedom to withdraw at any time from the study.

3.2.4 Randomisation process

Thirty viable patients were randomly placed into one of two groups consisting of fifteen subjects each as they entered into the study. Each patient had to pick one of thirty folded pieces of paper of which fifteen were numbered “1” and fifteen were numbered “2”. Once a paper was selected, the patient was placed into the relevant group and the paper was discarded.
3.3 Sample group procedure

Each patient was asked a detailed case history (Appendix C) and underwent a full physical examination (Appendix D). A lumbar spine and pelvis regional examination (Appendix E) was performed. Participants attended four sessions over a period of eight days and were treated on all of these sessions.

Subjective data and objective measurements were recorded on four sessions, prior to treatment. Subjective data were obtained using the McGill Pain Questionnaire (Appendix G) and the Numerical Pain Rating Scale (Appendix H). Objective measurements were taken using the Universal Goniometer (Appendix I) and the Wagner Pressure Algometer (Appendix J). Examination findings were recorded on a SOAP note (Appendix F) on each visit and were signed by the supervising clinician present.

Patients were treated according to their specific group.
Group 1 - 15 patients were treated with the INIT to the affected Gluteus Medius muscle.
Group 2 - 15 patients were treated with the INIT to the affected Gluteus Medius muscle and a SIJ adjustment pertaining to the type of SIJ dysfunction on the ipsilateral side.

3.3.1 Procedure

The procedure from the initial response of the participant to the study was as follows:

- Participant was briefly assessed to determine viability for study by means of a history, a myofascial TrP examination of the affected Gluteus Medius and motion palpation of the SIJs.
- Participant was selected based on inclusion and exclusion criteria.
- Participant was informed of the research study and signed the subject information and consent form (Appendix B).
- Case history was taken (Appendix C).
- Full physical examination was performed (Appendix D).
- Lumbar and pelvis regional examination was performed (Appendix E).
• Patient completed the McGill Pain Questionnaire (Appendix G) and the Numerical Pain Rating Scale (Appendix H).
• Hip extension and abduction ranges of motion readings of the involved side were taken using the Universal Goniometer and recorded (Appendix I).
• Algometry readings of the Gluteus Medius myofascial TrPs on the involved side were taken using the Wagner Pressure Algometer and recorded (Appendix J).
• SOAP note was signed by the supervising clinician (Appendix F).
• Patient was treated according to his/her specific group.

3.4 Interventions

Participants attended four sessions over an eight day period and were treated on all of these sessions. Group 1 patients were treated with only the INIT. Group 2 patients were treated with the INIT and a sacroiliac adjustment.

3.4.1 Trigger point examination and INIT of the Gluteus Medius muscle

3.4.1.1 Trigger point examination

Each participant was examined for the presence of Gluteus Medius myofascial Trps on the involved side (Figure 3.1).

Figure 3.1 Trigger Point Palpation of Gluteus Medius Muscle (Travell and Simons, 1997)
• The patient lay on the examining bed on the unaffected side with a pillow placed between their bent knees exposing the affected Gluteus Medius muscle.
• The muscle was palpated along and below the iliac crest for points of maximum tenderness by applying thumb pressure with the examining hand.
• TrP 1 was located below the iliac crest but close to the posterosuperior SIJ in the posterior portion of the muscle
• TrP 2 was located just below the centre of the iliac crest.
• TrP 3 was located below the iliac crest but close to the anterior superior iliac spine in the anterior portion of the muscle.

3.4.1.2 INIT

Each patient was treated with the INIT on the affected Gluteus Medius muscle (Figure 3.2).

![Figure 3.2 Application of INIT on the Gluteus Medius Muscle (Chaitow, 2002)](image)

• The patient lay prone on the examining bed, exposing the affected Gluteus Medius muscle.
• The examiner stood at the caudal end of the bed on the ipsilateral side of the affected muscle, facing cephalad.
Thumb pressure with the cephalad hand was applied over the TrP for 20 seconds as the caudal hand simultaneously extended and abducted the ipsilateral leg at the hip into a pain free position.

The patient then lay on the unaffected side.

The examiner stood in front of the patient.

Isometric contraction was achieved by the patient extending and abducting the affected leg at the hip against the examiner as thumb pressure was simultaneously applied over the TrP for 10 seconds.

The examiner stood behind the patient

Isolytic stretch was achieved by the patient passively flexing and adducting the affected leg at the hip as thumb pressure was simultaneously applied over the TrP for 10 seconds.

3.4.2 Motion palpation and adjustment of the sacroiliac joint

3.4.2.1 Motion palpation

Each patient was motion palpated over their SIJs for the presence of a sacroiliac dysfunction, as described by Plaugher (1993), on the ipsilateral side of the involved Gluteus Medius muscle.

a) Flexion of the posterior superior sacroiliac joint

- The patient stood next to a chair and maintained balance by holding onto the chair.
- The examiner took thumb contacts on the posterior superior iliac spine (PSIS) and on the second sacral tubercle.
- The patient was instructed to slowly flex the ipsilateral leg at the hip as far forward as possible.
- Normally the PSIS moved posteriorly and inferiorly whilst the second sacral tubercle moved slightly anteriorly and inferiorly. The thumb contacts approximated.
- In the presence of a flexion restriction, the thumbs contacts did not approximate.
b) **Extension of the posterior superior sacroiliac joint**

- The patient stood in the same position and the examiner took the same thumb contacts as in a).
- The patient was instructed to slowly flex the contralateral leg at the hip as far forward as possible.
- Normally the PSIS moved anteriorly and superiorly.
- In the presence of an extension restriction, the thumb contacts did not separate.

c) **Flexion/Extension of the posterior middle sacroiliac joint (PMSIJ)**

- The patient stood in the same position as in a).
- The examiner took thumb contacts on SIJ at the level of S4 and on the second sacral tubercle.
- The patient was instructed to slowly flex the ipsilateral leg at the hip and the PMSIJ move posteriorly and inferiorly.
- The patient was instructed to slowly flex the contralateral leg at the hip and the PMSIJ joint moved anteriorly and superiorly.

d) **Flexion /Extension of the posterior inferior sacroiliac joint (PISIJ)**

- The patient stood in the same position as a).
- The examiner took thumb contacts on sacral apex SIJ and at the adjacent ischium.
- The patient was instructed to slowly flex the ipsilateral leg at the hip and the sacral apex and adjacent ischium moved anteriorly and superiorly relative to sacral apex.
- In the presence of a flexion restriction, the thumb contacts did not approximate.
- The patient was instructed to slowly flex the contralateral leg at the hip and the sacral apex and adjacent ischium moved posteriorly relative to sacral apex.
- In the presence of an extension restriction, the thumb contacts did not separate.

e) **Standing forward flexion**

- The patient stood with their feet shoulder width apart.
- The examiner placed a thumb contact on each PSIS.
- The level of each PSIS was compared.
- The patient was instructed to flex forward as far as possible
• In the presence of a dysfunction the PSISs were asymmetrical and the lower PSIS, which existed on the involved side, moved superiorly to the other.

3.4.2.2 Adjustment of the sacroiliac joint

Drop piece adjustments were used to adjust the involved SIJ. This type of adjustment eliminated the possibility of multiple releases in the lumbar spine by enabling the examiner to specifically adjust only the dysfunctional SIJ when performing the adjustment.

