The effectiveness of three treatment protocols in the treatment of iliotibial band friction syndrome

Mini-dissertation submitted in partial compliance with the requirements for the Masters Degree in Technology: Chiropractic, in the department of Chiropractic at the Durban University of Technology.

By

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I, Grant S. D. Turnbull, do declare that this dissertation is representative of my own work, both in conception and execution.

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Abstract

Background

Iliotibial Band Friction Syndrome (ITBFS) is an overuse injury induced by friction of the iliotibial band (ITB) over the lateral epicondyle of the femur (LFE) with secondary inflammation. ITBFS is a prevalent condition and is the most common cause of lateral knee pain in long distance runners and cyclists.

There are a significant number of aetiological factors related to ITBFS. As a result of this the general chiropractic approach to the treatment of ITBFS is multimodal and include interventions such as joint manipulation, cryotherapy, orthotics, massage, electrical stimulation, acupuncture type procedures and therapeutic exercise. Dry-needling is an effective therapy in the treatment of active Myofascial Trigger Points (MFTP's) that are associated with ITBFS. However, the available literature suggests that to determine its efficacy, it should be performed in isolation. The association of sacroiliac joint dysfunction in ITBFS has also been addressed and are thought to co-exist and perpetuate one another. It is recommended that chiropractors include pelvic manipulation in their treatment protocol for ITBFS however there is a paucity of literature showing its effectiveness in the treatment of this condition.

There appears to be a need for further research in the form of randomized controlled clinical trials with regard to chiropractic specific procedures, performed in isolation, in the treatment of ITBFS. Therefore this study aimed to add to the literature by assessing the effect of the sacroiliac joint manipulation and dry needling in the treatment of ITBFS.

Objectives

The study aimed to determine the comparative effectiveness of dry needling alone versus manipulation alone, as well as a combination of the two interventions in the treatment of ITBFS.

Methods

This study was a randomised, open label trial. 47 participants with ITBFS were divided into three groups, each group receiving a different intervention i.e.: group one received dry needling of the active MFTP's in the Tensor Fascia Lata (TFL) and ITB, group two received sacroiliac joint manipulation, group three received a combination of the two interventions. Subjective measurements, in the form of the Numerical Pain Rating Scale-101 (NRS-101), and objective measurements, in the form of algometer readings in the TFL, ITB and Nobles Compression test as well as digital inclinometer readings of Modified Obers test, were utilised to determine the effects of the respective interventions. These measurements were recorded twice, once prior to commencing the treatment programme. These values were then evaluated to compare the efficacy of the different treatment interventions. Each participant received four treatments over a two week period.

Results

There were no statistically significant differences between the three treatment groups as they all seemed to parallel one another with regards to overall improvement in subjective and objective measurements ($P<0.5$). However on closer examination subtle differences between the groups were noted. An interesting endpoint is that the combination group did not fair the best throughout the study, which was contrary to the original hypothesis. The groups receiving only the single intervention appeared to fair marginally better over the combination group. A secondary endpoint that became evident during the study and on analysis of the data, was that hip joint instability must also be considered when treating ITBFS when there is concomitant sacroiliac joint dysfunction.

Conclusion

A decision needs to be made with regard to which intervention best suits the individual at the time. A combination therapy, which originally was thought to be the best treatment option, should possibly be reconsidered. Perhaps a single intervention of manipulation or dry needling should be decided upon. In totality, all intervention proved to be effective in the treatment of ITBFS.

Table of Contents

List of Appendices

List of Tables

List of Figures

Chapter One

Introduction

1.1. The Problem and its Setting:

Iliotibial Band Friction Syndrome (ITBFS) is an overuse injury induced by friction of the iliotibial band (ITB) over the lateral epicondyle of the femur (LFE) with secondary inflammation (Lindenburg, Pinshaw and Noakes, 1985). ITBFS is a prevalent condition, mainly amongst athletes, and is the most common cause of lateral knee pain in long distance runners (Noble, Hajek, Porter, 1980) and cyclists (Farrell, Reisinger, Tillman, 2002), accounting for up to a half of all running related knee injuries (Noakes and Granger, 2003) and fifteen to twenty-four percent of all overuse injuries occurring at the knee in cyclists (Farrell *et al*., 2002).

The most common symptoms of ITBFS is a sharp, burning type pain on the lateral aspect of the knee (Fredericson, White, Macmahon and Andriacchi, 2000), as well as pain on running or walking downhill and pain after running (Noble *et al*.,1980; Nicholas and Hershman, 1995; Norris, 1998). Athletes may note that they start out activity pain free but develop symptoms as the session progresses in duration and mileage. In severe cases the pain may persist when walking and may become intense on ascending and descending a flight of stairs (Reid, 1992; Fredericson *et al.*, 2000). On examination there is tenderness over the lateral epicondyle of the femur, a positive Nobles test, a positive Obers test as well as swelling and possible crepitus over the lateral aspect of the knee (Noble *et al.,* 1980; Nicholas and Hershman, 1995; Norris, 1998).

There are a significant number of aetiological factors related to ITBFS and a patient presenting with this syndrome may have one or many of these factors which have resulted in the development of the condition. Lindenburg *et al.*, (1985) and Reid (1992) discussed these various aetiological factors and concluded that they comprise of training errors, which includes increasing mileage too soon, inadequate warm up and running on the road camber as well as biomechanical factors, which include genu varum, foot hypersupination, overpronation, cavus foot, leg length discrepancies, sacroiliac joint and fibular head fixations. Baker (1995) and Fredericson *et al.,* (2000) agreed that poor footwear with inadequate shock absorption and hip abductor weakness are the primary cause. All these contributing factors result in excessive tautness of the ITB and thus the development of ITBFS (Noble *et al.,* 1980; Lindenburg *et al.,* 1985; Reid, 1992).

Due to the vast number of etiological factors, contributing to the development of ITBFS, the treatment of this condition has been multifactorial. Research conducted by Reid, (1992) and Fredericson *et al.,* (2000) outlined that treatments are mainly aimed at reducing inflammation with the use of ice and anti-inflammatory drugs and that other therapies aim to reduce ITB tautness through stretching and myofascial trigger point (MFTP) therapy such as dry needling and ischemic compression. They also state that corrective actions with regard to training programs and surface terrain are addressed as well as the correction of biomechanical abnormalities through the use of orthotics. Surgical intervention is regarded as a last case resort in stubborn chronic cases (Reid, 1992; Baer, 1999; Fredericson *et al.*, 2000; Souza, 2001). Hoskins, McHardy, Grad, Windsham and Onley, (2006) reported that chiropractors approach to the treatment of lower extremity conditions is multimodal and include interventions such as joint manipulation, cryotherapy, orthotics, massage, electrical stimulation, acupuncture type procedures and therapeutic exercise.

Moore and Dalley (1999) stated that the ITB arises from the gluteus maximus, gluteus medius and tensor fascia lata (TFL) muscles and inserts into the lateral tibial tubercle. Therefore, due to this anatomical relationship, injury to the ITB will be associated with MFTP formation within these muscles (Chaitow and Delany, 2002). MFTP's develop within a skeletal muscle as a result of that muscle being overloaded and the presence of MFTP's within a muscle may result in changes in the muscle such as pain on stretching or movement, decreased range of motion due to shortening and weakened strength (Travell and Simons, 1983).

According to Vernon and Schneider (2009) dry needling is effective in the treatment of MFTP's. In a study carried out by Hall (1997) investigating the effectiveness of dry needling of the TFL and ITB combined with stretching compared to a placebo-controlled group, there was a statistically significant improvement in the experimental group.

Mennel (1960) proposed that a tight ITB may result from a sacroiliac joint dysfunction. According to Kirkaldy-Willis and Burton (1992), the inverse may also occur when the ITB becomes tight it may result in a sacroiliac joint dysfunction. Chaitow and Delany (2002), concur with this theory stating that MFTP's in the associated musculature and a tight ITB will maintain sacroiliac joint dysfunction.

Wood (1997) conducted a study comparing a management programme for ITBFS including the following: ice therapy, orthotics, stretching exercises and altered training regimens, to the management programme combined with sacroiliac joint manipulation in the management of acute ITBFS. The results showed no significant improvement between the two groups. He concluded that the effect of the sacroiliac joint manipulation was masked by the many other complimentary auxiliary therapeutic interventions and recommended that future research should consider isolating the sacroiliac joint manipulation in the treatment of ITBFS.

The literature reveals that a multimodal approach in the treatment of ITBFS has had a beneficial effect on the condition (Reid, 1992; Fredericson *et al.*, 2000) however, there is an urgent need for further research in the form of randomized controlled clinical trials with regard to chiropractic specific procedures, performed in isolation, in the treatment of ITBFS (Hall, 1997; Wood, 1997; Hoskins *et al*., 2006; Ellis, Hing and Reid, 2007). Souza (2001) recommends that chiropractors include pelvic manipulation in their treatment protocol for ITBFS, however, there is a paucity of literature showing its effectiveness in the treatment of this condition (Hoskins *et al*., 2006; Ellis *et al*., 2007). Dry needling has shown to have a beneficial effect in this condition (Hall, 1997) but literature suggests that to determine its efficacy, it should be performed in isolation. Therefore, this study aimed to add to the literature by assessing the effect of the sacroiliac joint manipulation and dry needling in the treatment of ITBFS.

1.2. The Statement of the Problem:

The aim of the study was to compare the effectiveness of dry needling of active MFTP’s in the tensor fascia lata and iliotibial band versus sacroiliac joint manipulation versus a combination of the two interventions, in the treatment of iliotibial band friction syndrome.

The objective was to measure the difference between the interventions, if any, in terms of subjective pain perception and objectively through orthopaedic testing with regards to the following:

- The relative effectiveness of dry needling of the TFL and ITB in the treatment of ITBFS
- The relative effectiveness of sacroiliac joint manipulation in the treatment of ITBFS
- The relative effectiveness of combining the two interventions in the treatment of ITBFS
- To compare the difference in efficacy of the three intervention groups in the treatment of ITBFS

1.3 Hypothesis

One: Dry needling the TFL and ITB will have a favourable effect in the treatment of ITBFS

Two: Sacroiliac joint manipulation will have a favourable effect in the treatment of ITBFS

Three: A combination treatment of the two interventions will have a favourable effect in the treatment of ITBFS

Four: The combination group receiving two interventions will improve the most in terms of the subjective and objective measurements

This chapter has introduced the reason as to why this research is necessary and further elaboration on the subject will be discussed in Chapter Two.

Chapter Two

Literature Review

2.1. Introduction:

The purpose of this chapter is to provide a review of the relevant literature regarding information on ITBFS and the interventions utilized in the treatment of this condition. This chapter aims to provide a clearer understanding of the condition in terms of its origin, how it manifests, diagnosis and treatment. The research aimed to add to the literature by determining the efficacy of dry needling of the ITB and related hip musculature, restoring normal pelvic biomechanics in the form of sacroiliac joint manipulation as well as a combination of the two interventions in the treatment of ITBFS.

2.2. Definition:

Iliotibial Band Friction Syndrome (ITBFS) is an overuse injury induced by friction of the iliotibial band over the lateral epicondyle of the femur with secondary inflammation (Lindenburg, Pinshaw and Noakes, 1985).

2.3. Anatomy:

2.3.1. The Iliotibial Band (ITB):

According to Moore and Dalley (1999), the ITB arises from the terminal fibers of the gluteus maximus, gluteus medius and tensor fascia lata muscles. It is described as a condensation of fibers, or tract, that originates from the iliac tubercle and which ends at the knee where these fibers converge and attach to the lateral tibial tubercle i.e.: Gerdys tubercle (Travell and Simons, 1983). Whilst some terminal fibers of the ITB blend anteriorly to the patellar retinaculum, others attach deeper to the lateral femoral condyle or to the tibial tuberosity (Travell and Simons, 1983).

The ITB crosses both the hip and knee joints and is responsible, along with the synergistic relationship of its proximal musculature from which it arises, for supporting the weight bearing leg during the stance phase of the gait cycle by preventing adduction of the lower limb through increased tension in the ITB generated by muscle contraction (Reid, 1992).

2.3.2. The Tensor Fascia Lata (TFL):

According to Travell and Simons (1983), the TFL originates from the anterior iliac crest and the anterior superior iliac spine. The muscle has two parts, an anteromedial and posterolateral part. The anteromedial fibers terminate in the lateral patellar retinaculum and deep fascia of the leg, superficial to the patellar ligament. The posterolateral part attaches below the knee onto the lateral tubercle of the tibia, or Gerdy's tubercle, via the ITB from which some fibers attach to the lateral femoral condyle and linea aspera of the lower femur.

Travell and Simons (1983), further pointed out that the main function of the TFL is to assist pelvic stabilization and hip flexion during the stance phase and swing phase of the gait cycle, respectively. It also acts to assist, via action of the anteromedial fibers, flexion and abduction of the thigh and, via action of the posterolateral fibers, medial rotation of the thigh. In addition to this the TFL, along with its relationship with the ITB, contributes to the stabilization of the knee.

2.3.3. The Sacroiliac Joint:

The paired sacroiliac joints are arranged at oblique angles to the sagital plane and lie within the pelvic ring. The joints receive support in the form of the posterior sacroiliac ligaments and the anterior capsules of the joint, the former being thicker and stronger, to stabilize the posterior aspect of the joint, whilst the latter being less dense and adding support to the anterior aspect of the joint. The chief union between the sacrum and ilia is the interosseous sacroiliac ligaments which fill the irregular space above and behind the joint and is covered by the posterior sacroiliac ligament. The joint is “C” shape with a convexity facing anteroinferiorly. The sacroiliac joint appears in a multitude of forms that not only differs between individuals but also within the same individual and relative length of the cephalic and caudal extensions is also variable. The sacroiliac joint is considered a true diarthrodial joint with a joint cavity containing synovial fluid, articular cartilage and a joint capsule lined with a synovial membrane. Ligamentous connections that reinforce the joint capsule allow movement between the contiguous surfaces (Gatterman, 1990).

Moore and Dalley (1999), concurred stating that the sacroiliac joint permits limited movement, other than that of a gliding and rotatory motion, and is more responsible for the transmission of weight from the axial skeleton and lumbar spine through to the lower limb. Movement at the joint is said to vary between three to five degrees (Gatterman, 1990) or one to three millimeters (Schafer and Faye, 1990). The lack of movement is a result of the irregular interlocking articulations of the joint surfaces and the strong interosseous and sacroiliac ligaments (Gatterman, 1990). Moore and Dalley (1999), also mention that the sacrotuberous and sacrospinous ligaments limit upward movement of the inferior end of the sacrum thereby providing resilience to the sacroiliac region.

The sacroiliac joint is a synovial joint or diarthrosis. The sacral surface is covered with hyaline cartilage and the iliac surface is covered with fibrocartilage. The depth of cartilage on the opposing articular surfaces within the joint differ and most investigations report a ratio of 1:3 between the iliac and sacral surfaces. The anterior part of the joint capsule is clearly identifiable from the overlying anterior sacroiliac ligament while the fibers of the posterior part of the joint capsule blend with those of the interosseous ligament. The inferior part of the joint capsule blends with the periosteum of the contiguous sacrum and innominates. The sacroiliac joint is supported by overlying ligaments and fascia which are of the strongest in the body and are comprised of the anterior sacroiliac ligaments, the interosseous ligaments, the posterior sacroiliac ligaments, the sacrotuberous ligaments, the sacrospinous ligaments and the illiolumbar ligaments (Lee, 2004).

2.4. Pathology:

2.4.1. Iliotibial Band Friction Syndrome:

According to Renne (1975), ITBFS is a non-traumatic overuse injury caused by friction of the distal portion of the ITB over the LFE as a result of repetitive flexion and extension of the knee. Renne (1975), pointed out that this friction of the ITB against the LFE is said to occur at around thirty degrees of knee flexion and is referred to as the zone of impingement (Orchard, Fricker, Abud, Mason, 1996; Farrell *et al*., 2002). It is thought that the condition occurs more as a result of repetition through the impingement zone rather than force and time spent in the impingement zone (Farrell *et al*., 2002). The thickest portion of the ITB, which is adjacent to the LFE, moves anterior to the axis of motion in the last thirty degrees of knee extension and moves posterior to the axis of the motion, and the epicondylar prominence, during knee flexion movements of more than thirty degrees (Reid, 1992). The band remains tense in both these positions (Reid, 1992) and with this constant friction it results in irritation and inflammation of the tissues between the ITB and the LFE (Renne, 1975; Orava, 1978). These particular areas that become irritated and inflamed include the lateral synovial recess (Renne, 1975; Orava, 1978; Nemeth and Sanders, 1996; Nishimura *et al*., 1997; Fredericson *et al.,* 2002); the posterior fibres of the ITB (Fredericson *et al.,* 2002) and the periosteum of the LFE (Noble *et a*l., 1980; Nishimura *et al*., 1997; Kirk, Kuklo, Klemme, 2000). It is suggested that through repetitive irritation, the tissues simply do not have adequate time to heal and the resultant syndrome develops (Kirk *et al*., 2000).

2.4.2. Myofascial Pain Syndrome:

Myofascial Pain Syndrome (MPS) is considered as a common condition that presents frequently to primary health care practitioners and is recognised as being multi-factorial in origin (Gatterman, 1990; Chaitow and Delany, 2002).

A myofascial trigger point (MFTP) is defined as a hyperirritable area within a skeletal muscle that is associated with a hypersensitive palpable nodule in a taut band and palpation of the band may produce a local twitch response. The area of the muscle in which the trigger point is located is painful on compression and can give rise to characteristic referred pain, referred tenderness, motor dysfunction and autonomic phenomena (Travell and Simons, 1983; Chaitow and Delany, 2002).

As previously stated, the development of MFTP's is multi-factorial, however Travell and Simons, (1983) and Chaitow and Delany, (2002) agree that certain stimuli are consistent with, and contribute to the development of MFTP's and consist of the following:

Primary factors:

- Mechanical stresses: acute sustained or repetitive overload i.e.: prolonged muscle contraction,
- Trauma: direct injury to the muscle or sudden strain as it is subjected to abnormal exercise or movements or repetitive microtrauma,
- Leaving the muscle in a shortened position for a prolonged period, especially if the muscle is in a contracted state,
- Nerve compression: through a cascade of events results in altered communication between the neuron and the endplate,
- Environmental conditions: includes but not limited to excessive heat, cold or dampness and
- Systemic biochemical disturbances: may include hormonal disturbances.

Secondary factors:

- Synergistic or antagonistic muscles may develop MFTP's as a result of compensation of those muscles housing the primary MFTP's,
- Satellite MFTP's may develop in referral zones of primary MFTP's and
- Local ischemia of tissues.

Once a MFTP has manifested within a skeletal muscle it may be aggravated or perpetuated by certain factors. These potential perpetuating factors, outlined by Travell and Simons, (1983), include:

- Mechanical stresses: skeletal asymmetry (leg length discrepancies), poor posture, prolonged immobility and muscle trauma,
- Nutritional inadequacies: include decreased levels of vitamin B1, B6, B12, folic acid, iron, calcium, potassium and other trace minerals,
- Metabolic and endocrine inadequacies: hypoglycemia, hyperuricemia and hypothyroidism,
- Chronic infection: viral, bacterial and parasitic and
- Psychological factors: this includes anxiety and depression.

2.4.3. Pathology of the Sacroiliac Joint and Effect of Manipulation

Gatterman (1990), stated that trauma or vigorous activity which places repeated strain on the sacroiliac joint may lead to its dysfunction. By restoring normal pelvic biomechanics by way of manipulation, it is postulated that there will be a reflex inhibition of gamma and alpha neurons which may lead to the readjustment of muscle tone in the surrounding hip musculature, namely gluteus maximus and TFL, thus potentially leading to relaxation and decreased tension in the ITB (Bernard and Kirkaldy-Willis, 1987).

Kasunich (2003), suggested that sacroiliac dysfunction arises as a result of transmission of forces from the foot along the kinematic chain. Any abnormal contraction, shortening or lengthening of the musculature can affect the mechanics of the sacroiliac joint and in turn alter pelvic biomechanics. In the case of sacroiliac joint dysfunction, this abnormal muscle function can result in the sacrum being pulled against the ilium and there is tightening of the sacroiliac joint. Mennel (1960) proposed that a tight ITB may result from a sacroiliac joint subluxation.

According to Kirkaldy-Willis and Burton (1992), the inverse may also occur when the ITB becomes tight, it may result in a sacroiliac joint dysfunction. Chaitow and Delany (2002), concurred with this theory stating that trigger points in the associated musculature and a tight ITB will maintain sacroiliac joint dysfunction.

Korr (1976), stated that through joint manipulation and restoration of normal joint biomechanics there appeared to be a reflex effect, known as a somatosomatic reflex effect, which normalizes hypotony to hypertonic muscles surrounding the joint. This effect is achieved through a positive feedback cycle mediated by the gamma motor loop in which hypertonic muscle may result from and contribute to proprioceptive irritation, collectively referred to as a facilitated segment (Gatterman, 1990).

Haldemann (2005), explained that manipulation must have an effect on organ dysfunction, tissue pathology and a system complex, and it achieves this through creating changes in the musculoskeletal and nervous systems. By mobilizing the joint through manipulation there will be an immediate decrease in muscle spasm in and around the inflamed joint.

Homewood (1962), along with Korr (1976), suggested that joint dysfunction may induce persistent nociceptive and altered proprioceptive input. This persistent afferent input triggers the development of pathologic somatosomatic reflexes. If these reflexes persist, they in turn induce altered function in segmentally supplied somatic structures. Manual therapy and manipulative therapy has the potential for arresting both the local and distant somatic effects by terminating the altered neurogenic reflexes that are associated with somatic joint dysfunction. Spinal manipulation may also stretch mechanoreceptors in the joint capsule which leads to an inhibitory effect on nociceptive activity (Wyke, 1975).

Literature also suggests that sacroiliac joint dysfunction and aberrant hip range of motion are associated with one another (Cibulka, Sinacore, Cromer, Delitto, 1997). It is also thought that when the sacroiliac joint dysfunction is restored, by way of manipulation, a relative hip instability may be exposed (Vleeming, Volkers, Snijders, Stoeckart, 1990; Cibulka *et al.,* 1997; Bisset, 2003). According to Cibulka *et al.,* (1997), Vleeming *et al.,* (1990) and Bisset, (2003) the biomechanical mechanism that results in this is that by restoring the normal movement within the sacroiliac joint, which previously being immobile added stability to the relative instability of the associated hip joint, the now exposed hip joint instability may possibly result in some reflex muscle spasm to compensate and attempt to add some stability to this area, which may manifest itself along the ITB. In keeping with the pelvic and hip biomechanics sacroiliac joint manipulation may also provide relaxation to hip internal rotators, namely the TFL and gluteus medius muscles, thus improving hip range of motion (ROM) (Bernard and Kirkaldy-Willis, 1987; Gatterman, 1990; Souza, 2001; Haldemann, 2005). This theory needs to be considered as its mechanism has been displayed to a certain degree in this study and is shown in the results in Chapter Four and discussed in Chapter Five.

Table 2.1. Effects of Manipulation and Dry needling (Chaitow and Delany, 2002; Peterson and Bergman, 2002)

Manipulation versus **Dry Needling**

Decrease pain	Decrease pain
Increase flexibility in joint and muscle	Increase flexibility in muscle
Decrease muscle spasm	Decrease muscle spasm
Decrease edema	
Decrease adhesions	

2.5. Etiological Factors:

There are a significant number of etiological factors related to ITBFS and a patient presenting with this syndrome may have one or many of these factors which have resulted in the development of the condition. Lindenburg *et al.*, (1985) and Reid (1992) discuss these various aetiological factors and concluded that they comprise of training errors, which includes increasing mileage too soon, inadequate warm up and road camber and biomechanical factors, which include genu varum, foot hypersupination, overpronation, cavus foot, leg length discrepancies, sacroiliac joint and fibular head fixations. Fredericson *et al.,* (2002) and Baker (1995) agreed that poor footwear with inadequate shock absorption and hip abductor weakness are the primary cause. All these contributing factors result in excessive tautness of the ITB and thus the development of ITBFS (Noble *et al.,* 1980; Lindenburg *et al.,* 1985; Reid, 1992).

Holmes, Pruitt and Whalen (1993), added that varus knee alignment, and external tibial rotation of more than twenty degrees can result in a tightening of the ITB and thus increased friction at the impingement area. Holmes *et al.,* (1993), Messier *et al.,* (1995) and Farrell *et al.,* (2002) agreed that kinematics and kinetics plays an important role in ITBFS and that a reduction in muscular tension, within the TFL and gluteus maximus muscles, will result in a decreased reaction force, and in turn decrease friction at the impingement site.

Anatomical evidence suggests that ITBFS develops primarily as a result of dysfunction of the hip musculature and that the condition at the knee occurs secondary to this. It is essential that the correction in hip biomechanics and muscle function need to be restored in the treatment of this condition (Fairclough, Hayashi, Toumi, Lyons, Bydder, Phillips, Best, Benjamin, 2007).

2.6. Epidemiology:

ITBFS is thought to be the most common cause of lateral knee pain in long distance runners (Noble *et al*., 1980) accounting for up to a third of all running related knee injuries (Noakes and Granger, 2003). ITBFS is also highly prevalent in cyclists and has an incidence of fifteen to twenty-four percent of all overuse injuries occurring at the knee in cyclists (Farrell *et al*., 2002). ITBFS generally affects individuals between the ages of twenty and forty years of age (Noble *et al*., 1980; Lindenburg *et al.,* 1985). It has been noted that ITBFS is not as prevalent in populations younger than eighteen years (Lindenburg *et al.*, 1985) and in populations older than forty-five years, ITBFS seems to be secondary to degenerative changes within the knee and/or bony ankylosis of the sacroiliac joints (Kirkaldy-Willis and Burton, 1992)

2.7. Symptoms and Signs:

ITBFS is characterized by a sharp, burning type pain on the lateral aspect of the knee (Fredericson *et al.,* 2002). There may be pain on running or walking downhill and pain after running (Noble *et al.,* 1980; Nicholas and Hershman, 1995; Norris, 1998). The athletes may notice that they start out activity pain free but develop symptoms as the session progresses in duration and mileage. In severe cases the pain may persist when walking and may become intense on ascending and descending a flight of stairs (Reid, 1992; Fredericson *et al.*, 2002). On examination of the ITB and lateral aspect of the knee there is tenderness, swelling and possible crepitus over the lateral epicondyle of the femur. A positive Nobles test and a positive Modified Obers test are also present (Noble *et al.,* 1980; Nicholas and Hershman, 1995; Norris, 1998). Nobles Compression test, described by Reid (1992) and Magee (1992), is a specific diagnostic test to determine the presence of ITBFS in a patient. This test indicates that there is inflammation at the point of impingement where the ITB moves back and forth over the LFE during flexion and extension of the knee (Reid, 1992; Magee, 1992). The Modified Obers test, also described by Reid (1992) and Magee (1992), determines ITB tightness and flexibility and is considered a reliable test in determining the severity of ITBFS as well as monitoring improvements as a result of treatment (Saunders, 1998; Reese and Bandy, 2003).

Signs and symptoms of MFTP's within a muscle can be clinically identified by the following characteristics (Travell and Simons, 1983):

- A taut palpable band,
- A tender nodule,
- Weakness in the muscle,
- Decreased range of motion,
- Increased pain on active or passive stretching,
- Referred pain on compression of the trigger point,
- A local twitch response and
- Painful on muscle contraction.

The presence of MFTP's within the TFL muscle, when stimulated, refers pain to the anterolateral thigh, over the greater trochanter and extending down the thigh towards the knee (Travell and Simons, 1983; Chaitow and Delany, 2002). Patients may complain of a pain deep in the hip and pain that radiates down the thigh to as far as the knee. The pain may at times prevent the patient from brisk walking or lying on the affected side (Travell and Simons, 1983; Chaitow and Delany, 2002).

The diagnosis of Myofascial Pain Syndrome (MPS) is not limited to a one specific examination but rather a combination of tests as well as signs and symptoms with which the patient my present (Travell and Simons, 1983).

Travell and Simons, (1983) and Chaitow and Delany, (2002) outline the diagnostic criteria and signs of a MFTP:

Essential or minimal criteria:

- Referred pain in the zone of reference,
- Local twitch response,
- Taut palpable band with exquisite spot tenderness of the nodule,
- Full stretch range of motion is limited by pain and
- Patient recognises and complains of pain when pressure is applied to tender nodule.

Confirmatory Observations:

- Visual or tactile identification of a local twitch response and
- Pain or altered sensation when pressure is applied to the tender nodule.

In the diagnosis of a MFTP, all of the essential or minimal criteria must be present and the presence of confirmatory signs merely reinforces the diagnosis (Travell and Simons, 1983; Chaitow and Delany, 2002).

2.8. Current Treatments:

Due to the vast number of etiological factors, contributing to the development of ITBFS, the treatment of this condition has been multifactorial. Treatments are mainly aimed at reducing inflammation with the use of the rest, ice, compression and elevation (R.I.C.E.) principle and anti-inflammatory drugs, reduction in ITB tautness through stretching and MFTP therapy such as dry needling, corrective actions with regard to training and surface terrain, correction of biomechanical abnormalities through the use of orthotics, manipulative therapy to restore pelvic biomechanics and surgical intervention as a last case resort in stubborn chronic cases (Reid, 1992; Baer, 1999; Fredericson *et al.*, 2000; Souza, 2001). Hoskins *et al.,* (2006) reported that chiropractors approach to the treatment of lower extremity conditions is multimodal and include, interventions such as joint manipulation, cryotherapy, orthotics, massage, electrical stimulation, acupuncture type procedures and therapeutic exercise.

2.8.1. Rest

It is advised that patients suffering with ITBFS rest from activity between four to six weeks. As ITBFS is an overuse syndrome that results in inflammation, a cessation of activity should result in the relief of symptomatic pain. A rest period will allow for a reduction in the inflammatory process, desensitization of nerve endings and a decrease in oedema (Noble, 1980).

2.8.2. Cryotherapy

The use of ice in the treatment of ITBFS is highly recommended as it reduces the inflammatory response and decreases pain associated with MFTP’s (Orava, 1978; Noble, 1980; McMaster, 1982; Baker; 1995).

2.8.3. Stretching

Stretching of the ITB, which occurs through the TFL muscle, is a recommended therapy in the treatment of ITBFS (Firer, 1989; Baker, 1995). Placing emphasis on stretching techniques are important for returning the muscle to its original length (Travell and Simons, 1983; Chaitow and Delany, 2002).

2.8.4. Dry needling

Dry needling may interrupt the abnormal neural circuits responsible for perpetuating the pain-spasm-pain-cycle by mechanically disrupting the dysfunctional nerve endings or contractile elements of the muscle, which sustain trigger point (TP) activity (Melzack, 1981). The effect of dry needling results in the alleviation of the patients symptoms (Travell and Simons, 1983; Chaitow and Delany, 2002) and dry needling of the TFL is effective in the treatment of ITBFS (Baldry, 1989; Hall, 1997**;** Vernon and Schneider, 2009).

2.8.5. Orthotics

The use of orthotic shoe inserts are commonly used in the treatment of ITBFS (Noakes, 1992). Generally, lateral wedges are built into the midsole of the shoe in cases where the individual has severe genu varum or very high arched feet (Noakes, 1992; Reid, 1992). A rigid cavus foot is unable to absorb shock adequately (Sutker, 1985; Noakes, 1992) and a wedge is used to force the foot to pronate which increases the shock absorbing capacity by twenty-five percent. Leg length inequalities may also require orthotics, in extreme cases, to compensate for the short stature of the limb (Noakes, 1992). Lindenburg *et al.,* (1985) states that a predisposition to developing ITBFS is possibly due to both inadequate pronation as well as excessive pronation and thus orthotics should be used to resist or increase pronation.

2.8.6. Oral anti-inflammatory Drugs

Non-steroidal anti-inflammatory drugs (NSAID’s) may be useful in the treatment of ITBFS, in acute stages and acute episodes on a chronic condition, by reducing inflammation that has developed as a result of ITBFS and assist in a reduction in recovery time (Renne, 1975; Noble, 1980; Baker, 1995). Ellis *et al.,* (2007), indicated that patients receiving NSAIDs show a statistically significant improvement.