Drop piece adjustments are based on Newton’s 1\textsuperscript{st} law, which states: ‘A body is in equilibrium, if no force is acting upon it. If at rest, it remains so. If in motion, it persists in motion unless an opposing force is met.’

An adjustive thrust delivered to a vertebral segment on the appropriate raised drop piece of a chiropractic bed applies this law of motion. The thrust imparts motion to the vertebral segment which develops kinetic energy as the drop piece moves from a raised to a neutral position. The motion is maintained until the drop piece suddenly impacts the bed. The counter reactive force generated on impact is then imparted to the vertebral segment, thus completing the adjustment (Bergman \textit{et al.}, 1993 and Gatterman, 1990).

Each patient was adjusted, as described by Bergmann \textit{et al} (1993), depending on the type of SI dysfunction they presented with.

\textit{a) Anterior superior ilium drop (restricted SIJ flexion)}

• The patient was instructed to lie supine with their pelvis placed over the pelvic section of the chiropractic bed.
• The examiner stood in a fencer stance on the ipsilateral side of the dysfunction.
• A hypothenar contact was taken with the caudal hand on the anterior superior iliac spine.
• The cephalad hand reinforced the contact hand with a pisiform contact in the anatomical snuff box of the contact hand.
• The adjustive thrust was delivered in an anterior to posterior direction through the joint when the appropriate drop piece tension was established.
b) Posterior ilium drop (restricted SIJ extension)

- The patient was instructed to lie prone with the pelvis over the pelvic section of the chiropractic bed.
- The examiner stood in a fencer stance on the ipsilateral side of the dysfunction.
- A hypothenar contact was taken with the caudal hand on the posterior superior iliac spine.
- The cephalad hand reinforced the contact hand with a pisiform contact in the anatomical snuff box of the contact hand.
- The adjustive thrust was delivered in a posterior to anterior direction through the joint when the appropriate drop piece tension was established.

3.5 Measurements

3.5.1 Subjective measurements

Subjective data were obtained using the McGill Pain Questionnaire (Appendix G) and the Numerical Pain Rating Scale (Appendix H).

Each patient was required to complete these on all four sessions, prior to treatment.

3.5.1.1 McGill pain questionnaire

The McGill Pain Questionnaire was used to determine the subjective changes each patient experienced. It is recognized as a valid and acceptable measurement for moderate/severe pain which is either acute/chronic (Nussbaum and Dourones, 1998) and is referred to being the leading global standard for assessing the sensory and affective dimensions of pain (McDowell and Newell, 1996).

The questionnaire has twenty category scales with verbal descriptions of pain, a 5 point rating index representing the present pain and a pain diagram to indicate the location of pain. Patients were required to mark the appropriate verbal description in each category as well as indicate the location of pain. The questionnaire was graded and the measurement was recorded.
3.5.1.2 Numerical pain rating scale

The Numerical Pain Rating Scale was used to obtain subjective information about the intensity of pain each patient experienced. It is regarded as a reliable and consistent measure of experimental and clinical pain intensity (Price, Bush, Long and Harkins, 1994). It has been shown to be more valid in measuring the effect of treatment on pain levels as compared to other pain intensity scales (Boltan and Wilkinson, 1998). The scale ranges from naught to ten and increases from no pain to most severe pain. Patients were asked to mark the level of pain they were experiencing at the time. This level was calculated as a percentage of one hundred.

3.5.2 Objective measurements

Objective measurements were obtained using the Universal Goniometer (Appendix I) and the Wagner Pressure Algometer (Appendix J).

Objective measures of each patient were taken on all four sessions, prior to treatment.

3.5.2.1 Goniometry

The Universal Goniometer was used to measure hip ranges of motion of the affected Gluteus Medius muscle. It is an essential device to assess improvement in joint flexibility. It has been shown to provide reliability and validity (Yeomans, 2000).

The protractor measures 180 degrees and has one axis that joins two arms. One arm is kept stationary on a fixed point while the other arm is moved around the axis of the protractor. The resulting angle is measured in degrees (Bierma-Zienstra, Bohnen, Ramlal, Ridderikhoff, Verhaar and Prins, 1998).

The hip ranges of motion for extension and abduction of each patient was measured, as described by Valmassy (1996), on the ipsilateral side of the involved Gluteus Medius muscle.
a) Hip extension
- The patient was instructed to lie prone.
- The goniometer was centered at the hip joint of the involved side.
- The stationary arm was fixed on the lateral surface of the trunk of the body.
- The mobile arm was placed horizontally on the lateral border of the upper leg in line with the greater trochanter and lateral epicondyle of the femur.
- The patient was instructed to perform active hip extension, with their knees extended, as far backward as they could go.
- The mobile arm was moved along with the upper leg to the point of the patient’s maximum hip extension and the resultant angle was recorded (Appendix I).

b) Hip abduction
- The patient was instructed to lie supine.
- The goniometer was centered on the hip joint axis, a horizontal line through the hips at the greater trochanter of the femur.
- The stationary arm was horizontally fixed on the involved side, on the anterior surface of the trunk of the body, in line with the ASIS.
- The mobile arm was placed vertically on the anterior surface of the upper leg at the midpoint of the medial and lateral femoral epicondyles.
- The patient was instructed to perform active hip abduction, with the knees extended, as far outward as they could go.
- The mobile arm was moved along with the upper leg to the point of the patient’s maximum hip abduction and the resultant angle was recorded (Appendix I).

3.5.2.2 Pressure algometry

The Wagner Pressure Algometer was used to measure pressure threshold, tolerance and tissue compliance of trigger points in the affected Gluteus Medius muscle. It has been shown to have high reliability and validity (Fischer, 1986). It is successful in evaluating different treatments for myofascial and musculoskeletal pain (Rachlin, 1994).

The algometer is a pressure threshold meter that is calibrated in kilograms per square centimeter and ranges from 0 to 10kg (Fischer, 1986).
a) Procedure

- The patient was instructed to lie on the examining bed on the unaffected side with a pillow placed between their knees exposing the affected Gluteus Medius muscle.
- The muscle was palpated along and below the iliac crest for points of maximum tenderness by applying thumb pressure with the examining hand.
- The TrPs were located and marked with a pen.
- The algometer was placed on the TrP perpendicular to the skin.
- The device was pushed into the TrP until the patient indicated minimum pressure that was causing pain.
- The resultant reading was recorded (Appendix J).

3.6 Data Analysis

3.6.1 Processing of data

3.6.1.1 Demographic data

Demographic data was tabulated under the following headings: sample size, gender ratio, race distribution, age range and mean age. The table was divided into two treatment groups and their combined totals.

3.6.1.2 Subjective data

The McGill Pain Questionnaire and the Numerical Pain Rating Scale were completed on each visit prior to treatment. The average values of each subject in the two groups for the four visits were calculated. The processed data was statistically analyzed.

3.6.1.3 Objective data

The Universal Goniometer was used to measure the pre and post ranges of motion for hip extension and hip abduction. This was measured in degrees and the average pre-and post-
goniometer readings of each subject in the two groups for the four visits were calculated. The processed data was statistically analysed.

The Wagner Pressure Algometer was used to measure the pre and post pressure tolerance readings of the three Gluteus Medius myofascial Trps on each visit. This was measured in kg/cm² and the average pre and post-algometer readings for each TrP of each subject in the two groups for the four visits were calculated. The processed data was statistically analysed.