2.8.7. Electromodalities

Ultrasound and transcutaneous electrical stimulation (TENS) have been shown to be effective in the treatment of ITBFS. Ultrasound has been shown, through its heating effects, to aid oxygen delivery to target tissues, enhance microcirculation, decrease pain and spasm and improve plasticity of collagen. It also, by way of its therapeutic properties, decreases inflammation, accelerates hematoma resorption, promotes healing and performs phonophoresis (Reid, 1992).

According to Reid (1992), TENS minimizes atrophy due to immobilization and therefore can maintain paralysed muscles, reinforce voluntary contraction, increase range of motion, breakdown adhesions and overcome reflex inhibition, all of which can assist in the relief of pain and spasm.

2.8.8. Surgery

Firer (1989), asserted that not all cases of ITBFS are cured by conservative methods and surgery is indicated when conservative therapy has failed. Noble (1980) suggested that surgery should only be considered once the patient has attempted a four to six week rest period and had received conservative therapy which includes a series of corticosteroid injections to alleviate the symptoms.

2.8.9. Sacroiliac Joint Manipulation

Sacroiliac joint manipulation has been advocated in the treatment of ITBFS and patients have responded favorably to sacroiliac joint and fibular head manipulation (Wood, 1997; Baer, 1999, Souza, 2001).

2.9. Previous Studies:

Lindenburg *et al.,* (1985) investigated the etiological factors that pertain to ITBFS. The objective was to identify those runners who are at risk as well as to direct treatment toward addressing and correcting the causal factors. The sample group consisted of thirty-six participants who were treated and followed for at least one year. They found that there was a higher incidence of ITBFS in those participants with genu varum and cavus foot and noted that road camber and hardness of shoes appear to be etiological factors. They also concluded that treatment directed at correcting causal factors was as effective as conventional treatment of symptoms i.e.: rest, ice, stretch and ultrasound. It is made clear here that a treatment plan addressing the etiological factors combined with treatment interventions must be implemented.

Wood (1997) built on these findings and investigated the effectiveness of chiropractic sacroiliac joint manipulation in the management of acute ITBFS in long distance runners. The study consisted of a control group, of fifteen participants, who received ice therapy, orthotics, stretching exercises and altered training programs to the experimental group, also consisting of fifteen participants, who received the same treatment protocol with the addition of a sacroiliac joint manipulation. The participants were seen eleven times over an eight week period i.e.: once in the initial consult, twice each week from weeks two to five, once in week six, once in week eight and one follow up in week nine. The study showed no significant improvement between the two groups. A secondary endpoint that was identified was that the group receiving the manipulation had an increase in subjective pain. This was attributed to a stretch reflex in the TFL and gluteus maximus muscles that occur during the rapid stretching whilst the thrust is being applied (Souza, 2001). The reflex contraction in these muscles may place tension on their tendons which in turn may have aggravated the inflammatory reaction occurring at the distal end of the ITB (Korr, 1976; Souza, 2001). Wood (1997) also suggested that there is a lack of research in the field of the sacroiliac joint manipulation and its relationship with lower extremity biomechanics. The possible lack of a result may have been attributed to the masking of the effect of the sacroiliac joint manipulation by the other complimentary auxiliary therapeutic interventions.

Baer (1999), in keeping with the manipulative paradigm, stated in a case report that Active Release Therapy (ART) of the TFL and ITB, combined with sacroiliac joint manipulation and fibular head manipulation showed to be a quick and effective treatment for ITBFS. In the report it mentions that the patient was seen for five sessions over a one month period. By the end of the treatment period there was a resolution of subjective and objective findings. Baer (1999) only incorporated two interventions in the treatment regimen but agreed that the causative factors need to be addressed.

With regard to soft tissue therapy approach Hall (1997), investigated the effectiveness of dry needling of the TFL and ITB combined with a stretching regimen, compared to a placebo therapy of detuned ultrasound in the treatment of ITBFS. The study consisted of thirty participants divided into two equal groups of fifteen by random assignment. The trial was conducted over a period of four weeks. Participants received three treatments per week for the first two weeks and two treatments per week for the last two weeks. A follow up consultation took place one month later. The experimental group received authentic treatment in the form of dry needling, cryotherapy and stretching as well as home stretches which they were expected to keep up during their treatment period. The placebo group received treatment in the form of detuned ultra sound. The study showed a significant statistical improvement in the group receiving dry needling and stretching.

Adding to this literature were Ellis *et al.,* (2007), who discussed, in their systematic review, four Randomized Controlled Clinical Trials (RCT's) investigating the effect of conservative therapy in the treatment and management of ITBFS. These trials consisted of non-steroidal anti-inflammatory drugs, deep transverse friction massage, phonophoresis versus immobilization and corticosteroid injection. The NSAIDs, phonophoresis and corticosteroid injections showed to have a significant statistical improvement in the management of ITBFS. They concluded that there is an urgent need for further research in the form of randomized controlled clinical trials with regard to chiropractic specific procedures, performed in isolation, in the treatment of ITBFS.

As a result of the foregoing literature the research aimed to investigate the effectiveness of dry needling of the TFL and ITB, sacroiliac joint manipulation as well as a combination of the two interventions in the treatment of ITBFS.

Chapter Three

Materials and Methods

3.1. Study Design and Protocol:

The study was a randomised, open label, controlled clinical trial, quantitative in nature. It included forty-seven participants with acute ITBFS and was conducted at the Durban University of Technology (DUT) Chiropractic Day Clinic.

Based on this study design, this research was approved by the Faculty of Health Sciences and Ethics Committee (FHSEC 037/09, appendix A) indicating that the research protocol satisfied the ethical requirements set out by the Faculty of Health Sciences Research Committee for such studies. Furthermore, this approval indicates that the research protocol is in line with the Declaration of Helsinki, 1975 (Johnson, 2005).

Advertisement (Appendix B) flyers and posters were displayed on notice boards at DUT, running clubs, cycling clubs and health clubs in and around the Durban area notifying potential candidates of the study. All those responding to the advertisements were interviewed telephonically, or personally, to determine whether they complied with the selection criteria. Candidates that met the criteria were included in the study and were eligible to receive four free treatments.

3.1.1. Standard of Acceptance:

The following information was obtained telephonically from interested participants, or directly from those who presented to the clinic.

1. Participants had to have characteristic signs and symptoms of ITBFS which included pain on the lateral (outer) aspect of the knee at rest, during activity, after activity or whilst walking up or down a flight of stairs with localized tenderness on the lateral aspect of the knee just above the joint line (Reid, 1992; Fredericson *et al.*, 2002).

2. Participants had to be between 18 and 45 years of age (Lindenburg *et al.*, 1985; Kirkaldy-Willis and Burton, 1992).
3. Participants may not have had previous surgical intervention for their ITBFS (Noble, 1980; Firer, 1989).
4. Participants had to have experienced the symptoms for one to two weeks (Vizniak, 2007).

The participants that met the cursory interview outlines were invited to an initial consultation at Durban University of Technology Chiropractic Day Clinic. Here the participants were given a Letter of Information and Consent Form (Appendix C), which informed them of the nature of the study, the selection criteria and what would be required of them should they be accepted into the study. Following this, participants were required to sign the Letter of Information and Consent Form (Appendix C). This letter informed them that they may withdraw from the study at any time for any reason. The participant then underwent a Case History (Appendix D), Physical Examination (Appendix E), Lumbar Regional Examination (Appendix F), Hip Regional Examination (Appendix G) and a Knee Regional Examination (Appendix H). The treatment was noted on the SOAPE (Subjective data, Objective data, Assessment/Diagnosis, Plan of Treatment, Education to participant) note (Appendix I). These assessments, along with the inclusion and exclusion criteria discussed below, were used to finally select the forty-five participants for the study.

3.1.2. Inclusion Criteria:

Both males and females were accepted into the study. Participants had to be between the ages of 18 and 45 years of age. Participants younger than 18 were considered minors and the development of the condition does not seem to be as prevalent in ages younger than this (Lindenburg *et al.*, 1985). Participants older than 45 may have already developed degenerative changes within the knee and fibrous ankylosis in the sacroiliac joints (Kirkaldy-Willis and Burton, 1992).

Participants had to have presented with the characteristic signs and symptoms of ITBFS. Every participant had to present with points 1 and 2, and with at least one of the other points stipulated below (Noble *et al.,*1980; Nicholas and Hershman, 1995; Norris, 1998):

1. A positive Nobles Compression test must present,
2. A positive Modified Obers test must be present,
3. Burning pain over the lateral aspect of the knee that is experienced during activity or after activity,
4. Pain whilst running or walking downhill,
5. Pain on the lateral aspect of the knee when ascending or descending a flight of stairs,
6. Localized tenderness over the lateral femoral condyle, approximately 2-4cm superior to the lateral joint line of the knee and
7. Swelling and possible crepitus over the LFE.

In addition to the above criteria, the patient must also have had to present with the following:

1. The patient must have had a sacroiliac joint fixation on the involved side, diagnosed through the technique outlined by Peterson and Bergman (2002).
2. The patient must have had at least one MFTP in the TFL and in the ITB, diagnosed by using palpation and compression techniques described by Chaitow and Delany (2002).

All participants were required to agree to abide by the conditions set out in the Letter of Information and Consent Form (Appendix C).

3.1.3. Exclusion Criteria:

1. Contraindications including but not limited to Spinal Manipulative Therapy (SMT): atherosclerosis of major blood vessels, abdominal aortic aneurysm, tumors, bone infections, traumatic injuries such as fractures, arthritides, metabolic disorders, neurologic disorders (Gatterman, 1990).

2. Contraindications including but not limited to dry needling: systemic illness, fever, high anxiety/emotional stress, feeling faint, bleeding disorders (Han and Harrison, 1997)
3. If the participant had any other concomitant injuries which have been associated with their ITBFS (Gatterman, 1990).
4. Differential diagnoses including lateral meniscus or lateral collateral ligament pathology, superior tibiofibular joint sprain, popliteal or biceps femoris tendonitis, sacroiliac syndrome, common fibular nerve injury or referred pain from the lumbar spine (Fredericson *et al.*, 2000). These conditions were ruled out with a careful case history and relevant orthopaedic examinations.
5. If the participant had received any other form of treatment for their ITBFS while participating in the study or if the participant had undergone previous surgical intervention for their ITBFS (Noble, 1980; Firer, 1989).
6. Participants taking anti-inflammatory drugs for their condition. However if no anti-inflammatory drugs have been ingested in the 3 days prior to application for the study, they will be considered. Alternatively they must endure a 3 day washed out period before being accepted for the study (Poul, West, Buchanan and Grahame, 1993).

3.1.4. Subject Allocation:

The population size was restricted to a minimum of forty-five participants with random allocation being used to separate participants into three equal groups of fifteen. Once a patient had been selected they were required to draw a number from a box in which a slip of paper with the numbers “1”, “2” and “3” could possibly be chosen. The number that they picked determined which group they were allocated into. Once a group was full, its associated number was removed from the box (Cottrell and McKenzie, 2005). Participants in group “1” received dry needling of the active MFTP’s in the TFL and ITB on the involved side. Participants in group “2”, which was the larger group of seventeen, received sacroiliac joint manipulation of the sacroiliac joint on the involved side. Participants in group “3” received a combination of the two interventions i.e.: they received dry needling of the active MFTP’s in the

TFL and ITB, and sacroiliac joint manipulation on the involved side. The reason for the one larger group is only as a result of having more responses to the advertisement and the researcher felt that in the event of drop outs from the study, there would be a surplus of participants to compensate a possible drop out rate. The additional participants chose their number from a bag that had equal amounts of group numbers from which they both happened to choose group two. As a result, group two ended up consisting of seventeen participants while group one and three consisted of fifteen participants.

3.2. Intervention:

3.2.1. Treatment Procedure and Frequency:

As mentioned previously, forty-seven candidates were finally selected as participants during the initial consultation which was a scheduled appointment at the Durban University of Technology Chiropractic Day Clinic. Each participant was then randomly allocated into group "1", "2" or "3". This procedure was achieved simply by the participant selecting a piece of paper marked "1", "2" or "3" out of a box. This is also known as the hat method (Cottrell and McKenzie, 2005). The participant then immediately received a first treatment. The treatment issued to the participant was determined by which group they had been allocated into:

Group 1- Participants received dry needling of the active MFTP's in the TFL and ITB on the involved side.

Group 2- Participants received sacroiliac joint manipulation of the sacroiliac joint on the involved side.

Group 3- Participants received a combination of the two interventions i.e.: they will receive dry needling of the active MFTP's in the TFL and ITB, and sacroiliac joint manipulation on the involved side.

All participants received four treatments each, over a two week period i.e.: two treatments the first week and two treatments in the second week (Vizniak, 2007).

3.3. Materials and Measurements:

A set of subjective and objective data was collected in the initial consultation prior to any treatments and a set of the same data was collected again at the last consultation after all the treatments had been completed. This was done to determine the effect that the treatment had on the condition in terms of the subjective and objective findings.

3.3.1. Subjective Measurements:

Subjective measurements were acquired using a questionnaire which the participants answered as accurately as possible and this aided in determining the severity of their pain. The questionnaire utilized in this research was the following:

3.3.1.1 Numerical Pain Rating Scale-101 Questionnaire (NRS-101):

The perception of pain intensity is recorded on a numerical scale from 1 to 100, with 0 being no pain and 100 being the worst pain ever experienced. The patient delivers two ratings of their pain on the 10cm line scale. One rating is when the pain was at its worst and one rating for when the pain was at its least. The average of these two figures indicates the average pain experienced by the patient as a percentage (Jenson, Karoly, Braver, 1986). (Appendix H)

The NRS-101 questionnaire is regarded as a superior measuring instrument as it is easy to administer and score. It can also be performed in a written or verbal form. This makes it a very simple and user friendly pain measurement tool and therefore tendencies for incorrect responses from patients are infrequent (Liggins, 1982).

3.3.2. Objective Measurements:

3.3.2.1. A Modified Ober's test:

This test, described by Reid (1992), determines ITB tightness and was performed as follows:

The patient was made to lie in the lateral recumbent position with the uppermost limb being the affected side. The examiner extends the patients affected limb at the hip and thigh with slight hip abduction. The patients affected limb must remain in full extension at the knee. The examiner, while stabilizing the pelvis to limit movement at the hip, slowly releases support of the affected limb to allow it to fall into adduction. A normal or negative test would result if the limb adducted through the neutral point. However a tight ITB restricts adduction and prevents the limb from falling past the neutral point and would therefore constitute a positive test for ITB tightness. Measurements for this test were recorded using a digital inclinometer (Saunders, 1998; Reese and Bandy, 2003).

3.3.2.2. Digital Inclinometer:

The Modified Ober's test, which is the test to indicate hip ITB tightness and flexibility, was measured using a digital inclinometer.

According a study conducted by Reese and Bandy (2003), it was concluded that the use of an inclinometer to measure hip adduction using both the Ober's Test and the Modified Ober's Test appears to be a reliable method for the measurement of ITB flexibility.

The measurements were taken with the participant lying in the lateral recumbent position with their symptomatic side facing superiorly. The digital inclinometer was positioned at the popliteal fossa on the involved limb using a Velcro strap to hold it securely in place. The Modified Ober's Test was performed on all the participants to measure hip adduction and ITB tightness. With regard to the readings on the inclinometer, if the limb was at neutral the reading was 0 degrees. If the limb fell below the horizontal (adducted), it was recorded as a positive number. If the limb remained above the horizontal (abducted), it was recorded as a negative number (Saunders, 1998; Reese and Bandy, 2003).

3.3.2.3. Noble's Compression Test:

This test, described by Reid (1992), was performed with the patient lying in the supine position and the affected limb placed in 90 degrees of flexion. The examiner then applied pressure over the proximal part of the lateral femoral epicondyle, approximately 2-4 centimetres above the lateral joint line of the knee (Noble *et al.,*1980). The examiner then gradually extended the patients knee. If the patient complained of a pain that was similar to that experienced during activity, when the knee was at approximately 30 degrees of flexion, then the test was positive for ITBFS. An algometer was used to determine the local pain sensitivity of this test (Fischer, 1986). A description on how the algometer was utilized in this situation is discussed later in section 3.3.2.5.

3.3.2.4. Diagnosis, Location and Measurement of Myofascial Trigger Points:

The presence of MFTP's, within a muscle, were identified using the following diagnostic criteria (Travell and Simons, 1983; Chaitow and Delany, 2002):

- Palpable taut band,
- Focal tenderness,
- Referred pain in the zone of reference and
- Painful limit to full stretch and decreased range of motion.

Minimal criteria:

- Taut palpable band,
- Exquisite spot tenderness of a nodule in a taut band and
- Subjects recognition of pain.

Confirmatory observations:

- Visual or tactile identification of a local twitch response,
- Pain or altered sensation on compression of the tender nodule,
- Painful limit to full range of motion,
- Pain on muscle contraction and
- Muscle weakness.

All minimum criteria must be present for the diagnosis of MFTP's and the presence of confirmatory signs reinforces the diagnosis (Travell and Simons, 1983; Chaitow and Delany, 2002). The measurement of MFTP tenderness was measured using an algometer (Fischer, 1986).

3.3.2.5. Algometer:

An algometer is a pressure or force gauge that is used for the assessment of local pain sensitivity. This gauge is fitted with a rubber disc footplate that has a surface area of $1cm^2$ and this is the part that is applied to a defined area of the patient's body when taking readings. A metal rod connects the rubber disc to the gauge (body) that is calibrated in lb/cm^2. Pressure exerted on the disc and rod results in the indicator moving in a clockwise direction around the dial on the body. After each measurement the value is held. This is known as maximum hold function which allows a reading even after the meter has been removed from the patient. Once the reading has been recorded the meter can be restored to zero by pressing a zeroing button (Fischer, 1986).

In this study the algometer was used to determine local pain sensitivity to the Noble's Compression test and MFTP's. In the Noble's Compression test the area of most tenderness was identified, normally 2-4 centimeters proximal to the lateral joint line of the knee whilst at approximately thirty degrees of knee flexion (Noble *et al.,*1980), on which the algometer was placed. Similarly, MFTP's were located in the TFL and ITB and the algometer was placed on these areas. Pressure was applied that increased steadily and consistently until the pressure sensation turned to pain. This is known as the pain threshold point and it is at this stage that the patient needs to verbalise such a change. At this point the algometer was removed and the reading was recorded. The higher the pressure reading on the algometer the less tender the area under investigation is, and the lower the reading indicates a greater tenderness (Fischer, 1986).

Table 3.1. Outline of Treatment and Measurement Plan

Week	Treatment	Group 1	Group 2	Group 3
1	1	Measurements and Dry Needling Treatment	Measurements and Manipulation Treatment	Measurements and Combination Treatment
	2	Dry Needling Treatment	Manipulation Treatment	Combination Treatment
2	3	Dry Needling Treatment	Manipulation Treatment	Combination Treatment
	4	Dry Needling Treatment and Final Measurements	Manipulation Treatment and Final Measurements	Combination Treatment and Final Measurements

3.3.2.6. Statistical Analysis:

SPSS version 15 (SPSS Inc., Chicago, Illinois, USA) was used for statistical analysis of data. The three groups were compared at baseline in terms of demographics variables and side affected using Pearson’s chi square tests and ANOVA tests as appropriate.

Intra-group comparisons were made between all time points. A significant time effect indicated successful treatment intervention. Inter-group comparisons were achieved using repeated measures ANOVA tests for each outcome measured separately. A significant time group interaction effect indicated a significant treatment effect.

Profile plots were used to assess the trend and direction of the treatment effect. Presence of joint fixations post treatment was compared between the three treatment groups using Pearson's chi square test since all participants had joint fixations pre treatment. A p value of <0.05 was considered as statistically significant.

Chapter 4

Statistical Methodology and Results

4.1 Introduction

This chapter will cover the results of the study which includes the statistical methodology, descriptive statistics and analytical statistics.

4.2 Terms and Abbreviations

- ***p*-value**- measures and expresses the statistical significance. It shows that differences are not caused by chance but rather real differences between treatments or results. Generally, statistical significance is accepted at $p < .05$ which means that the probability that the results occurred by chance is 5 percent or less (Mouton, 1996).

- **SD**- standard deviation. Determines how much individual values deviate or differ from the mean (Mouton, 1996).

- **Mean**- an average generated by dividing the sum of the values by the number of values (Mouton, 1996).

4.3 Results
4.3.1 Descriptive statistics
4.3.1.1 Demographics of the Sample

Participants were randomised to three treatment groups. There were no significant differences between the three groups in terms of demographic variables or side affected (Table 4.1).

Table 4.1: Comparison of demographic variables and side affected between the three treatment groups.

		Group						*p* value
		Dry needling		Manipulation		Combination		
		Count	%	Count	%	Count	%	
Gender	Male	8	53.3%	12	70.6%	12	80.0%	0.282
	Female	7	46.7%	5	29.4%	3	20.0%	
Ethnicity	Caucasian	11	73.3%	11	64.7%	12	80.0%	0.656
	Black	1	6.7%	4	23.5%	1	6.7%	
	Indian	1	6.7%	0	.0%	1	6.7%	
	Coloured	2	13.3%	2	11.8%	1	6.7%	
Side Affected	Right	6	40.0%	5	29.4%	6	40.0%	0.768
	Left	9	60.0%	12	70.6%	9	60.0%	
Age	Mean (SD)	28.93 (5.39)		26.35 (6.71)		28.20 (6.88)		0.501

There were a total of 47 participants that completed the study. Of those, 32 were male and 15 were female. The racial demographic data indicated that 72 percent of the participants were Caucasian, 13 percent were Black, 11 percent were Coloured and 4 percent were Indian.

The data shows that the side most affected by ITBFS was the left, at 64 percent and the average age of the participants appeared to be between 26 and 29 years.

4.3.2 Analytical Statistics
4.3.2.1 Inter-group Comparisons
4.3.2.1.1 NRS-101 Questionnaire

There was overall a highly significant change over time in all groups (p<0.001) but there was no treatment effect since the time*group interaction effect was not significant (p=0.978) and Figure 4.1 shows that the rate of change over time was the same in all three groups as the profiles over time of the three groups were parallel.

Table 4.2: Repeated measures ANOVA table of between and within subjects effects for NRS-101 Questionnaire

Effect	**Statistic**	**p value**
Time	Wilk's lambda= 0.411	<0.001
Time*group	Wilk's lambda=0.999	0.978
Group	F=0.867	0.427

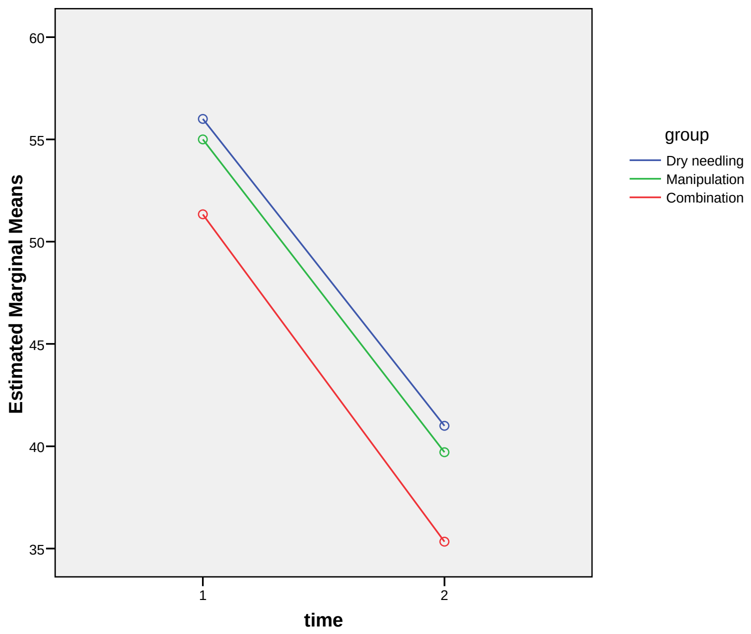


Figure 4.1: Mean NRS by time and group

There was no significant statistical improvement between the groups. However, on closer examination it appears that the combination group marginally improved the best (indicated by the steeper inclined red line). The dry needling and manipulation groups parallel each other in terms of their improvement. This result is discussed further in Chapter Five.

4.3.2.1.2. Algometer Readings(Kg/gm²) Of Point Tenderness In the Tensor Fascia Lata(TFL)

There was overall a highly significant change over time in all groups ($p<0.001$) but there was no treatment effect since the time*group interaction effect was not significant ($p=0.859$), Figure 4.2 showed that the rate of change over time was the same in all three groups as the profiles over time of the three groups were parallel.

Table 4.3: Repeated measures ANOVA Table of between and within subjects effects for Algometer at TFL

Effect	Statistic	p value
Time	Wilk's lambda= 0.544	<0.001
Time*group	Wilk's lambda=0.933	0.859
Group	F=0.181	0.835

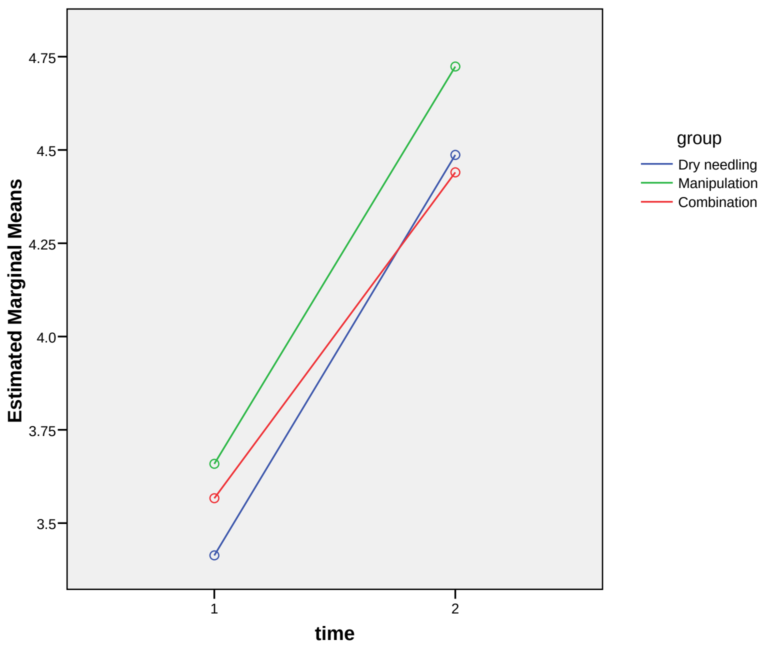


Figure 4.2: Mean Algometer TFL by time and group

There was no significant statistical improvement between the groups. However, on closer examination it appears that the groups receiving dry needling and manipulation improved the most (indicated by the steeper inclined blue and green lines, respectively), whilst the combination group improved the least. This result is discussed further in Chapter Five.

4.3.2.1.3 Algometer Readings In Iliotibial Band (ITB)

There was overall a highly significant change over time in all groups ($p<0.001$) but there was no treatment effect since the time*group interaction effect was not significant ($p=0.560$), Figure 4.3 showed that the rate of change over time was the same in all three groups as the profiles over time of the three groups were relatively parallel.

Table 4.4: Repeated measures ANOVA Table of between and within subjects effects for Algometer in ITB

Effect	**Statistic**	**p value**
Time	Wilk's lambda= 0.412	<0.001
Time*group	Wilk's lambda=0.974	0.560
Group	F=0.403	0.670

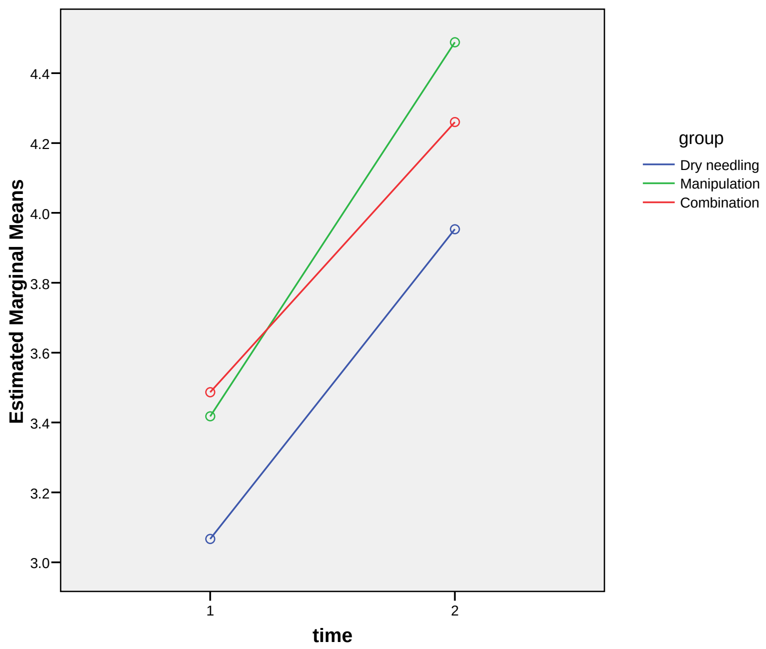


Figure 4.3: Mean Algometer ITB by time and group

There was no significant statistical improvement between the groups. However, on closer examination it appears that the group receiving manipulation alone improved the most (indicated by the steeper inclined green line). The dry needling group faired well with the combination group improving the least. This result is discussed further in Chapter Five.

4.3.2.1.4 Algometer Readings of Nobles Compression Test

There was overall a highly significant change over time in all groups (p<0.001) but there was no treatment effect since the time*group interaction effect was not significant (p=0.741), Figure 4.4 showed that the rate of change over time was the same in all three groups as the profiles over time of the three groups were relatively parallel.

Table 4.5: Repeated measures ANOVA Table of between and within subjects effects for Algometer Readings of Nobles Compression Test

Effect	**Statistic**	**p value**
Time	Wilk's lambda= 0.480	<0.001
Time*group	Wilk's lambda=0.986	0.741
Group	F=0.066	0.936

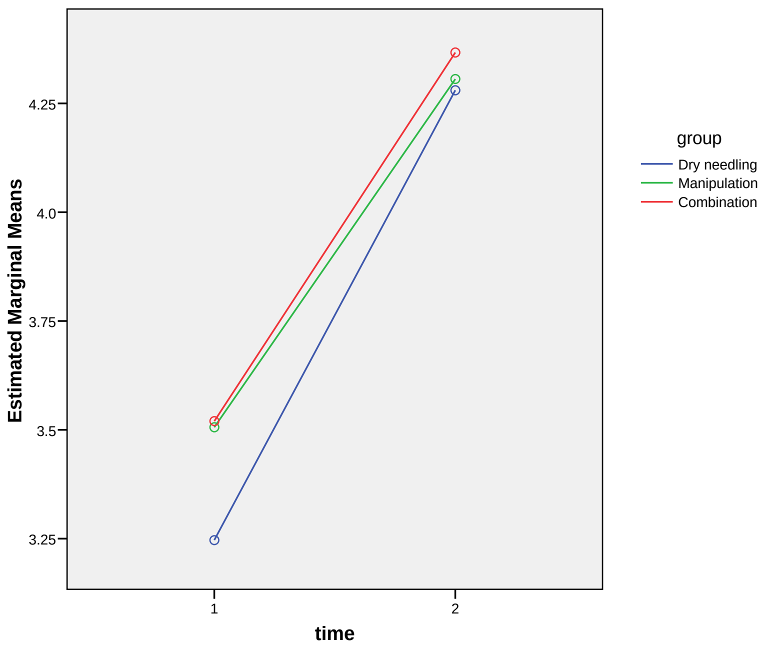


Figure 4.4: Mean Algometer Nobles compression test by time and group

There was no significant statistical improvement between the groups. However, on closer examination it appears that the group receiving dry needling alone improved the most (indicated by the steeper inclined blue line). The manipulation group rendered the worst results in this case with the combination group improving only slightly more over the manipulation group. This result is discussed further in Chapter Five.