3.6.2 Statistical analysis of the data

All of the data above was statistically analyzed using Repeated Measures and Independent t-tests. P-values were calculated to determine the statistical significance of the data. P-values less than 0.05 were statistically significant. P-values greater than 0.05 were not statistically significant.

Subjective data collected from the McGill Pain Questionnaire and the Numerical Pain Rating Scale were plotted on bar graphs to determine whether treatments were effective and which treatment was most effective.

Objective data collected from the goniometer and algometer readings were plotted on bar graphs to determine whether treatments were effective and which treatment was most effective. The p-values were tabulated and statistically compared with each other to determine if any statistically significant difference existed within and between the two groups.
CHAPTER FOUR – RESULTS

4.1 Introduction

The results obtained during the study are presented in this chapter. Subjective and objective data obtained during the study were statistically analysed to determine significant improvements in each group and if there were significant differences between each group.

The analysis includes:

- A demographical comparison.
- McGill Pain Questionnaire.
- Numerical Pain Rating Scale.
- Goniometer readings of hip extension and hip abduction of the involved side.
- Algometer readings of Gluteus Medius myofascial TrPs on the involved side.

4.2 Demographic Data

Table 4.1 Demographic Data

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
<th>Combined Total of Group 1 and Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Size</td>
<td>15</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>Age Range</td>
<td>18-37</td>
<td>19-49</td>
<td>18-49</td>
</tr>
<tr>
<td>Gender Ratio (M:F)</td>
<td>3:12</td>
<td>5:10</td>
<td>8:22</td>
</tr>
<tr>
<td>Mean Age</td>
<td>27.40</td>
<td>25.67</td>
<td>26.53</td>
</tr>
</tbody>
</table>
4.3 Subjective Data

Group 1 is represented by coloured bar
Group 2 is represented by coloured bar

4.3.1 McGill pain questionnaire for Group 1

Based on intra-group analysis, Figure 4.1 illustrates there was a statistically significant difference of the mean pain rating score (p=0.01).
4.3.2 McGill pain questionnaire for Group 2

![Bar Graph Representing the McGill Pain Questionnaire for Group 2](image)

Based on intra-group analysis, Figure 4.2 illustrates there was a statistically significant difference of the mean pain rating score (p=0.01).
4.3.3 Comparison of the McGill pain questionnaire between Group 1 and Group 2

Figure 4.3 Bar Graph Comparing the McGill Pain Questionnaire between Group 1 and Group 2

Table 4.2 P-values for the Difference between Visit 1 and Visit 4 for Group1 and Group2

<table>
<thead>
<tr>
<th>Visit</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visit 1</td>
<td>0.567</td>
</tr>
<tr>
<td>Visit 4</td>
<td>0.116</td>
</tr>
</tbody>
</table>

Based on inter-group analysis, Figure 4.3 illustrates there was no statistically significant difference of the mean pain rating score between the two groups for visit 1 and visit 4, as indicated by Table 4.2 (p>0.05).
4.3.4 Numerical pain rating scale for Group 1

Based on intra-group analysis, Figure 4.4 illustrates there was a statistically significant difference of the mean pain level (p=0.000).
4.3.5 Numerical pain rating scale for Group 2

Based on intra-group analysis, Figure 4.5 illustrates there was a statistically significant difference of the mean pain level ($p=0.001$).

Figure 4.5 Bar Graph Representing the Numerical Pain Rating Scale for Group 2
4.3.6 Comparison of the Numerical pain rating scale between Group 1 and Group 2

Figure 4.6 Bar Graph Comparing the Numerical Pain Scale between Group 1 and Group 2

Table 4.3 P-values for the Difference between Visit 1 and Visit 4 for Group1 and Group2

<table>
<thead>
<tr>
<th>Visit</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visit 1</td>
<td>1.000</td>
</tr>
<tr>
<td>Visit 4</td>
<td>0.089</td>
</tr>
</tbody>
</table>

Based on inter-group analysis, Figure 4.6 illustrates there was no statistically significant difference of the mean pain level between the two groups for visit 1 and visit 4, as indicated by Table 4.3 (p>0.05).
4.4 Objective Data

Goniometer readings taken prior to treatment for hip ranges of motion of the affected Gluteus Medius were referred to as:

- Pre-Goniometer Readings – Pre-Hip Extension and Pre-Hip Abduction

Goniometer readings taken after treatment for hip ranges of motion of the affected Gluteus Medius were referred to as:

- Post-Goniometer Readings – Post-Hip Extension and Post-Hip Abduction

Algometer readings taken prior to treatment of TrPs of the affected Gluteus Medius were referred to as:

- Pre-Algometer Readings – Pre-TrP1, Pre-TrP2 and Pre-TrP3

Algometer readings taken after treatment of TrPs of the affected Gluteus Medius were referred to as:

- Post-Algometer Readings – Post-TrP1, Post-TrP2 and Post-TrP3

Group 1 is represented by the following coloured bars:

- goniometer readings - Pre-Hip Extension
  - Pre-Hip Abduction
  - Post-Hip Extension
  - Post-Hip Abduction

- algometer readings - Pre-TrP1
  - Pre-TrP2
  - Pre-TrP3
  - Post-TrP1
  - Post-TrP2
  - Post-TrP3
Group 2 is represented by the following coloured bars:

- goniometer readings - Pre-Hip Extension
  - Pre-Hip Abduction
  - Post-Hip Extension
  - Post-Hip Abduction

- algometer readings - Pre-TrP1
  - Pre-TrP2
  - Pre-TrP3
  - Post-TrP1
  - Post-TrP2
  - Post-TrP3
4.4.1 Comparison of the Mean Pre- and Post-Goniometer Readings Group 1

![Bar Graph Comparing the Mean Pre- and Post-Goniometer Readings for Group 1](image)

Figure 4.7 Bar Graph Comparing the Mean Pre- and Post-Goniometer Readings for Group 1

<table>
<thead>
<tr>
<th>Visit</th>
<th>Pre- and Post-Hip Extension</th>
<th>Pre- and Post-Hip Abduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visit 1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Visit 2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Visit 3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Visit 4</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 4.4 P-values for the Mean Pre- and Post-Goniometer Readings for Group 1
Based on intra-group analysis, Figure 4.7 illustrates there was no statistically significant difference of the mean pre- and post-goniometer readings, as indicated by Table 4.4 (p>0.05). Table 4.5 indicates there was an increase in the number of mean goniometer readings at maximum range over the four visits.

Table 4.5 Cross tabulation of Minimum and Maximum Mean Pre- and Post-Goniometer Readings for Group 1

<table>
<thead>
<tr>
<th></th>
<th>Pre-Hip Extension</th>
<th>Post-Hip Extension</th>
<th>Pre-Hip Abduction</th>
<th>Post-Hip Abduction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>min (&lt;15)</td>
<td>max (15)</td>
<td>min (&lt;15)</td>
<td>max (15)</td>
</tr>
<tr>
<td>Visit 1</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Visit 2</td>
<td>7</td>
<td>8</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Visit 3</td>
<td>7</td>
<td>8</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Visit 4</td>
<td>6</td>
<td>9</td>
<td>4</td>
<td>11</td>
</tr>
</tbody>
</table>
4.4.2 Comparison of the Mean Pre- and Post-Goniometer Readings for Group 2

![Figure 4.8 Bar Graph Comparing the Mean Pre- and Post-Goniometer Readings for Group 2](attachment:figure.png)

Table 4.6 P-values for the Mean Pre- and Post-Goniometer Readings for Group 2

<table>
<thead>
<tr>
<th>Visit</th>
<th>Pre- and Post-Hip Extension</th>
<th>Pre- and Post-Hip Abduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visit 1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Visit 2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Visit 3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Visit 4</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 4.7 Cross tabulation of Minimum and Maximum Mean Pre- and Post-Goniometer Readings for Group 2

<table>
<thead>
<tr>
<th>Visit</th>
<th>Pre-Hip Extension</th>
<th>Post-Hip Extension</th>
<th>Pre-Hip Abduction</th>
<th>Post-Hip Abduction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>min (&lt;15)</td>
<td>max (15)</td>
<td>min (&lt;15)</td>
<td>max (15)</td>
</tr>
<tr>
<td>Visit 1</td>
<td>8</td>
<td>7</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Visit 2</td>
<td>5</td>
<td>10</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Visit 3</td>
<td>1</td>
<td>14</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>Visit 4</td>
<td>1</td>
<td>14</td>
<td>1</td>
<td>14</td>
</tr>
</tbody>
</table>

Based on intra-group analysis, Figure 4.8 illustrates there was no statistically significant difference of the mean pre- and post-goniometer readings, as indicated by Table 4.6 (p>0.05). Table 4.7 indicates there was an increase in the number of goniometer readings at maximum range over the four visits.
4.4.3 Comparison of the Mean Pre-Goniometer Readings between Group 1 and Group 2

Figure 4.9 Bar Graph Comparing the Mean Pre-Goniometer Readings between Group 1 and Group 2

Table 4.8 P-values for the Mean Pre-Goniometer Readings for Group 1 and Group 2

<table>
<thead>
<tr>
<th>Visit</th>
<th>Pre-Hip Extension</th>
<th>Pre-Hip Abduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visit 1</td>
<td>1.000</td>
<td>0.330</td>
</tr>
<tr>
<td>Visit 2</td>
<td>0.710</td>
<td>1.000</td>
</tr>
<tr>
<td>Visit 3</td>
<td>0.035</td>
<td>0.139</td>
</tr>
<tr>
<td>Visit 4</td>
<td>0.080</td>
<td>0.245</td>
</tr>
</tbody>
</table>
Based on inter-group analysis, Figure 4.9 illustrates there was no statistically significant difference of the mean pre-goniometer readings except on visit 3 for hip extension, as indicated by Table 4.8 (p<0.05).
4.4.4 Comparison of the Mean Post-Goniometer Readings between Group 1 and Group 2

![Graph]

Figure 4.10 Bar Graph Comparing the Mean Post-Goniometer Readings between Group 1 and Group 2

Table 4.9 P-values for the Mean Post-Goniometer Readings for Group 1 and Group 2

<table>
<thead>
<tr>
<th></th>
<th>Post-Hip Extension</th>
<th>Post-Hip Abduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visit 1</td>
<td>1.000</td>
<td>0.330</td>
</tr>
<tr>
<td>Visit 2</td>
<td>0.462</td>
<td>0.700</td>
</tr>
<tr>
<td>Visit 3</td>
<td>0.035</td>
<td>0.128</td>
</tr>
<tr>
<td>Visit 4</td>
<td>0.330</td>
<td>0.682</td>
</tr>
</tbody>
</table>
Based on inter-group analysis, Figure 4.10 illustrates there was no statistically significant difference of the mean post-goniometer readings except on visit 3 for hip extension, as indicated by Table 4.9 (p<0.05).
4.4.5 Comparison of Visit 1 Mean Pre-Goniometer and Visit 4 Mean Post-Goniometer Readings for Group 1

![Graph comparing Visit 1 Mean Pre-Goniometer and Visit 4 Mean Post-Goniometer Readings for Group 1](image)

Figure 4.11 Bar Graph Comparing Visit 1 Mean Pre-Goniometer and Visit 4 Mean Post-Goniometer Readings for Group 1

Table 4.10 P-values for Visit 1 Mean Pre-Goniometer and Visit 4 Mean Post-Goniometer Readings for Group 1

<table>
<thead>
<tr>
<th></th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip Extension</td>
<td>0.125</td>
</tr>
<tr>
<td>Hip Abduction</td>
<td>0.031</td>
</tr>
</tbody>
</table>
Table 4.11 Cross tabulation of Minimum and Maximum Visit 1 Mean Pre-Goniometer and Visit 4 Mean Post-Goniometer Readings for Group 1

<table>
<thead>
<tr>
<th></th>
<th>Pre-Hip Extension</th>
<th>Post-Hip Extension</th>
<th>Pre-Hip Abduction</th>
<th>Post-Hip Abduction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>min (≤15)</td>
<td>max (15)</td>
<td>min (≤15)</td>
<td>max (15)</td>
</tr>
<tr>
<td>Visit 1</td>
<td>8</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visit 4</td>
<td>4</td>
<td>11</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on intra-group analysis, Figure 4.11 illustrates there was no statistically significant difference of visit 1 mean pre-goniometer and visit 4 post-goniometer readings for hip extension but there was a statistically significant difference for hip abduction, as indicated by Table 4.10 (p<0.05). Table 4.11 indicates there was an increase in the number of post-goniometer readings at maximum range on visit 4 as compared to the number of pre-goniometer readings at maximum range on visit 1.
4.4.6 Comparison of Visit 1 Mean Pre-Goniometer and Visit 4 Mean Post-Goniometer Readings for Group 2

![Bar Graph Comparing Visit 1 Mean Pre-Goniometer and Visit 4 Mean Post-Goniometer Readings for Group 2](image)

Figure 4.12 Bar Graph Comparing Visit 1 Mean Pre-Goniometer and Visit 4 Mean Post-Goniometer Readings for Group 2

Table 4.12 P-values for Visit 1 Mean Pre-Goniometer and Visit 4 Mean Post-Goniometer Readings for Group 2

<table>
<thead>
<tr>
<th></th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip Extension</td>
<td>0.016</td>
</tr>
<tr>
<td>Hip Abduction</td>
<td>0.001</td>
</tr>
</tbody>
</table>
Table 4.13 Cross tabulation of Minimum and Maximum Visit 1 Mean Pre-Goniometer and Visit 4 Mean Post-Goniometer Readings for Group 2

<table>
<thead>
<tr>
<th></th>
<th>Pre-Hip Extension</th>
<th>Post-Hip Extension</th>
<th>Pre-Hip Abduction</th>
<th>Post-Hip Abduction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>min (&lt;15)</td>
<td>max (15)</td>
<td>min (&lt;15)</td>
<td>max (15)</td>
</tr>
<tr>
<td>Visit 1</td>
<td>8</td>
<td>7</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>Visit 4</td>
<td></td>
<td>1</td>
<td>14</td>
<td>3</td>
</tr>
</tbody>
</table>

Based on intra-group analysis, Figure 4.12 illustrates there was a statistically significant difference of visit 1 mean pre-goniometer and visit 4 post-goniometer readings for hip extension and hip abduction, as indicated by Table 4.12 (p<0.05). Table 4.13 indicates there was an increase in the number of post-goniometer readings at maximum range on visit 4 as compared to the number of pre-goniometer readings at maximum range on visit 1.
4.4.7 Comparison of Visit 1 Mean Pre-Goniometer and Visit 4 Mean Post-Goniometer Readings between Group 1 and Group 2

![Bar Graph Comparing Visit 1 Mean Pre-Goniometer and Visit 4 Mean Post-Goniometer Readings between Group 1 and Group 2](image)