4.3.2.1.5 Inclinometer Readings (degrees) Of ITB Flexibility i.e.: Hip Adduction Angle Whilst Performing Modified Obers Test

There was overall a highly significant change over time in all groups ($p<0.001$) but there was no treatment effect since the time*group interaction effect was not significant ($p=0.548$), Figure 4.5 showed that the rate of change over time was the same in all three groups as the profiles over time of the three groups were relatively parallel.

Table 4.6: Repeated measures ANOVA Table of between and within subjects effects for Inclinometer

Effect	Statistic	p value
Time	Wilk's lambda= 0.116	<0.001
Time*group	Wilk's lambda=0.973	0.548
Group	F=1.315	0.279

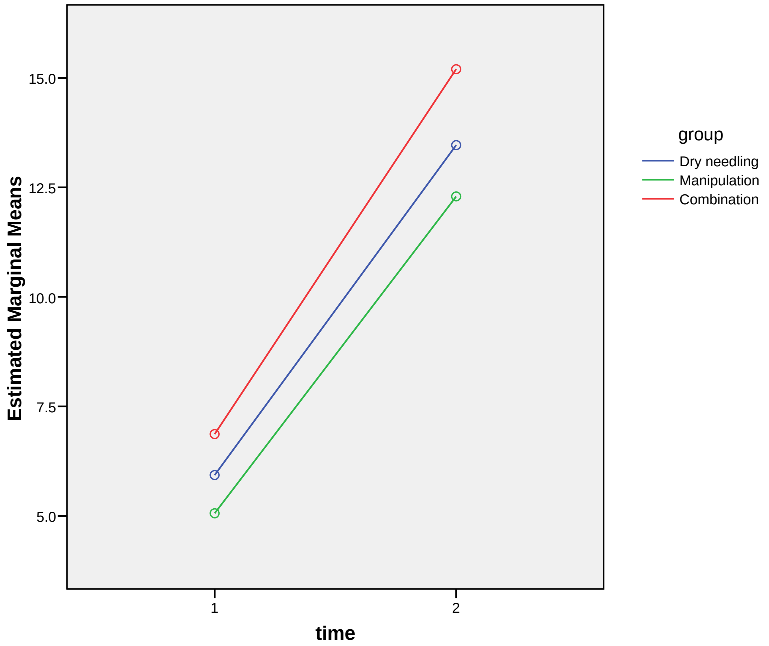


Figure 4.5: Mean Inclinometer readings by time and group

There was no significant statistical improvement between the groups. However, on closer examination it appears that the group receiving the combination therapy improved the most (indicated by the steeper inclined red line). The manipulation group and dry needling group are fairly consistent with one another with regard to their degree of improvement. This result is discussed further in Chapter Five.

4.3.2.1.6 Presence of Sacroiliac Joint Fixations Post Treatment

There was a highly significant difference in percentage with no fixations post treatment between the treatment groups (p<0.001). All participants in the dry needling group still had fixations while none of the participants in the manipulation group or the combination group had fixations post treatment.

Table 4.7 Post Treatment Comparison of the Presence of Sacroiliac Joint Fixations

			Presence Of Sacroiliac Joint Fixations Post Treatment		Total
			Present	Absent	
group	Dry needling	Count	15	0	15
		% within group	100.0%	.0%	100.0%
	Manipulation	Count	0	17	17
		% within group	.0%	100.0%	100.0%
	Combination	Count	0	15	15
		% within group	.0%	100.0%	100.0%
Total		Count	15	32	47
		% within group	31.9%	68.1%	100.0%

Pearson's chi square = 47, $p<0.001$

The data indicates that all patients that received manipulation, whether in the manipulation or combination group had a resolution of sacroiliac joint fixations.

4.4 Summary

Overall, there is no statistical significance between the three treatment groups with regards to their improvements and all groups improved as a result of the treatment interventions administered. However, on close evaluation of the results, there appeared to be subtle differences in improvements that will be discussed in more depth in Chapter Five.

Chapter 5

Discussion of Results

5.1 Introduction

This chapter focuses on the discussion and interpretation of the results rendered from the study and those depicted in Chapter Four. The researcher recognizes that the groups were too small and that the P value is not significant enough to draw accurate conclusions. However, for the purpose of the study close examination of the data was observed to find possible trends that may manifest and set a base for which future larger research can benefit.

5.2 Objectives

The aim of the study was to compare the relative effectiveness of dry needling of active MFTP's in the tensor fascia lata and iliotibial band versus sacroiliac joint manipulation versus a combination of the two interventions, in the treatment of iliotibial band friction syndrome.

The objective was to measure this difference between the interventions, if any, in terms of subjective pain perception and objectively through orthopaedic testing with regards to the following:

- The relative effectiveness of dry needling of the TFL and ITB in the treatment of ITBFS.
- The relative effectiveness of sacroiliac joint manipulation in the treatment of ITBFS
- The relative effectiveness of combining the two interventions in the treatment of ITBFS.

- To compare the difference in efficacy of the three intervention groups in the treatment of ITBFS.

5.3 Data

5.3.1 Primary Data

The Primary Data was all the data that was acquired within the study through various testing methods. These tests included the NRS-101 subjective pain perception scale (Jenson, Karoly, Braver, 1986), algometer readings for point tenderness (Fischer, 1986) and inclinometer readings for flexibility and Range of Motion (ROM) (Reese and Bandy, 2003).

5.3.2 Secondary Data

Secondary Data consisted of information collected from personal communication and interviews, journals, articles, text books, interaction with other health care professionals.

5.5 Descriptive statistics

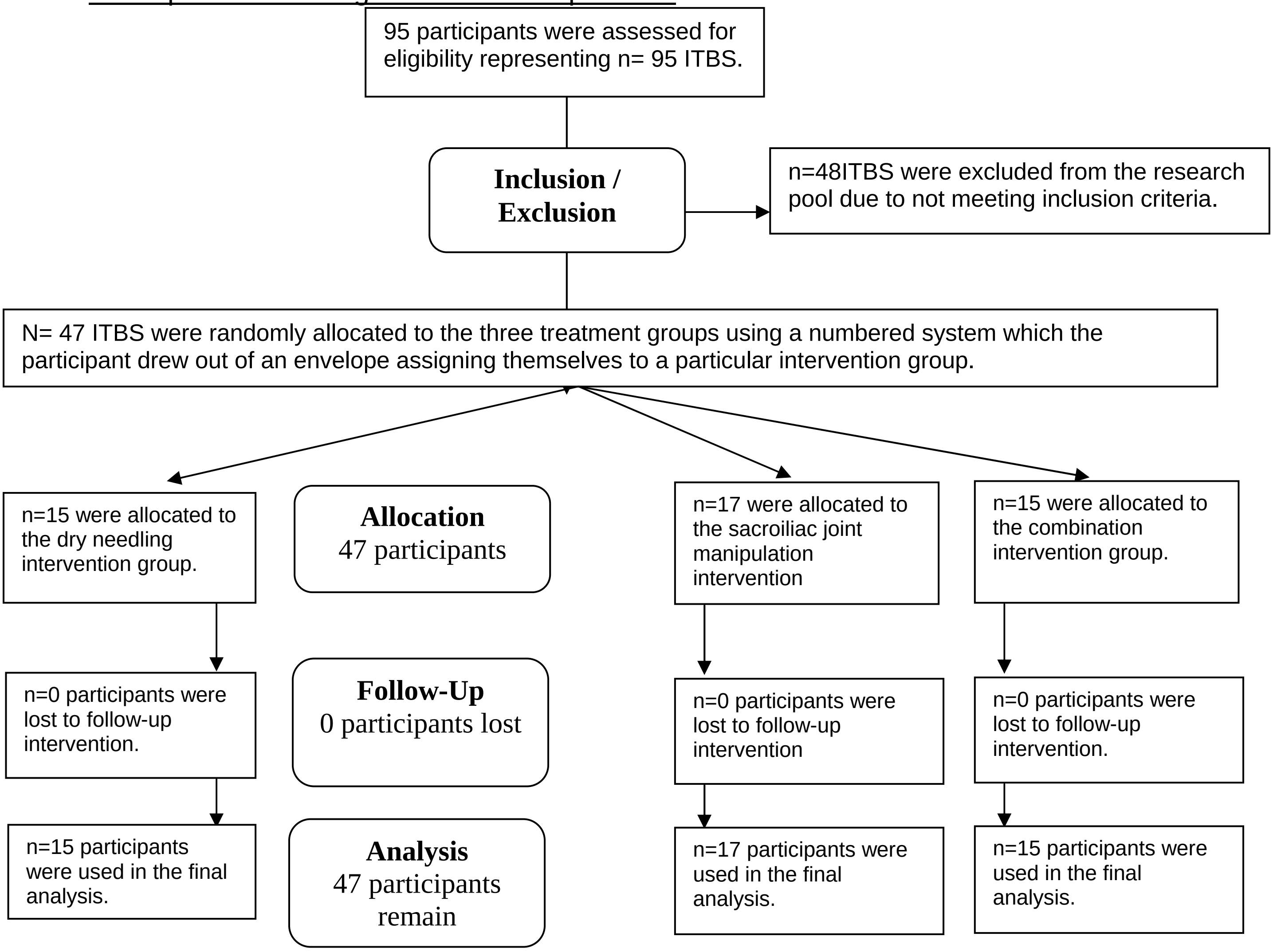
5.5.1 Drop out Analysis and Demographics of the Sample

5.5.1.1. Drop out analysis

There were a total of forty-seven participants that started and completed the study.

Figure 5.1

Participant flow through the treatment process.



5.5.1.2 Demographics of the Sample

Of the 47 participants, 32 were male and 15 were female. This is consistent with the literature as cited by Lindenburg *et al.,* (1985) with regard to the incidence of ITBFS amongst males and females.

The average age of the participants is between 26 and 29 years. This is consistent with the literature that states that the incidence and prevalence of ITBFS generally occurs between the ages of 20 and 40 years of age (Noble *et al*., 1980; Lindenburg *et al.,* 1985).

The ethnic demographics of the study indicated that 72 percent of participants were Caucasian, 13 percent were Black, 11 percent Coloured and 4 percent were Indian.

The participants in this study indicated that their left ITB was affected 64 percent of the time, whilst the remainder of the participants experienced right sided ITB involvement, making up the other 36 percent. This is in contradiction to Lindenburg *et al.,* (1985); Noakes, (1992) and Reid, (1992) who stated that in South Africa, right side involvement is more predominant as runners generally run toward the flow of traffic and therefore run on the road camber tilting to the right. One explanation may lie in the fact that this study was not limited to runners only, and recreational athletes (i.e.: athletes that supplement their training with running to enhance cardiovascular endurance) were also considered as participants. This concurs with Farrell *et al*., (2002). Additionally many of the participants in this study reported running on treadmills or on off road terrain, which would obscure the clinical picture as suggested by Lindenburg *et al.,* (1985); Noakes, (1992) and Reid, (1992).

5.5.2 Analytical Statistics

It must be noted that all the groups improved substantially and there were in fact no significant statistical improvements between the groups. However, on closer examination, there were subtle differences between the groups and these will be discussed in the following sections.

5.5.2.1 Inter-group Comparisons

5.5.2.1.1 NRS-101 Questionnaire

MFTP's present as pain in the form of local or referred pain that is of ischemic origin (Gatterman, 1990). When treating these trigger points using the treatment intervention of dry needling, it aims to decrease the intensity of pain by decreasing adhesions and resolving the hypermetabolic state within the muscle that had manifested as a result of prolonged muscle spasm (Travell and Simons, 1983; Chaitow and Delany, 2002). Needling may interrupt the abnormal neural circuits responsible for perpetuating the pain-spasm-pain-cycle by mechanically disrupting the dysfunctional nerve endings or contractile elements of the muscle, which sustain MFTP activity (Melzack, 1981). These benefits of dry needling are indicated in Table 2.1., in Chapter Two. As shown in Figure 4.1, the participants receiving dry needling as a treatment intervention (indicated by the blue line), had a substantial reduction in pain perception after their treatment period.

In contrast, the pain in sacroiliac joint dysfunction arises as a result of inflammation in and around the joint due to aberrant movement and biomechanics as well as reflex muscle spasm (Gatterman, 1990). By restoring normal joint movement through sacroiliac joint manipulation, it may result in normalisation of muscular spasm of surrounding hip and pelvic musculature, decrease oedema and decrease adhesions, all of which may result in decrease pain experienced by the patient (Gatterman, 1990; Peterson and Bergman, 2002). Wyke, (1975) adds that spinal manipulation stretches mechanoreceptors in the joint capsule which leads to an inhibitory effect on nociceptive activity. Homewood, (1962) and Korr, (1976) suggest that manipulative therapy has the potential to correct altered nociceptive and proprioceptive input. As indicated by the green line in Figure 4.1, the results seem to support the hypothesized mechanisms of actions as discussed above.

By combining the two interventions and considering the aforementioned explanations, it could be assumed that the results would be amplified in the combination group (i.e.: a reduction in pain from both the dry needling and manipulative interventions) as opposed to one therapeutic intervention. This proposed enhanced result appears to hold truth as depicted by the red line in Figure 4.1.

5.5.2.1.2. Algometer Readings (Kg/gm²) Of Point Tenderness In the Tensor Fascia Lata (TFL)

Figure 4.2 depicts that the groups receiving dry needling alone (group 1) as well as the group receiving manipulation alone (group 2) faired best with regard to point tenderness within the TFL, revealing that these groups improved to the same extent.

This result was expected in the group receiving the dry needling therapy as the treatment would serve the same benefits as mentioned in the previous Section 5.5.2.1.1., where it is thought that dry needling decreases pain as a result of breaking down of adhesions within the muscle that results in abnormal neural circuits that create a pain-spasm-pain cycle causing muscle dysfunction and development of MFTP's (Melzack, 1981; Travell and Simons, 1983; Chaitow and Delany, 2002).

Within group 2, this result was also expected as manipulation served to restore normal pelvic biomechanics and it is postulated that there will be a reflex inhibition of gamma and alpha neurons which leads to the readjustment of muscle tone in the surrounding hip musculature, which includes the TFL, thus potentially leading to relaxation and decreased tension in the ITB (Korr, 1976; Bernard and Kirkaldy-Willis, 1987; Gatterman, 1990; Haldemann, 2005). In addition to the above, manipulation may restore neurogenic reflexes and inhibit nociceptive activity all of which may decrease point tenderness within the muscle (Homewood, 1962; Wyke, 1975; Korr, 1976).

In the group receiving the combination treatment there appears to be a lesser degree of improvement. This can possibly be due to the fact that manipulation was administered post needling of the MFTP's. Therefore normal muscle function may have already been restored prior to manipulation and according to Korr (1976), the fibers may have been reset in a shortened position (post manipulation) due to a reflex muscle spasm from sudden overstretching with manipulation and thus creating tenderness within the muscles in and around the sacroiliac joint, namely the TFL and Gluteus Maximus (Souza, 2001). This result may also be due to the fact that participants in this group had received an additional intervention and have, therefore, experienced a greater deal of post treatment soreness and thus less of an improvement. This result was not expected as previous NRS readings, in Figure 4.1 were less in the combination group albeit the NRS readings being an overall subjective perception of pain and not specific to one localized area as in this case where a specific objective algometer reading has been recorded. It must also be noted that perceived pain is not the same as a pain threshold tenderness that one measures with an algometer (Travell and Simons, 1983; Fischer, 1986; Chaitow and Delany, 2002).

5.5.2.1.3 Algometer Readings In Iliotibial Band(ITB)

The group receiving dry needling faired well (Figure 4.3). This result would be expected and the benefits of such therapy have been discussed (Section 5.5.2.1.1.), where dry needling aims to breakdown adhesions within the muscle resulting in disruption of abnormal neuronal circuits, thus resolving spasm and restoring normal muscle length (Melzack, 1981; Travell and Simons, 1983; Chaitow and Delany, 2002). It must be noted that the majority of the MFTP’s found, and subsequently needled, were nearer the distal third of the ITB, closer to the site of impingement and insertion.