Table 4.14 P-values for the Difference between Visit 1 Mean Pre-Goniometer and Visit 4 Mean Post-Goniometer Readings for Group 1 and Group 2

<table>
<thead>
<tr>
<th></th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip Extension</td>
<td>0.450</td>
</tr>
<tr>
<td>Hip Abduction</td>
<td>0.109</td>
</tr>
</tbody>
</table>
Table 4.15 Cross tabulation of the Changes in Mean Goniometer Readings from Visit 1 to Visit 4 for Group 1 and Group 2

<table>
<thead>
<tr>
<th></th>
<th>Hip Extension</th>
<th></th>
<th>Hip Abduction</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no change</td>
<td>improvement</td>
<td>no change</td>
<td>improvement</td>
</tr>
<tr>
<td><strong>Group 1</strong></td>
<td>11</td>
<td>4</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td><strong>Group 2</strong></td>
<td>8</td>
<td>7</td>
<td>2</td>
<td>13</td>
</tr>
</tbody>
</table>

Based on inter-group analysis, Figure 4.13 illustrates there was no statistically significant difference of visit 1 mean pre-goniometer and visit 4 post-goniometer readings, as indicated by Table 4.14 (p>0.05). Table 4.15 indicates there was a marked improvement in hip extension and hip abduction for group1 as compared to group 2.
4.4.8 Comparison of the Mean Pre- and Post-Algometer Readings for Group 1

Figure 4.14 Bar Graph Comparing the Mean Pre- and Post-Algometer Readings for Group 1

Table 4.16 P-values for the Difference Between Mean Pre- and Post-Algometer Readings for Group 1

<table>
<thead>
<tr>
<th></th>
<th>Post – Pre Algometer</th>
<th>Post – Pre Algometer</th>
<th>Post – Pre Algometer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TrP 1</td>
<td>TrP 2</td>
<td>TrP 3</td>
</tr>
<tr>
<td>Visit 1</td>
<td>0.010</td>
<td>0.014</td>
<td>0.002</td>
</tr>
<tr>
<td>Visit 2</td>
<td>0.012</td>
<td>0.002</td>
<td>0.002</td>
</tr>
<tr>
<td>Visit 3</td>
<td>0.003</td>
<td>0.031</td>
<td>0.002</td>
</tr>
<tr>
<td>Visit 4</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
</tr>
</tbody>
</table>
Based on intra-group analysis, Figure 4.14 illustrates there was a statistically significant difference of the mean pre- and post-algometer readings for each TrP on each visit, as indicated by Table 4.16 (p<0.05).
4.4.9 Comparison of the Mean Pre- and Post-Algometer Readings for Group 2

Figure 4.15 Bar Graph Comparing the Mean Pre- and Post-Algometer Readings for Group 2

Table 4.17 P-values for the Difference Between Mean Pre- and Post-Algometer Readings for Group 2

<table>
<thead>
<tr>
<th></th>
<th>Post – Pre Algometer TrP 1</th>
<th>Post – Pre Algometer TrP 2</th>
<th>Post – Pre Algometer TrP 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visit 1</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td>Visit 2</td>
<td>0.001</td>
<td>0.002</td>
<td>0.002</td>
</tr>
<tr>
<td>Visit 3</td>
<td>0.001</td>
<td>0.001</td>
<td>0.002</td>
</tr>
<tr>
<td>Visit 4</td>
<td>0.001</td>
<td>0.001</td>
<td>0.002</td>
</tr>
</tbody>
</table>
Based on intra-group analysis, Figure 4.15 illustrates there was a statistically significant difference of the mean pre- and post-algometer readings for each TrP on each visit, as indicated by Table 4.17 (p<0.05).
4.4.10 Comparison of the Mean Pre-Algometer Readings between Group 1 and Group 2

![Bar Graph Comparing the Mean Pre-Algometer Readings between Group 1 and Group 2](image)

Figure 4.16 Bar Graph Comparing the Mean Pre-Algometer Readings between Group 1 and Group 2

Table 4.18 P-values for the Mean Pre-Goniometer Readings for Group 1 and Group 2
(The mean difference is significant at p<0.002381)

<table>
<thead>
<tr>
<th></th>
<th>Pre-TrP1</th>
<th>Pre-TrP2</th>
<th>Pre-TrP3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visit 1</td>
<td>0.967</td>
<td>0.624</td>
<td>1.000</td>
</tr>
<tr>
<td>Visit 2</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Visit 3</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Visit 4</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>
Based on inter-group analysis, Figure 4.16 illustrates there was a statistically significant difference of the mean pre-algometer readings for each TrP except on visit 1, as indicated by Table 4.18 (p<0.002381).
4.4.11 Comparison of the Mean Post-Algometer Readings between Group 1 and Group 2

Figure 4.17 Bar Graph Comparing the Mean Post-Algometer Readings between Group 1 and Group 2

Table 4.19 P-values for the Mean Post-Goniometer Readings for Group 1 and Group 2
(The mean difference is significant at p<0.002381)

<table>
<thead>
<tr>
<th>Visit</th>
<th>Post-TrP1</th>
<th>Post-TrP2</th>
<th>Post-TrP3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visit 1</td>
<td>0.00175</td>
<td>0.00119</td>
<td>0.59716</td>
</tr>
<tr>
<td>Visit 2</td>
<td>0.00209</td>
<td>0.62400</td>
<td>0.13953</td>
</tr>
<tr>
<td>Visit 3</td>
<td>0.05680</td>
<td>0.00227</td>
<td>0.00235</td>
</tr>
<tr>
<td>Visit 4</td>
<td>0.01240</td>
<td>0.00392</td>
<td>0.00471</td>
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</tbody>
</table>
Based on inter-group analysis, Figure 4.17 illustrates there was no statistically significant difference of the mean post-algometer readings for each TrP except on; visit 1: TrP1 and TrP2, visit 2: TrP1 and visit 3: TrP3, as indicated by Table 4.19 (p<0.002381).
4.4.12 Comparison of Visit 1 Mean Pre-Algometer and Visit 4 Mean Post-Algometer Readings for Group 1

Table 4.20 P-values for the Difference Between Visit 1 Mean Pre-Algometer and Visit 4 Mean Post-Algometer Readings for Group 1

<table>
<thead>
<tr>
<th>Post – Pre Algometer TrP 1</th>
<th>Post – Pre Algometer TrP 2</th>
<th>Post – Pre Algometer TrP 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000640</td>
<td>0.000643</td>
<td>0.000645</td>
</tr>
</tbody>
</table>

Based on intra-group analysis, Figure 4.18 illustrates there was a statistically significant difference of visit 1 mean pre-algometer and visit 4 mean post-algometer readings for each TrP, as indicated by Table 4.20 (p<0.05).
4.4.13 Comparison of Visit 1 Mean Pre-Algometer and Visit 4 Mean Post-Algometer Readings for Group 2

Figure 4.19 Bar Graph Comparing Visit 1 Mean Pre-Algometer and Visit 4 Mean Post-Algometer Readings for Group 2

Table 4.21 P-values for the Difference Between Visit 1 Mean Pre-Algometer and Visit 4 Mean Post-Algometer Readings for Group 2

<table>
<thead>
<tr>
<th>Post – Pre Algometer TrP 1</th>
<th>Post – Pre Algometer TrP 2</th>
<th>Post – Pre Algometer TrP 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000648</td>
<td>0.000637</td>
<td>0.000643</td>
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</tbody>
</table>

Based on intra-group analysis, Figure 4.19 illustrates there was a statistically significant difference of visit 1 mean pre-algometer and visit 4 mean post-algometer readings for each TrP, as indicated by Table 4.21 (p<0.05).
4.3.14 Comparison of Visit 1 Mean Pre-Algometer and Visit 4 Mean Post-Algometer Readings between Group 1 and Group 2

![Bar Graph Comparing Visit 1 Mean Pre-Algometer and Visit 4 Mean Post-Algometer Readings between Group 1 and Group 2](image)

Figure 4.20 Bar Graph Comparing Visit 1 Mean Pre-Algometer and Visit 4 Mean Post-Algometer Readings between Group 1 and Group 2

<table>
<thead>
<tr>
<th>Algometer Difference TrP 1</th>
<th>Algometer Difference TrP 2</th>
<th>Algometer Difference TrP 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Table 4.22 P-values for the Difference Between Visit 1 Mean Pre-Algometer and Visit 4 Mean Post-Algometer Readings for Group1 and Group 2

Based on inter-group analysis, Figure 4.20 illustrates there was a statistically significant difference of visit 1 mean pre-algometer and visit 4 post-algometer readings for Group 1 and Group 2, as indicated by Table 4.22 (p<0.05).
CHAPTER FIVE - DISCUSSION

5.1 Introduction

This chapter discusses the results obtained from the statistical analysis of the data presented in Chapter Four. It includes the demographic, subjective and objective results.

5.2 Demographic Results

With reference to Table 4.1, a total sample size of 30 subjects were recruited for the study. The age range was between 18-49 years of age. This indicates that a high prevalence with a wide distribution of age is seen in myofascial pain and dysfunction syndrome. In a study done by Skootsky et al (1989) to determine the prevalence of myofascial pain in general internal medical practice, 30% of patients with regional pain were diagnosed with myofascial pain and it was the single most common reason for the patient to visit their physician. The gender ratio of both groups was 8 males to 22 females. Females are more susceptible to SIJ dysfunction than males due to the greater SIJ mobility requirements for pregnancy and childbirth (Cramer and Darby, 1995). The female pelvis is also anatomically different from the male in that it is wider, shallower with larger pelvic apertures to adapt for child bearing (Moore and Dalley, 1999). SIJ dysfunction perpetuates Gluteus Medius myofascial TrPs when present (Travell and Simons, 1997) and this may be the reason for the increased number of females in the study.

The mean demographic results between the two groups were not statistically significant (p>0.05). This was important because it showed that the two groups were similar when the study commenced and therefore the results obtained when the study was completed, were valid in order to be statistically analyzed and compared.

5.3 Subjective Results

5.3.1 McGill pain questionnaire
It is evident that Groups 1 and 2 showed a decrease in the mean pain rating score over the four visits, as illustrated by Figures 4.1 and 4.2 respectively, that was statistically significant (p<0.05). Group 1 showed a decrease of 11.27 and Group 2 showed a decrease of 10.07 in the mean pain rating score between visits 1 and 4.

When compared, as illustrated by Figure 4.3, both groups showed a decrease in the mean pain rating score. This decrease in the mean pain rating score over the four visits and between visits 1 and 4 was not statistically significant (p>0.05), as shown by Table 4.2, indicating that both treatment methods were similarly effective in decreasing the verbal description of the pain experienced.

This concurs with a review by Rickards (2006) of previous studies conducted on the effectiveness of non-invasive treatments in decreasing TrP pain, indicating the positive effect of both treatment methods on Gluteus Medius myofascial TrPs.

5.3.2 Numerical pain rating scale

It is evident that Groups 1 and 2 showed a decrease in the mean pain level over the four visits, as illustrated by Figures 4.4 and 4.5 respectively, that was statistically significant (p<0.05). Group 1 showed a decrease of 5.1 and Group 2 showed a decrease of 5.46 in the mean pain level between visits 1 and 4.

When compared, as illustrated by Figure 4.6, both groups showed a decrease in the mean pain level. This decrease in the mean pain level over the four visits and between visits 1 and 4 was not statistically significant (p>0.05), as shown by Table 4.3, indicating that both treatment methods were similarly effective in decreasing the intensity of pain perceived.

This may be the result of the analgesic effect of both treatment methods by reducing the hypertonicity of muscle spindles which decreases the hyperactivity of nociceptors and the release of nerve sensitizing substances. The release of endogenous opioids may also decrease the pain perceived (Rachlin, 1994).

Group 2 showed a greater decrease in the mean pain levels between visits 1 and 4 as compared to Group 1 (5.46 > 5.1) indicating that Group 2’s treatment was superior to Group 1’s treatment.
subjectively. This may be due to pronounced analgesic effect of the combined treatment method of INIT and SIJ adjustment as compared to INIT alone. Muscle pain can be reduced by soft tissue and joint adjustive therapies and is related to the stimulation of mechanoreceptors that inhibit the spinal pain gating mechanism (Lederman, 2005).

5.4 Objective Results

5.4.1 Goniometer

It is evident that Groups 1 and 2 showed increases in the mean pre- and post-goniometer readings over the four visits, as illustrated by Figures 4.7 and 4.8 respectively. There were no statistically significant differences (p>0.05), as indicated by Tables 4.4 and 4.6.

With reference to Tables 4.10 and 4.11, Group 1 showed a statistically significant improvement of 6 subjects achieving the maximum range for hip abduction but not for hip extension. With reference to Tables 4.12 and 4.13, Group 2 showed statistically significant improvements of 7 subjects achieving the maximum range for hip extension and 11 subjects achieving the maximum range for hip abduction.

When compared, as illustrated by Figures 4.9 and 4.10, both groups showed increases in the mean pre- and post-goniometer readings over the four visits. There were no statistically significant differences of the mean pre- and post-goniometer readings except on visit 3 for hip extension (p<0.05), as indicated by Tables 4.8 and 4.9. The increase in range of motion readings indicate that both treatment methods were similarly effective in increasing joint mobility. The difference shown on visit 3 for hip extension could be related to the cumulative effect of the combined treatment method of INIT and SIJ, as compared to INIT alone, which is evident by the third treatment. Schneider (1995) states that both osseous and soft tissue therapies are important for the proper treatment of myofascial pain syndrome.

With reference to Table 4.15, Group 2 showed a marked improvement of 7 subjects achieving the maximum range for hip extension and 13 subjects achieving the maximum range for hip abduction as compared to Group 1 indicating Group 2’s treatment was superior to Group 1’s
treatment objectively. This supports a study by Johnson (2002) that showed muscle energy techniques combined with spinal adjustment to be an effective method of increasing joint movement.

5.4.2 Algometer

It is evident that Groups 1 and 2 showed increases in the mean pre- and post-algometer readings for each TrP over the four visits, as illustrated by Figures 4.14 and 4.15. This was statistically significant (p<0.05), as indicated by Tables 4.16 and 4.17.

With reference to Figures 4.18 and 4.19, both groups showed increases in the mean post-algometer readings for each TrP on visit 4 with Group 2 showing a marked increase of 2.89 for TrP 1, 2.77 for TrP 2 and 2.64 for TrP 3 as compared to Group 1 with an increase of 1.59 for TrP 1, 1.51 for TrP 2 and 1.34 for TrP 3. With reference to Schneider (1995), this can only be explained by the application of both INIT and SIJ adjustment for the proper treatment of myofascial pain syndrome.