The manipulation group showed the most improvement (Figure 4.3). A possible reason for this is that of the theories (Section 5.5.2.1.2.), where sacroiliac joint manipulation served to restore pelvic biomechanics by way of removing reflex inhibition that allowed readjustment of muscle tone of the surrounding hip musculature and in turn decrease tension and pain within the ITB (Wyke, 1975; Korr, 1976; Bernard and Kirkaldy-Willis, 1987; Gatterman, 1990; Haldemann, 2005).

The group receiving the combination therapy showed the least improvement (Figure 4.3). The reasons for this are consistent with those discussed in the previous Section 5.5.2.1.2., where the combination therapy may have caused initial normalcy in the musculature by way of dry needling and then a reflex muscle spasm as a result of immediate manipulative therapy, post dry needling (Korr, 1976; Souza, 2001).

5.5.2.1.4 Algometer Readings of Nobles Compression Test

The dry needling group showed the greatest improvement (Figure 4.4). This was possibly due to the fact that TP's were predominantly in the distal third of the ITB, therefore needling was performed close to the point of impingement and insertion and thus a local effect was achieved (Travell and Simons, 1983; Chaitow and Delany, 2002). The effect of the needling may also be immediate in reducing ITB tension (Chaitow and Delany, 2002), whereas the influence that manipulation has on the ITB is more indirect, through muscles of the hip, which may take effect over time (Bernard and Kirkaldy-Willis, 1987; Souza, 2001).

The manipulation group showed the least improvement in this case (Figure 4.4). This may be linked to a relative hip joint instability (Vleeming, Volkers, Snijders, Stoeckart, 1990; Cibulka, Sinacore, Cromer, Delitto, 1997, Bisset, 2003). This is thought to result from the aberrant hip joint range of motion associated with sacroiliac joint dysfunction (Cibulka *et al.,* 1997). When the sacroiliac joint dysfunction is restored to normal through manipulation, the relative hip joint instability is exposed as the stabilizing effect from the sacroiliac joint dysfunction (i.e.: an immobile joint), is resolved. As a result, it could be argued that there may be tension generated in the ITB to help stabilize the hip joint. This tension is most likely to be exerted near its point of insertion and thus discomfort at the zone of impingement where pressure in the Nobles Compression test is applied.

In the dry needling group, the sacroiliac joint dysfunction remained and thus the relative hip instability was still protected. In the combination group, the reflex muscle spasm (post manipulation), of the hip musculature, explained by Korr (1976) and Souza (2001) may have provided stability to the hip joint. Again, it must be noted that perhaps manipulation is more effective in treating the origin of ITB (i.e.: the TFL and gluteal muscles), and has less of an immediate effect on controlling actual inflammation at the lateral knee region (Bernard and Kirkaldy-Willis, 1987; Souza, 2001).

The combination group marginally improved over the manipulation group (Figure 4.4). A possible reason for this is that although a stretch reflex in the TFL and gluteus maximus muscles had occurred during the rapid stretching from the manipulation, it may have resulted in tightening and aggravation of the ITB at its distal end. This may have been compensated for slightly, by the local effect of the dry needling (Korr, 1976; Travell and Simons, 1983; Gatterman, 1990; Souza, 2001 Chaitow and Delany, 2002).

5.5.2.1.5 Inclinometer Readings (degrees) Of ITB Flexibility i.e.: Hip Adduction Angle Whilst Performing Modified Obers Test

Dry needling and manipulation show fairly consistent readings (Figure 4.5). Dry needling would have broken down adhesions within the TFL and ITB and restored normal length and flexibility within these structures and thus improved range of motion (Chaitow and Delany, 2002).

Manipulation would have achieved this through the reflex inhibition of muscle spasm surrounding the joint complex and restoring normal biomechanics and range of motion (Korr, 1976; Bernard and Kirkaldy-Willis, 1987; Gatterman, 1990). In this way there is relaxation on hip internal rotators (i.e.: TFL and gluteus medius), and therefore increased ability for the affected limb to be adducted further toward and beyond the midline (Korr, 1976; Bernard and Kirkaldy-Willis, 1987; Gatterman, 1990; Souza, 2001; Haldemann, 2005).

The combination group improved slightly more than the other groups (Figure 4.5). It can be assumed that the combined intervention had a greater influence on the range of motion of the hip as both the aforementioned effects of dry needling and manipulation had an impact (Korr, 1976; Bernard and Kirkaldy-Willis, 1987; Gatterman, 1990; Souza, 2001; Chaitow and Delany, 2002; Haldemann, 2005). In keeping with the theories of Cibulka *et al.,* (1997), when the sacroiliac joint dysfunction is restored, the relative hip joint instability is exposed, therefore, generating an increased range of motion at the hip joint. This in turn would lead to an increased positive reading on the inclinometer.

5.5.2.1.6 Presence of Sacroiliac Joint Fixations Post Treatment

All participants receiving manipulative therapy, whether they were in the manipulation group only or the combination group, showed an improvement in sacroiliac joint range of motion and resolution of joint fixation (Gatterman, 1990; Souza, 2001; Peterson and Bergman,2002; Haldemann, 2005).

5.6 Summary

Overall, there is no statistical significance between the three treatment groups. However, on close evaluation, there appeared to be subtle differences that may have been more significant had the study been conducted over a longer period of time and involving a larger sample group.

Of those subtle changes, there seemed to be a consistent reduction in subjective pain in all three groups. With regard to algometer readings of MFTP tenderness in the TFL and ITB, the groups receiving dry needling and manipulation faired the best and paralleled to one another with respect to improvements in algometer readings and thus an increase in pain threshold. The combination group showed the least improvement in this case which may possibly be due to the two intervention treatments conflicting with one another causing the participant more post treatment soreness.

Algometer readings of Nobles Compression test showed that the dry needling group improved the most. This was attributed to the fact that MFTP's found, and needled, were predominantly in the distal third of the ITB therefore, needling was performed close to the point of impingement and insertion and thus had more of a local and immediate effect (Travell and Simons, 1983; Chaitow and Delany, 2002). Another consideration is that manipulation has a more indirect effect on the ITB, through the proximal hip muscles, which is possibly delayed (Bernard and Kirkaldy-Willis, 1987; Souza, 2001).The combination group faired only slightly better over the manipulation group. This may have resulted as even though a stretch reflex in the TFL and gluteus maximus muscles had occurred during the rapid stretching from the thrust which may have caused tightening and aggravation of the ITB at its distal end, it may have been compensated slightly by the local effect of the dry needling (Korr, 1976; Travell and Simons, 1983; Gatteman, 1990; Souza, 2000; Chaitow and Delany, 2002). The manipulation group displayed the least improvement perhaps being attributed to relative hip joint instability. As hip joint instability and sacroiliac joint dysfunction coexist (Cibulka *et al.,* 1997; Vleeming *et al.,* 1990; Bisset ,2003), by restoring sacroiliac joint mobility through manipulation, a relative hip joint instability was exposed. As a result, stabilization for the hip joint was supplied by the hip musculature and this increased the tension in the ITB which manifested as pain at the site of impingement.

In the final assessment of hip range of motion using the digital inclinometer, the needling and manipulation groups paralleled one another again in their degree of improvement. However, this time the combination group faired best. This may possibly be due to the compound effect of the treatments which had a greater influence on range of motion, where the manipulation restored normal sacroiliac joint range of motion and muscle hypotony through neural feedback mechanisms and where needling broke down adhesions within the muscle and restored normal range of motion and flexibility within the muscle. In addition to this it is thought that when the sacroiliac joint dysfunction is restored, the relative hip joint instability is exposed and would result in an increased range of motion at the hip joint. This in turn led to an increased positive reading on the inclinometer.

It was noted that, on final assessment, those participants that received manipulation in the study no longer had fixated sacroiliac joints.

5.7 Outcomes in terms of Objectives

The first objective was to determine the effect of dry needling in the treatment of ITBFS. The overall results showed that there was an improvement in all the participants that received dry needling with regard to their subjective and objective measurements although not statistically significantly different to other intervention groups.

The second objective was to determine the effect of sacroiliac joint manipulation in the treatment of ITBFS. The overall results showed that there was an improvement in all the participants that received manipulation with regard to their subjective and objective measurements although not statistically significant ly different to other intervention groups.

The third objective was to determine the effect of a combination treatment i.e.: dry needling and sacroiliac joint manipulation, in the treatment of ITBFS. The overall results showed that there was an improvement in all the participants that received the combination therapy with regard to their subjective and objective measurements although not statistically significanty different to other intervention groups.

The fourth and final objective was to compare the difference in relative effectiveness between the three different intervention groups in the treatment of ITBFS. The results showed that there was no statistical significant difference between the groups with regard to their subjective and objective measurements and they all seemed to improve equally. However, on closer inspection, there seemed to be subtle differences between the groups which may possibly be magnified in future by having larger sample groups.

5.8 Conclusion

There were no statistically significant differences between the three treatment groups as they all seemed to parallel one another with regards to overall improvement in subjective and objective measurements. However, on closer examination subtle differences between the groups were noted.

An interesting endpoint that seems to be consistent with the data is that the combination group did not fair the best throughout the study, which was contrary to the original hypothesis. The two groups receiving only the single intervention appeared to fair marginally better over the combination group. This could direct treatment in the future to assess the condition accurately and decide which intervention is best suited to that particular individual at that point in time. A secondary endpoint that became evident during the study and on analysis of the data, was that hip joint instability must also be considered when treating ITBFS when there is concomitant sacroiliac joint dysfunction.

Chapter 6

Conclusion and Recommendations

6.1 Introduction

This chapter discusses the outcomes of the study and outlines any pitfalls and limitations experienced. Following the discussion are recommendations that could guide future research conducted on this particular condition.

6.2 Conclusions

The aim of this study was to determine whether there would be variations in improvement between three treatment interventions in the treatment of ITBFS. The three interventions tested were dry needling of the TFL and ITB, sacroiliac joint manipulation and a combination of the two.

There were no statistically significant differences between the three groups. The improvements within each group appeared to parallel one another, with only subtle differences noted in objective findings between the groups.

6.3 Limitations

1. It would be of importance to ensure that a complete rest period and lay off from activity is adhered to by the participant. Some participants continued to train during the treatment period which may have influenced their final readings.

2. That all responses in terms of subjective findings were true and the participants did not over or underestimate changes in the condition to please the researcher.

3. It is recognized that the sample group of 47 participants is perhaps too small to draw statistically significant conclusions. This may have impacted on the ability of the study to show significant differences between the treatment groups.

6.4 Recommendations

1. It would be advisable to increase homogeneity of the participants in terms of all conforming to one sport. Perhaps consider participants that run only as this was the predominant causative factor.

2. Future research should consider assessment of all trigger points in all muscles implicated in the condition. By doing this, the researcher would be able to determine the major muscle groups that are compromised in, and contribute to, the development of ITBFS.

3. It would be advisable to conduct a blinded assessment of the participants pre and post treatment period, which would improve the validity of the trial as there would be little margin for possible bias influence of measurements.

4. It would be interesting to see the outcome of this trial in a crossover study design. A possible consideration would be to treat one group with dry needling only in the first week and then sacroiliac joint manipulation only in the second week. Likewise with the second group, treat participants with manipulation only in the first week then dry needling only in the second week. This would demonstrate the efficacy of utilizing both interventions, in the treatment of ITBFS, at different time intervals and not simultaneously.

5. The final assessment and measurements can be recorded at a later period, perhaps one week after the last treatment. This will rule out any possibilities of the readings being as a result of the final treatment alone versus the entire treatment period.

6. The possible inclusion of rehabilitation and strengthening of the hip musculature in terms of the treatment for the relative hip joint instability should be considered in future studies.

7. Perhaps future research could address the use of an inflammation reducing intervention that could be appropriately utilized in conjunction with sacroiliac joint manipulation. This would allow the manipulation to take effect at the origin of the ITB i.e.: the hip musculature, and the inflammation reducing intervention to take effect at the site of impingement along the lateral knee line.

8. Maintain an equal group ratio. The researcher incorporated additional participants into the study as insurance against possible drop outs occurring. Perhaps those participants results should have been excluded from the study, however it was decided to include them as an increase in participants may have increased the validity of the trial. Those additional participants were allocated into their group using the same method as those before them. They both happened to choose group two.

9. Future research should consider a gender specific trial as differences in biomechanical make up, particularly the Q angle in females, may influence the data.

10. Another consideration that may benefit future studies is to complete a power analysis prior to commencing treatment to determine how many participants are required in each group in order to generate a significant P value.

References

Baer, J. M. 1999. Iliotibial Band Friction Syndrome in Cyclists: Evaluation and Treatment: A case report. Sports Chiropractic and Rehabilitation, 25:65-66

Baker, G. J. 1995. Iliotibial Band and Tibialis Posterioir Syndrome Resulting from a Fixated Talus: A Case Report. Chiropractic Sports Medicine, 9(4):119-121

Baldry, P. E. 1989. Acupuncture, Trigger Points and Musculoskeletal Pain. U.K. Churchill Livingstone.

Bernard, T. N. Kirkaldy-Willis, W. H. 1987. Recognising Specific Characteristics of Non-specific Low Back Pain. Clinical Orthopaedics. 217: 266-280

Bisset, G. J. 2003. The Effect of Sacroiliac Joint Manipulation on Hip Rotation Ranges of Motion in Patients Suffering with Chronic Sacroiliac Syndrome. Masters degree in technology: chiropractic. Dissertation. D.U.T, Berea, Durban, South Africa.

Chaitow, L. and Delany, J. W. 2002. Clinical Application of Neuromuscular Techniques. Vol. 2: The Lower Body. Churchill Livingston. pp 329-330; 358

Cibulka, M. T., Sinacore, D. R., Cromer, G. S., Delitto, A. 1997. Unilateral Hip Rotation Range of Motion Assymetry in Patients with Sacroiliac Joint Regional Pain. Spine, 23(9): 1009-1015.

Cottrell, R. R. and McKenzie, J. F. 2005. Health Promotion and Education Research Methods: Using the 5-Chapter Thesis/Dissertation Model. Jones and Bartlett. Pp 121-123

Ellis, R., Hing. W. and Reid, D. 2007. Iliotibial Band Friction Syndrome-A systematic Review. Manual Therapy, 12(3):200-208

Fairclough, J., Hayashi, K., Toumi, H., Lyons,K., Bydder, G., Phillips, N., Best, T. M., Benjamin, M. (2007). Is iliotibial band syndrome really a friction syndrome? Journal of Science and Medicine in Sport: 10: 74—76

Farrell, K. C., Reisinger, K. D. and Tillman, M. D. 2002. Force and Repetition in Cycling: Possible Implications for Iliotibial Band Friction Syndrome. The Knee, 10(1):103-109

Firer, P. 1989. Etiology and Results of Treatments of Iliotibial Band Friction Syndrome. American Journal of Sports Medicine, 17:704

Fischer, A. 1986. Pressure Threshold Meter: Its Use For Quantification of Tender Spots. Archives for Physical Medicine and Rehabilitation. 67:836-838.

Fredericson, M., White, J. J., Macmahon, J. M. and Andriacchi, T. P. 2000. Quantitative analysis of the Relative Effectiveness of 3 Iliotibial Band Stretches. Archive Division of Physical Medicine and Rehabilitation. Stanford Univ. USA. May; 83(5): 589-92

Gatterman, M. I., 1990. Chiropractic Management of Spine Related Disorders. USA. Williams and Wilkins. Pp 49; 111-128; 404

Haldemann, S. 2005. Principles and Practice of Chiropractic. 3rd ed. Mcgraw-Hill.

Hall, T. 1997. A study of the effectiveness of myofascial trigger point therapy on iliotibial band friction syndrome in sports persons. Masters degree in technology: chiropractic. Dissertation. D.U.T, Berea, Durban, South Africa.

Han, S. C. and Harrison, P. 1997. Myofascial Pain Syndrome and Trigger Point Management. Regional Anesthesia; 22(1): 89-101

Holmes JC, Pruitt AL, Whalen NJ. 1993. Iliotibial band syndrome in cyclists. American Journal of Sports Medicine; 21:419 –424.

Homewood, A. E.1962. The neurodynamics of the vertebral subluxation. Canadian memorial Chiropractic College.