When compared, as illustrated by Figure 4.16, both groups showed increases in the mean pre-algometer readings over the four visits. There was no statistically significant difference of the mean pre-algometer readings on visit 1 (p>0.002381), as indicated by Table 4.18. This was important because it showed that both groups were similar when the study was commenced and therefore the results obtained when the study was completed were valid in order to be statistically analyzed and compared. The increase in the pressure threshold readings indicate that both treatment methods were similarly effective in reducing the sensitivity of TrPs.

When compared, as illustrated by Figure 4.17, both groups showed increases in the mean post-algometer readings over the four visits. It is evident that both groups showed no statistically significant differences of the mean post-algometer readings except on visit 1: TrP 1 and TrP 2, visit 2: TrP 1 and visit 3: TrP 3 (p<0.002381), as indicated by Table 4.19.

With reference to Figure 4.20, it is evident that there was an increase in the mean post-algometer readings for each TrP on visit 4 between the two groups. According to Fischer (1986), the mean normal pressure threshold of healthy muscle sites range from 5.4 – 9.0 kg/cm² for males and 3.7 – 6.8 kg/cm² for females. This may be the result of the positive therapeutic effect of both
treatment methods in increasing the mean pressure threshold at each TrP to that within the normal mean pressure threshold range. Group 2 showed a greater increase in the mean algometer readings for each TrP between visits 1 and 4 (Group 2 TrP 1 2.89> 1.59 Group 1 TrP 1, Group 2 TrP 2 2.77> 1.52 Group 1 TrP 2 and Group 2 TrP 3 2.64> 1.34 Group 1 TrP 3) increase as compared to Group 1, indicating that Group 2’s treatment was superior to Group 1’s treatment objectively. With reference to Lederman (2005) the increased pressure threshold can be explained by the effectiveness of the combined soft tissue and joint adjustive therapy in reducing the sensitivity to pain by inhibiting the spinal pain gating mechanism.

5.5 Summary

According to Schneider (1995) most musculoskeletal pain syndromes are caused by a combination of muscular and articular dysfunction. Group 1 involved the application of INIT that treated only the muscular dysfunction. Group 2 involved the application of INIT and a spinal adjustment that treated both the muscular and articular dysfunction. Mense et al (2001) state that both muscular and articular dysfunction components need to be addressed in the therapeutic management of MPDS and it was therefore expected that the group treated with a combined treatment method of INIT and spinal adjustment would show a greater therapeutic response, indicating that it was a more effective treatment method as compared to INIT alone.

The application of ischaemic compression desensitizes nerve endings and reduces myofascial TrP hyperirritability and pain (Simons, 1981) while positional release, isolytic and isometric contractions stretch the contracted sarcomeres and reduce muscle hypertonicity by restoring the muscle to its’ normal length (Chaitow, 1996).

The marked therapeutic effect in Group 2 as compared to Group 1 can be explained by the addition of an SIJ adjustment in the treatment protocol of Group 2. An adjustment inhibits the spinal pain gating mechanism and the facilitated motor neuron pools responsible for muscle hyperactivity (Bergmann et al., 1993). The combined effect of INIT and a SIJ adjustment was therefore enhanced.
CHAPTER SIX – CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Both treatment methods showed statistically significant reductions in perceived pain levels and increases in the pressure tolerance of TrPs and hip ranges of motion of the affected Gluteus Medius muscle. With reference to Chapter One, Hypothesis 1 and 2 were therefore satisfied.

Although there were no statistically significant differences of objective and subjective results on inter-group analyses, Group 2 subjects responded with greater decrease in pain and a greater increase in pressure tolerance and hip ranges of motion as compared to Group 1 subjects. With reference to Chapter One, Null Hypothesis 3 and Hypothesis 4 were therefore satisfied.

In conclusion, the results of the study show the most effective treatment method for GMMPDS of the two proposed treatment methods is a combination of INIT and SIJ adjustive therapy. The combined treatment method treats both the muscle and skeletal dysfunctions that reflexly activate one another. This indicates the importance of treating not only the muscular but also the involved skeletal component for effective and comprehensive management of myofascial pain and dysfunction syndrome.

6.2 Recommendations

The following recommendations are made to aid in future studies involving GMMPDS:

- A larger sample size could be used in each group.

- A study that runs over a period of 4 weeks with a 2 week follow up should be conducted to determine the validity of subjective and objective results with longer term treatments.

- A home stretching and strengthening programme could be prescribed to determine the effect of self-management.
• Narrowing of variables such as age, sex, and occupation in order to provide more comparative results.

• Muscle strength could be measured in addition to range of motion to determine the effect of treatments on muscle strength and mobility.
REFERENCES


APPENDICES

APPENDIX A - Advertisement

DO YOU SUFFER FROM **LOW BACK PAIN**?

You might qualify for **FREE** treatment at the

University of Johannesburg

**Chiropractic Day Clinic**

Gate 7, Sherwell Road, Doornfontein

Participants must be between the ages of 18 – 50 and suffer from lower back pain for 4 weeks or longer

For more information, contact:

Leah Ramsunder  082 572 3819
APPENDIX B - Subject Information and Consent Form

Dear Participant

I am Leah Ramsunder, a MTech Chiropractic student of the Faculty of Health Sciences, University of Johannesburg. I want to invite you to participate in my research study.

The purpose of this study is to determine the most effective method of treating myofascial pain and dysfunction syndrome of the Gluteus Medius muscle. I will fully explain all the procedures and will answer all your questions to the best of my abilities. Your participation is voluntary and you are free to refuse/withdraw participation at any time, without penalty.

You must be between the ages of 18 and 50. You must have lower back pain for duration of four weeks or longer. You will be required to attend four sessions over a period of eight days. You will be required to undergo a case history and a regional examination of the lower back and pelvis on the first visit. You will be required to complete two questionnaires at the beginning of each visit. You will be treated on the first three sessions. A maximum period of one day will take place after the first and then after the second treatments. The fourth session will take place, after a maximum period of two days after the third treatment, in order to obtain final data for the study.

Your privacy will be protected by ensuring your anonymity and confidentiality. In other words, you will not be identified. The benefit of the study is free treatment to improve your lower back pain.

You may experience some discomfort due to the nature of the treatment, but this will be carefully monitored and will not have lasting effects.

After this study is completed, I will provide you with feedback regarding the outcomes, if you so wish.
Should you have any concerns or queries, the following persons can be contacted:

Researcher: Leah Ramsunder 082 572 3819
Supervisor: Dr M. Moodley 011 406 2065
Co-supervisor: Dr C. Hay 011 406 8028

I have been informed of my rights as to the procedure to be followed in this study. In signing this consent form, I fully agree to the method of treatment and understand that I am free to withdraw from the study at any time. I understand that any question I may have, will be answered.

Date: _______________                                    Researcher: ______________________

Date: _______________                                                   Patient: _________________________
APPENDIX C – Case History

UNIVERSITY OF JOHANNESBURG
CHIROPRACTIC DAY CLINIC

CASE HISTORY

Date: ____________

Patient: ____________________ File No: ____________

Age: _______  Sex: _______  Occupation: ____________

Student: ____________________ Signature: ____________

FOR CLINICIAN’S USE ONLY

Initial visit clinician: ____________________ Signature: ____________________

Case History:

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<tr>
<th>Examination:</th>
<th>Previous: TWR</th>
<th>Current: TWR</th>
<th>Previous: Other</th>
<th>Current: Other</th>
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<table>
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<tr>
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<th>Previous: TWR</th>
<th>Current: TWR</th>
<th>Previous: Other</th>
<th>Current: Other</th>
</tr>
</thead>
</table>

| Case status: | PTT: Conditional | Signed off: | Final sign out |

Recommendations:

88
**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 D – Physical Examination

UNIVERSITY OF JOHANNESBURG
CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

Underline abnormal findings in RED.