Hoskins, W., McHardy, A., Grad, H. P., Windsham, R. and Onley, R. 2006. Chiropractic Treatment of Lower Extremity Conditions: A Literature Review. Journal of Manipulative and Physiological Therapeutics, 29:658-671

Jenson, M. P., Karoly, P. and Braver, S. 1986. The Measurement of Clinical Pain Intensity: A Comparison of Six Methods. Pain, 27:117-126

Johnson, C. 2005. On the Subject of Human Subjects. Journal of Manipulative and Physiological Therapeutics, 28: 79-80.

Kasunich, N. J. 2003. Changes in low back pain in a long distance runner after stretching the iliotibial band. Journal Chiropractic Medicine; 2:37–40

Kirkaldy-Willis, W. H. and Burton, C. V. 1992. The Site and Nature of Lesion. Managing Low Back Pain. 3rd ed. Churchill Livingston.

Kirk LK, Kuklo T, Klemme W. 2000. Iliotibial band friction syndrome. Orthopedics;23(11):1209 –1214.

Korr, I. M. 1976. The Spinal Cord as Organiser of Disease Processes. Some Preliminary Perspectives. Journal of American Osteopathic Association. 76:89-99.

Lee, D. 2004. The Pelvic Girdle. An Approach to the Examination and Treatment of the Lumbopelvic-hip Region. 3rd ed. Churchill Livingston.

Liggins, C. A. 1982. The Measurement of Pain – A Brief Review. Physiotherapy. 38(2): 34-37.

Lindenburg, G., Pinshaw, R. and Noakes, T. D. 1985. Iliotibial band friction syndrome in runners. Physician and sports medicine. Pp 118-130.

Magee, D. J. 1992. Orthopaedic Physical Assessment. 2nd ed. U.S.A. W.B. Saunders.

McMaster, W. C. 1982. Cryotherapy. Physician and Sports Medicine, 10:112

Melzack, R. 1981. Myofascial Trigger Points: Relation to Acupunctyre and Mechanisms of Pain. Archives of Physical and Rehabilitative Medicine, 62:114-117

Mennel, J. 1960. Back Pain: Diagnosis and Treatment Using Manipulative Technique. Boston: Little, Brown and Company. Pp 226

Messier SP, Edwards DG, Martin DF, Lowery RB, Cannon DW, James MK, Curl WW, Read HM, Hunter DM. 1995. Etiology of iliotibial band friction syndrome in distance runners. Medical Science Sports Exercise; 27(7):951 –960.

Moore, K. L. and Dalley, A. F. 1999. Clinically orientated anatomy. 4th ed. Lippincott Williams and Wilkins. Pp 524: 531

Mouton, J. 1996. Understanding Social Research. 3rd Ed. Pretoria. Van Skaik Publishers.

Nemeth, W. C and Sanders, B. L. 1996. The lateral synovial recess of the knee: Anatomy and role in chronic iliotibial band friction syndrome. Arthroscopy: The Journal of Arthroscopic & Related Surgery; 12 (Issue 5): 574-580

Nicholas, J. A. and Hershman, E. B. 1995. The Lower Extremity and Spine. 2nd ed. Mosby Company. Pp 926-930; 1487; 1534

Nishimura, G., Yamato, M., Tamai, K., Takahasshi, J., Uetani, M. 1997. MR Findings in Iliotibial Band Syndrome. Skeletal Radiology, 26(9): 533-537

Noakes, T. D. 1992. Lore of Running. 3rd ed. Cape Town. Oxford University Press. Pp 448-452.

Noakes, T. and Granger, S. 2003. Running injuries. 3rd ed. C.T. Oxford University Press. Pp 120-127.

Noble, C. A., Hajek, M. R. and Porter, M. 1980. Iliotibial band friction syndrome in runners. American journal of sports medicine. 8: 232-234

Norris, C. M. 1998. Sports Injuries-Diagnosis and Management for Physiotherapists. 2nd ed. Butterworth-Heinemann. Pp 175-176

Orava, S. 1978. Iliotibial Tract Friction Syndrome in Athletes. An Uncommon Exertion Syndrome on the Lateral Side of the Knee. The British Journal of Sports Medicine, 12:69-73

Orchard, J. W., Fricker, P. A., Abud, A. T., Mason, B. R. 1996. Biomechanics of iliotibial band friction syndrome in runners. American Journal of Sports Medicine ;24:375-9

Peterson, D. H. and Bergman, T. F. 2002. Chiropractic Technique: Principles and Procedures. 2nd ed. Mosby, Inc. Pp319-327

Poul, J., West, J., Buchanan, N. and Grahame, R. 1993. Local Action of Transcutaneous Flubiprofen in the Treatment of Soft Tissue Rheumatism. British Journal of Rheumatology; 32:1000-1003

Reese, N. B. and Bandy, W. B. 2003. Use of an Inclinometer to Measure Flexibility of the Iliotibial Band Using the Ober Test and Modified Ober Test: Differences in Magnitude and Reliability of Measurements. Journal of Orthopaedic and Sports Physical Therapy, 33(6):326-330

Reid, D. C. 1992. Sports injury assessment and rehabilitation. U.K. Churchill Livingston. pp. 424-429.

Renne, J. W. 1975. The Iliotibial Band Friction Syndrome. Journal of Bone and Joint Surgery, 57A:1110-1111

Saunders, B. 1998. Sports Physical Therapy. Connecticut, USA: Appleton and Lange. Pp 582

Schafer, R. C. and Faye, I. J. 1990. The Pelvis: Motion Palpation and Chiropractic Technique. 2nd ed. Motion Palpation Institute. Pp 241-292

Souza, T. A. 2001. Differential Diagnosis and Management for the Chiropractor. 2nd ed. Aspen Publishers, Inc. pp 331-332

Sutker, A. N., Barber, F. A., Jackson, D. W. and Pagliano, J. W. 1985. Iliotibial Band Syndrome in Distance Runners. Sports Medicine (2):447-451

Travell, J. W. and Simons, D. J. 1983. Myofascial Pain and Dysfunction: The Trigger Point Manual. Vol 2. U.S.A. Williams and Wilkins. pp. 217-235.

Vernon, H. and Schneider, M. 2009. Chiropractic Management of Myofascial Trigger Points and Myofascial Pain Syndrome: A Systematic Review of the Literature. Journal of Manipulative and Physiological Therapeutics,32:14-24

Vizniak, N. A. 2007. Physical Assessment. 2nd ed. Vol. 1. Professional Health Systems Inc. pp 13

Vleeming, A., Volkers, A. C. W., Snijders, C. J., Stoeckart, R. 1990. Relation between Form and Function and the Sacroiliac Joint. 2: Biomechanical Aspects. Spine, 15(2):133

Wood, D. H. 1997. The effectiveness of chiropractic sacroiliac joint adjustment in the management of acute iliotibial band friction syndrome in long distance runners. Masters degree in technology: chiropractic. Dissertation. D.U.T, Berea, Durban, South Africa.

Wyke, B. 1975. Articular Neurology: The Present Position. Journal of Bone and Joint Surgery, 57B: 401

Appendix A

DURBAN UNIVERSITY of TECHNOLOGY

Faculty of Health Sciences

ETHICS CLEARANCE CERTIFICATE

Student Name	Grant Turnbull	**Student No**	20412427
Ethics Reference Number	037/09	**Date of FRC Approval**	24/08/2009
Qualification	Mtech: Chiropractic		
Research Title:	The effectiveness of three treatment protocols in the treatment of iliotibial band friction syndrome.		

In terms of the ethical considerations for the conduct of research in the Faculty of Health Sciences, Durban University of Technology, this proposal meets with Institutional requirements and confirms the following ethical obligations:

1. The researcher has read and understood the research ethics policy and procedures as endorsed by the Durban University of Technology, has sufficiently answered all questions pertaining to ethics in the DUT 186 and agrees to comply with them.
2. The researcher will report any serious adverse events pertaining to the research to the Faculty of Health Sciences Research Ethics Committee.
3. The researcher will submit any major additions or changes to the research proposal after approval has been granted to the Faculty of Health Sciences Research Committee for consideration.
4. The researcher, with the supervisor and co-researchers will take full responsibility in ensuring that the protocol is adhered to.
5. ***The following section must be completed if the research involves human participants:***

	YES	NO	N/A
❖ Provision has been made to obtain informed consent of the participants	X		
❖ Potential psychological and physical risks have been considered and minimised	X		
❖ Provision has been made to avoid undue intrusion with regard to participants and community	X		
❖ Rights of participants will be safe-guarded in relation to: - Measures for the protection of anonymity and the maintenance of Confidentiality.	X		
- Access to research information and findings.	X		
- Termination of involvement without compromise	X		
- Misleading promises regarding benefits of the research	X		

[redacted]
SIGNATURE OF STUDENT/RESEARCHER — 24.08 09 DATE

[redacted]
SIGNATURE OF SUPERVISOR/S — 24/8/9 DATE

[redacted]
SIGNATURE OF HEAD OF DEPARTMENT — 25/8/09 DATE

[redacted]
SIGNATURE: CHAIRPERSON OF RESEARCH ETHICS COMMITTEE — 25/8/09 D

Appendix B

Do You Suffer From

ITB

(Pain on the Outside aspect of Knee)

and

are between the ages of **18-45**

Research is currently being carried out at the

Durban University of Technology

Chiropractic Day Clinic.

FREE TREATMENT

is available to those who qualify to take part in this study.

For further information contact

Grant on:

031 3732205 / 2512

or 082 326 5321

Appendix C

Letter of Information and Consent

Title of the Research Study:
The effectiveness of three treatment protocols in the management of iliotibial band friction syndrome

Principle Investigator/s:
Grant Turnbull Contact number 082 326 5321

Co-Investigator/s:
Dr. Brian Kruger Contact number 031 564 9091
[MTech-Chiropractic]

Brief Introduction and Purpose of the Study:
You have been selected to take part in a study investigating the effects of dry needling and sacroiliac joint manipulation in the treatment and management of iliotibial band friction syndrome. The treatment protocol that you receive aims to reduce your symptomatic pain that you are experiencing from the condition and aid you in your return to pain free activity.

Outline of the Procedures:
All participants, including you, will be randomly split into three equal groups. Each of the groups will receive a standard clinical treatment including dry needling, sacroiliac joint manipulation or a combination of the two, depending on which group you are allocated into. If you fall into a group receiving dry needling all needles utilized will be sterile and will be used for one application only and then disposed of accordingly. The area will be cleaned with alcohol prior to insertion of the needle.

Risks or Discomforts to the Subject:
The treatment is safe and is unlikely to cause any adverse side effects, other than transient tenderness and stiffness that is common in spinal manipulative therapy. Patients may experience post-needling soreness, however this will be transient and the patients are not expected to have prolonged pain / soreness.

Benefits:
The treatment aims to decrease the subjects symptomatic pain experienced due to the condition and aid them in returning to normal daily activities. The researcher will gain insight to what extent the treatment methods have had an effect on this condition.

Reason/s why the Subject May Be Withdrawn from the Study:
If subject does not meet inclusion criteria or infringes on the exclusion criteria. The subject may withdraw from the study at anytime without reason.

Remuneration:
Treatment for the duration of the research process will be free of charge. Subjects taking part in the study will not be offered any other form of remuneration for taking part.

Costs of the Study:
Participants receiving treatment for the duration of the study will not be charged but if the participant wants further treatment upon completion of the study, normal consultation rates will apply.

Confidentiality:
All patient information will be kept confidential and will be stored in the Chiropractic Day Clinic for 5yrs, after which it will be shredded.
All the results of the study will be made available in the Durban University of Technology library in the form of a mini-dissertation, but no personal information will be included.

Persons to Contact In the Event of Any Problems or Queries:
Should you wish you can contact my research supervisor at the above details or alternatively you could contact the Faculty of Health Sciences Research and Ethics Committee as per Mr. Vikesh Singh (031) 3732701.

Statement of Agreement to Participate In the Research Study:
(I,…………………………………………………subject's full name, ID number……………………………………………………, have read this document in its entirety and understand its contents. Where I have had any questions or queries, these have been explained to me by ……………………………………………………to my satisfaction. Furthermore, I fully understand that I may withdraw from this study at any stage without any adverse consequences and my future health care will not be compromised. I, therefore, voluntarily agree to participate in this study.

Subject's name (print) ………………………………Subject's signature:……………………………… Date:………………

Researcher's name (print): ………………………… Researcher's signature:…………………………Date:......................

Witness name (print) signature: …………………Witness signature: ……………….......................Date:………………

Supervisor's name (print):…………………………Supervisor's signature: ………………………..Date:…………………

Appendix D

DURBAN UNIVERSITY OF TECHNOLOGY
CHIROPRACTIC DAY CLINIC
CASE HISTORY

Patient: ______________________________ Date: __________

File # : __________ Age: __________

Sex : __________ Occupation: ______________________________

Intern : ______________________________ Signature ______________________________

FOR CLINICIANS USE ONLY:

Initial visit

Clinician: Signature :

Case History:

Examination:
Previous: Current:

X-Ray Studies:
Previous: Current:

Clinical Path. lab:
Previous: Current:

CASE STATUS:

PTT: Signature: Date:

CONDITIONAL:
Reason for Conditional:

Signature: Date:

Conditions met in Visit No: Signed into PTT: Date:

Case Summary signed off: Date:

Intern's Case History:

1. **Source of History:**

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

3. **Present Illness:**

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

4. **Other Complaints:**

5. **Past Medical History:**

< General Health Status

< Childhood Illnesses

< Adult Illnesses

< Psychiatric Illnesses

< Accidents/Injuries

< Surgery

< Hospitalizations

6. Current health status and life-style:

< Allergies

< Immunizations

< Screening Tests incl. x-rays

< Environmental Hazards (Home, School, Work)

< Exercise and Leisure

< Sleep Patterns

< Diet

< Current Medication
Analgesics/week:

< Tobacco

< Alcohol

< Social Drugs

7. Immediate Family Medical History:

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

8. Psychosocial history:

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

9. Review of Systems:

< General

< Skin

< Head

< Eyes

< Ears

< Nose/Sinuses

< Mouth/Throat

< Neck

< Breasts

< Respiratory

< Cardiac

< Gastro-intestinal

< Urinary

< Genital

< Vascular

< Musculoskeletal

< Neurologic

< Haematologic

< Endocrine

< Psychiatric

Appendix E

Durban University of Technology

PHYSICAL EXAMINATION: SENIOR

Patient Name : ______________________ **File no :**__________ **Date :**________

Student : **Signature :**

VITALS:

Pulse rate:			Respiratory rate:	
Blood pressure:	R	L	Medication if hypertensive:	
Temperature:			Height:	

Weight:	Any recent change? Y / N		If Yes: How much gain/loss	Over what period

GENERAL EXAMINATION:

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

SYSTEM SPECIFIC EXAMINATION:

CARDIOVASCULAR EXAMINATION

RESPIRATORY EXAMINATION

ABDOMINAL EXAMINATION

NEUROLOGICAL EXAMINATION

COMMENTS

Clinician: **Signature :**

DURBAN UNIVERSITY OF TECHNOLOGY
CHIROPRACTIC DAY CLINIC
PHYSICAL EXAMINATION

Patient:______________________________ File#:__________ Date:________

Clinician:______________________________ Signature:______________________

Student:______________________________ Signature:______________________

1. VITALS

Pulse rate:
Respiratory rate:
Blood pressure: R L Medication if hypertensive:
Temperature:
Height:
Weight: Any change Y/N If Yes : how much gain/loss

Over what period

2. GENERAL EXAMINATION

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

Urinalysis:

3. CARDIOVASCULAR EXAMINATION

1) Is this patient in **Cardiac Failure** ?
2) Does this patient have signs of **Infective Endocarditis** ?
3) Does this patient have **Rheumatic Heart Disease ?**

Inspection
- Scars
- Chest deformity:
- Precordial bulge:
- Neck -JVP:

Palpation:
- Apex Beat (character + location):
- Right or left ventricular heave:
- Epigastric Pulsations:
- Palpable P2:
- Palpable A2:

Pulses: - General Impression:
- Radio-femoral delay:
- Carotid:
- Radial:
- Dorsalis pedis:
- Posterior tibial:
- Popliteal:
- Femoral:

Percussion: - borders of heart

Auscultation:- heart valves (mitral, aortic, tricuspid, pulmonary)
- Murmurs (timing,systolic/diastolic, site, radiation, grade).