Patient: ____________________  Date: ________________

Clinician: ____________________  File No: ____________

Student: ____________________  Signature: ____________

Signature: ____________

Height: ____________  Weight: ____________  Temp: ____________

Rates:  Heart: ____________  Pulse: ____________  Respiration: ____________

Blood pressure:  Arms:  L  R

Legs:  L  R

General Appearance:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
STANDING EXAMINATION

1. Minor’s sign
2. Skin changes
3. Posture Erect
   Adams’
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°

L. Rot
Flex.
R. Rot
L. Lat Flex
R. Lat Flex

Ext.

I = pain-free limitation
II = 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

15. Visual acuity

16. Breast examination:
   Inspection:
   - skin
   - size
   - contour
   - nipples
   - arms overhead
   - hands against hips
   - leaning forward
   - axillary lymph nodes
   - breast incl. tail

   Palpation

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

         L   R
   III   IV  VI  III  IV  VI

   - visual fields
   - accommodation
   - Ophthamoscopic
   - Examination
     - iris
     - pupils
     - red reflex
     - optic disc
     - vessels
     - general background
- macula
- vitreous
- lens

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

9. Neck
   • posture
   • size
   • swelling
   • scar
   • discolouration
   • hair line
Ranges of motion (cervical spine)

The following are normal ranges of motion

Forward flexion = 45° chin to larynx or sternum
Extension = 55° forehead parallel to ground
L/R Rotation = 70°
L/R Lat Flexion = 40°

9. NEUROLOGICAL EXAMINATION (CERVICAL SPINE)

<table>
<thead>
<tr>
<th>DERMATOMES</th>
<th>Left</th>
<th>Right</th>
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<tbody>
<tr>
<td>C2</td>
<td>Neck Flexion C1/2</td>
<td>Biceps C5</td>
</tr>
<tr>
<td>C3</td>
<td>Lat. Neck Flexion C3</td>
<td>Brachio-radialis C6</td>
</tr>
<tr>
<td>C4</td>
<td>Shoulder Elevation C4</td>
<td>Triceps C7</td>
</tr>
<tr>
<td>C5</td>
<td>Shoulder Abduction C5</td>
<td></td>
</tr>
<tr>
<td>C6</td>
<td>Elbow Flexion C5</td>
<td></td>
</tr>
<tr>
<td>C7</td>
<td>Elbow Extension C7</td>
<td></td>
</tr>
</tbody>
</table>
C8 | Elbow Flexion at 90° C6
---|---
T1 | Forearm Pronation C6
   | Forearm Supination C6
   | Wrist Extension C6
   | Wrist Flexion C7
   | Finger Flexion C8
   | Finger Abduction T1
   | Finger Adduction T1

9. 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)

10. Musculoskeletal:
    (I) ROM
    * Hip

<table>
<thead>
<tr>
<th></th>
<th>L</th>
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<tbody>
<tr>
<td>flex.</td>
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<tr>
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<tr>
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</tr>
<tr>
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- knee
- ankle

(ii) leg length

- Co-ordination
  - point to point
  - dysdiachokinesia

10. TMJ
  - Inspection
    - ROM
    - deviation
  - Palpation
    - crepitus
    - tenderness

11. Thorax
  - Inspection
    - skin
    - shape
    - respiratory distress
    - rhythm (respiratory)
    - depth (respiratory)
    - effort (respiratory)
    - intercostals/supracentavicular 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
     - roving's sign
     - psoas sign
     - obturator sign
     - cutaneous hyperaesthesia
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)

(iii) Mood

(v) Memory and attention
- orientation (time, place, person)
- remote memory
- recent memory
- new learning ability

(vi) Higher cognitive functions
- information and vocabulary
- (general and specialised knowledge)
- abstract thinking

NEUROLOGICAL EXAMINATION (LUMBAR SPINE)

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APPENDIX E – Lumbar and Pelvis Regional Examination

UNIVERSITY OF JOHANNESBURG
CHIROPRACTIC DAY CLINIC

REGIONAL EXAMINATION
LUMBAR SPINE AND PELVIS

Date: __________________________
Patient: ________________________ File No: ________________________
Clinician: ______________________ Signature: ______________________
Student: ________________________ Signature: ______________________

A. 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
   • Spinous Percussion
   • Treadmill
   • Minor’s Sign
   • Quick Test
   • Trendelenburg Test
5. RANGE OF MOTION

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

\( / = \text{Pain free limitation} \quad \text{\textbar} = \text{Painful limitation} \)

6. GAIT

- Rhythm, pendulousness
- On Toes (S1)
- On Heels (L4, 5)
- Half 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 Maneouvre
2. MOTION PALPATION

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C. SUPINE

01. OBSERVATION

- Hair, Skin, Nails
- Fasciculations

2. PULSES

- Femoral
- Popliteal
- Dorsalis Pedis
- Posterior Tibial

3. MUSCLE CIRCUMFERENCE

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5. **ABDOMINAL EXAMINATION**

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

Comments:

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**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
   - Pscas Test

---

**LATERAL RECUMBENT**

   - Sacroiliac Compression
   - Ober's Test
   - Femoral Nerve Stretch Test
   - Myotomes:
     - Quadratus Lumborum 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
- Bum’s Bench Test
- Flip Test
- Hoover’s Test
- Ankle Dorsiflexion Test
- Pin-point pain
### APPENDIX F - SOAP Note

**CHIROPRACTIC DAY CLINIC**

**SOAP NOTE:**

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**O:**

**A:**

**P:**

**Comments:**

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### APPENDIX F - SOAP Note

**CHIROPRACTIC DAY CLINIC**

**SOAP NOTE:**

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**S:**

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**A:**

**P:**

**Comments:**
APPENDIX G - McGill Pain Questionnaire

McGill Pain Questionnaire. The descriptors fall into four major groups: sensory, 1-10; affective, 11-15; evaluative, 16; and miscellaneous, 17-20. The rank value for each descriptor is based on its position in the word set. The sum of the rank values is the pain rating index (PRI). The present pain intensity (PPI) is based on a scale of 0 to 5.
APPENDIX H - Numerical Pain Rating Scale

Name _____________________________            Age________                       File no _______

Group

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Sex

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VISIT: 1
Date __________

How much pain have you had because of your condition?  
Please tick the appropriate box to indicate the severity of pain you had.

No pain

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

VISIT: 2
Date __________

How much pain have you had because of your condition since your last treatment?  
Please tick the appropriate box to indicate the severity of pain you had.

No pain

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

VISIT: 3
Date __________

How much pain have you had because of your condition since your last treatment?  
Please tick the appropriate box to indicate the severity of pain you had.

No pain

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

VISIT: 4
Date __________

How much pain have you had because of your condition since your last treatment?  
Please tick the appropriate box to indicate the severity of pain you had.

No pain

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
## APPENDIX I - Goniometer Readings

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APPENDIX J - Algometer Readings

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