4. RESPIRATORY EXAMINATION

1) Is this patient in **Respiratory Distress** ?

Inspection - Barrel chest:
- Pectus carinatum/cavinatum:
- Left precordial bulge:
- Symmetry of movement:
- Scars:

Palpation - Tracheal symmetry:
- Tracheal tug:
- Thyroid Gland:
- Symmetry of movement (ant + post)
- Tactile fremitus:

Percussion - Percussion note:
- Cardiac dullness:
- Liver dullness:

Auscultation - Normal breath sounds bilat.:
- Adventitious sounds (crackles, wheezes, crepitations)
- Pleural frictional rub:
- Vocal resonance - Whispering pectoriloquy:
  - Bronchophony:
  - Egophony:

5. ABDOMINAL EXAMINATION

1) Is this patient in **Liver Failure** ?

Inspection - Shape:
- Scars:
- Hernias:

Palpation - Superficial:
- Deep = Organomegally:
- Masses (intra- or extramural)
- Aorta:

Percussion - Rebound tenderness:
- Ascites:
- Masses:

Auscultation - Bowel sounds:
- Arteries (aortic, renal, iliac, femoral, hepatic)

Rectal Examination
- Perianal skin:
- Sphincter tone & S4 Dermatome:
- Obvious masses:
- Prostate:
- Appendix:

6. G.U.T EXAMINATION

External genitalia:
Hernias:
Masses:
Discharges:

7. NEUROLOGICAL EXAMINATION

Gait and Posture
- Abnormalities in gait:
- Walking on heels (L4-L5):
- Walking on toes (S1-S2):
- Rombergs test (Pronator Drift):

Higher Mental Function
- Information and Vocabulary:
- Calculating ability:
- Abstract Thinking:

G.C.S.:
- Eyes:
- Motor:
- Verbal:

Evidence of head trauma:

Evidence of Meningism:
- Neck mobility and Brudzinski's sign:
- Kernigs sign:

Cranial Nerves:

I Any loss of smell/taste:
Nose examination:

II External examination of eye:
- Visual Acuity:
- Visual fields by confrontation:
- Pupillary light reflexes = Direct:
  = Consensual:
- Fundoscopy findings:

III Ocular Muscles:
Eye opening strength:

IV Inferior and Medial movement of eye:

V
a. Sensory
- Ophthalmic:
- Maxillary:
- Mandibular:

b. Motor
- Masseter:
- Jaw lateral movement:

c. Reflexes
- Corneal reflex
- Jaw jerk

VI Lateral movement of eyes

VII a. Motor - Raise eyebrows:
- Frown:
- Close eyes against resistance:
- Show teeth:
- Blow out cheeks:

b. Taste - Anterior two-thirds of tongue:

VIII General Hearing:
Rinnes = L: R:
Webers lateralisation:
Vestibular function - Nystagmus:
- Rombergs:
- Wallenbergs:

Otoscope examination:

IX & X Gag reflex:
Uvula deviation:
Speech quality:

XI Shoulder lift:
S.C.M. strength:

XII Inspection of tongue (deviation):

Motor System:

a. Power
- Shoulder = Abduction & Adduction:
  = Flexion & Extension:
- Elbow = Flexion & Extension:
- Wrist = Flexion & Extension:
- Forearm = Supination & Pronation:
- Fingers = Extension (Interphalangeals & M.C.P's):
- Thumb = Opposition:
- Hip = Flexion & Extension:
  = Adduction & Abduction:
- Knee = Flexion & Extension:
- Foot = Dorsiflexion & Plantar flexion:
  = Inversion & Eversion:
  = Toe (Plantarflexion & Dorsiflexion):

b. Tone
- Shoulder:
- Elbow:
- Wrist:
- Lower limb - Int. & Ext. rotation:
- Knee clonus:
- ankle clonus:

c. Reflexes
- Biceps:
- Triceps:
- Supinator:
- Knee:
- Ankle:
- Abdominal:
- Plantar:

Sensory System:

a. Dermatomes
- Light touch:
- Crude touch:
- Pain:
- Temperature:
- Two point discrimination:

b. Joint position sense
- Finger:
- Toe:

c. Vibration:
- Big toe:
- Tibial tuberosity:
- ASIS:
- Interphalangeal Joint:
- Sternum:

Cerebellar function:

Obvious signs of cerebellar dysfunction:
= Intention Tremor:
= Nystagmus:
= Truncal Ataxia:
Finger-nose test (Dysmetria):
Rapid alternating movements (Dysdiadochokinesia):
Heel-shin test:
Heel-toe gait:
Reflexes:
Signs of Parkinsons:

8. SPINAL EXAMINATION:(See Regional examination)

Obvious Abnormalities:
Spinous Percussion:
R.O.M:
Other:

9. BREAST EXAMINATION:

Summon female chaperon.

Inspection
- Hands rested in lap:
- Hands pressed on hips:
- Arms above head:
- Leaning forward:

Palpation
- masses:
- tenderness:
- axillary tail:
- nipple:
- regional lymph nodes:

Appendix F

REGIONAL EXAMINATION - LUMBAR SPINE AND PELVIS

DURBAN UNIVERSITY of TECHNOLOGY

Patient:______________________________ File#:______ Date:_________

Intern\Resident:________________________ Clinician:________________

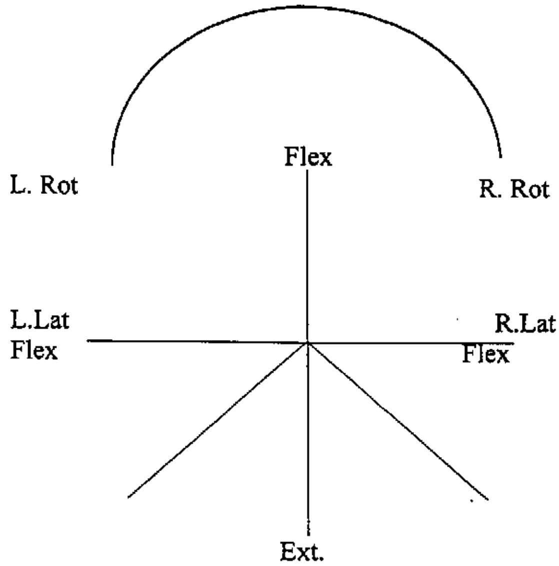
STANDING:

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

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

GAIT:

Normal walking
Toe walking
Heel Walking
Half squat



ROM:

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

Which movt. reproduces the pain or is the worst?

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

SUPINE:

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

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

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

SITTING:

Spinous Percussion
Valsalva
Lhermitte

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

Slump 7 test	L										
	R										

LATERAL RECUMBENT:

	L	R
Ober's		
Femoral n. stretch		
SI Compression		

PRONE:

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

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

NON ORGANIC SIGNS:

Pin point pain
Axial compression
Trunk rotation
Burn's Bench test

Flip Test
Hoover's test
Ankle dorsiflexion test
Repeat Pin point test

NEUROLOGICAL EXAMINATION

Fasciculations

Plantar reflex

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

MYOTOMES

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

BASIC THORACIC EXAM

History
Passive ROM
Orthopedic

BASIC HIP EXAM

History
ROM: Active
Passive : Medial rotation : A) Supine (neutral) If reduced - hard \ soft end feel
B) Supine (hip flexed): - Trochanteric bursa

MOTION PALPATION AND JOINT PLAY

	L	R
Upper Thoracics		
Lumbar Spine		
Sacroiliac Joint		

FEB 2007

Appendix G

HIP REGIONAL EXAMINATION

DURBAN INSTITUTE *of* TECHNOLOGY

Patient: ______________________ **File no:** __________ **Date:** __________

Intern / Resident: ______________________ **Signature:** ______________________

Clinician: ______________________ **Signature:** ______________________

Observation

- Gait: ______________________ • Posture: ______________________
- Weight-bearing symmetry: ______________________
- Balance and proprioception (Stork-standing test): ______________________
- Bony / soft tissue contours: Buttock contour ______________________
  Hip flexion contracture ______________________
  Lumbar lordosis ______________________
  Scoliosis ______________________
- Skin: ______________________ • Swelling: ______________________
- Leg length inequality: ______________________

Palpation

- Anterior aspect

			Right	Left
1.	Iliac crests			
2.	Greater trochanter			
3.	Pubic symphysis and tubercle			
4.	Femoral head			
5.	Femoral Δ	femoral artery		
		lymph nodes		
6.	ASIS's			
7.	Inguinal ligament			
8.	Inguinal hernia			
9.	Muscles - Quadriceps			
10.	Adductors			
11.	Abductors			
12.	Psoas			

- Posterior

			Right	Left
1.	Iliac crests posteriorly			
2.	Ischial tuberosity			
3.	Muscles	Piriformis		
		Gluteals		
		Hamstrings		
4.	PSIS's			
5.	Sciatic notch			
6.	SI joints			
7.	Lumbar Spine			
8.	Sacrum + coccyx			

Active Movements (note ROM and pain)

		Right	Left
1.	Flexion (110-120°)		
2.	Extension (10-15°)		
3.	Adduction (30°)		
4.	Abduction (30-50°)		
5.	Medial rotation (30-40°)		
6.	Lateral rotation (40-60°)		

Passive Movements (note end-feel, ROM and pain)

		Right	Left
1.	Flexion (tissue stretch or approximation)		
2.	Extension (tissue stretch)		
3.	Adduction (tissue stretch or approximation)		
4.	Abduction (tissue stretch)		
5.	Medial rotation (tissue stretch)		
6.	Lateral rotation (tissue stretch)		

Resisted Isometric Movements (note strength and pain)

		Right	Left
1.	Flexion		
2.	Extension		
3.	Adduction		
4.	Abduction		
5.	Medial rotation		
6.	Lateral rotation		
7.	Knee flexion		
8.	Knee extension		

Joint Play Movements

		Right	Left
1.	Caudal glide (long axis traction)		
2.	Compression		
3.	Lateral distraction		
4.	Quadrant (scouring) test		

Special Tests

			Right	Left
1.	Patrick's FABER Test			
2.	Trendelenberg Test			
3.	Craig's Test			
4.	Leg Length:	Actual		
		Apparent		
5.	Sign of the Buttock			
6.	Thomas Test (hip flexion contracture)			
7.	Rectus Femoris Contracture Test			
8.	Ely's Test (rectus femoris hypertonicity)			
9.	Ober's Test (ITB contracture)			
10.	Noble Compression Test (ITB Friction Syndrome)			
11.	Piriformis Test			
12.	Hamstrings	Hamstring Contracture Test		
		90°-90° SLR Test		
		Tripod Test		

Appendix H

DURBAN UNIVERSITY of TECHNOLOGY

DURBAN UNIVERSITY OF TECHNOLOGY
KNEE REGIONAL EXAMINATION

Patient:__________ File:__________ Date:__________
Intern:__________ Signature:__________
Clinician:__________ Signature:__________

- **OBSERVATION** (Standing, Seated and during gait cycle).

A. Anterior view
Genu Varum:__________
Genu Valgum:__________
Patellar position:__________
Tibial Torsion:__________
Skin:__________
Swelling:__________

B. Lateral view
Genu Recurvatum:__________
Patella Alta:__________
Patella Baja:__________
Skin:__________

C. Posterior view
Swelling:__________
Skin:__________

D. General
Movement symmetry:__________
Structures symmetry:__________

- **ACTIVE MOVEMENTS**

Flexion (0 - 135°)__________
Extension (0 - 15°)__________
Medial Rotation (20 - 30°)__________
Lateral rotation (30 - 40°)__________

- **PASSIVE MOVEMENTS**

Tissue approx__________
Bone-bone__________
Tissue stretch__________
Tissue stretch__________
Patellar movement__________

- **RESISTED ISOMETRIC MOVEMENTS**

Knee: Flexion:__________
Extension:__________
Internal rotation:__________
External rotation:__________

Ankle: Plantarflexion__________
Dorsiflexion__________

- **LIGAMENTOUS ASSESSMENT**

One-Plane Medial Instability
Valgus stress (abduction)
Extended__________
Resting Position__________

One-Plane Lateral Instability
Varus stress (adduction)
Extended__________
Resting Position__________

One-Plane Anterior Instability
Lachman Test (0-30°)__________
Anterior Drawer Sign __________

One-Plane Posterior Instability
Posterior "sag" Sign__________
Posterior Drawer Test__________

Anterolateral Rotatory Instability
Slocum Test__________
Macintosh Test__________

Anteromedial Rotatory Instability
Slocum Test__________

Posterolateral Rotatory Instability
Jacob __________
Hughston's Drawer Sign__________
Reverse pivot shift test__________

Posteromedial Rotatory Instability
Hughston's Drawer Sign__________

- **TESTS FOR MENISCUS INJURY**

McMurray________________ Anderson med-lat grind________________

"Bounce Home"________________ Apley's________________

- **PLICA TESTS**

Mediopatellar Plica ________________ Hughston's Plica________________

Plica "Stutter"________________

- **TESTS FOR SWELLING**

Brush/Stroke Test ________________ Patellar Tap Test________________

- **TESTS FOR PATELLA FEMORAL PAIN SYNDROME**

Clarke's Sign ________________ Passive patella tilt test________________

Waldron test________________

- **OTHER TESTS**

Wilson's________________ Quadriceps Contusion Test________________

Fairbank's________________ Leg Length Discrepancy________________

Noble Compression________________

- **JOINT PLAY**

Movement of the tibia on the femur P → A:__________ A → P:__________

Translation of the tibia on the femur M → L:__________ L M:__________

Long axis distraction of the tibiofemoral joint ________________

Inf, sup, lat, + med glide of the patella ________________

Movement of the inf. tibiofibular joint A → P:__________ P → A:__________

Movement of the sup. tibiofibular joint A → P:__________ P → A:__________

Movement of the sup. tibiofibular joint S → I :__________ I → S__________

- **PALPATION**

Tenderness________________ Swelling________________

Joint line________________ Nodules/exostoses________________

Ligaments________________ Muscles: thigh:________________

Patella:________________ Leg :________________

Patella tendon:________________ Popliteal artery:________________

Bursae:________________

- **REFLEXES AND CUTANEOUS DISTRIBUTION**

	R	L
Patellar Reflex (L3,L4)		
Medial Hamstring Reflex (L5,S1)		

- **DERMATOMES**

	R	L		R	L
L2			S1		
L3			S2		
L4			S3		
L5					

Appendix I

DURBAN UNIVERSITY OF TECHNOLOGY

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

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

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

A:

O:

P:

E:

Special attention to: **Next appointment:**

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

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

A:

O:

P:

E:

Special attention to: **Next appointment:**

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

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

A:

O:

P:

E:

Special attention to: **Next appointment:**

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

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

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

A:

0:

P:

E:

Special attention to: *Next appointment:*

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

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

A:

O:

P:

E:

Special attention to: *Next appointment:*

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

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

A:

O:

P:

E:

Special attention to: *Next appointment:*

Appendix J

Numerical Pain Rating Scale- 101 Questionnaire

PATIENT NAME: ______________________________

FILE NUMBER: __________ **DATE:** _______ **GROUP:** _________

Please indicate on the line below the number between 0 and 100 that best describes the pain of your major problem at this point, when it is at its **WORST**. A zero (0) would mean "no pain at all" and one hundred (100) would mean, "pain as bad as it could be."

Please write only one number.

0____**100**

Please indicate on the line below the number between 0 and 100 that best describes the pain of your major problem at this point, when it is at its **LEAST**. A zero (0) would mean "no pain at all" and one-hundred (100) would mean, "pain as bad as it could be."

Please write only one number.

0 ____**100**

Appendix K

Data Sheet

Key:

Modified Obers Test: **O**

Nobles Compression Test: **N**

Nobles Compression Test Point Tenderness: **Npt** (Algometer reading)

ITB Flexibility: **I** (Inclinometer reading)

Point Tenderness in TFL: **Tpt** (Algometer reading)

Point Tenderness in ITB: **Ipt** (Algometer reading)

Sacroiliac Joint Fixations: **S**

	Pre-Treatment	Post-Treatment
O =		
N =		
Npt =		
I =		
Tpt =		
Ipt =		
S =		