AN INVESTIGATION INTO THE ASSOCIATION BETWEEN THE ROLE OF MYOFASCIAL TRIGGER POINTS OF THE LOWER EXTREMITY AND THE CLINICAL DIAGNOSIS OF ILIOTIBIAL BAND FRICTION SYNDROME.

By

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Dissertation submitted in partial compliance with the requirements for the Master's Degree in Technology: Chiropractic at Durban Institute of Technology.

I, Michele Broadhurst, do declare that this dissertation is representative of my own work in both conception and execution.

23/01/04

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DEDICATION

This is dedicated to my parents who have supported me throughout my life and if not for their love and encouragement this would not have come to pass. Not only have you been parents to me, but you are also my source of strength and my best friends. For all of this and so much more I am eternally grateful.

ACKNOWLEDGMENTS

My thanks goes to the following:

Dr Charmaine Korporaal, my supervisor, friend and mentor. Without your knowledge, support and encouragement I would have been lost. Thank you for turning so much muddy water clear. You are a super star.

Pat and Linda, in reception, for your assistance and understanding.

Mrs Ireland, for your encouragement and efficiency in organising my research, and your prayers.

To the clinicians at DIT for your constant support, smiles and adding a light to my life when darkness loomed. Your knowledge and encouragement will not be forgotten.

All my patients who participated in the study. Without you, none of this would have been possible.

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ABSTRACT

The purpose of this study was to investigate the association between the role of Myofascial Trigger Points of the lower extremity to the clinical presentation of Iliotibialband Friction syndrome.

The aetiology of ITBFS is clear, structural joint abnormalities such as genu varum, lateral pelvic tilt, forefoot varus, leg length inequality, a sudden increase in mileage, running on uneven surfaces are the most common causes of ITBFS (Sanders 1990).

There is a shortening of the musculature on the side of overpronation and therefore there will also be compensation on the other side of the leg. Weak abductors, hamstrings, gluteus maximus and a tight TFL are stated as causes of ITBFS (Noakes 1992; Norris, 1998; Baker, 1995; Zuluaga, 1995; Fu and Stone, 1994). Garrick and Webb 1990 state that quadriceps insufficiency, which results in weakness and a decrease in muscle functioning, predisposes ITBFS. The most common treatments for ITBFS are directed at treating the joint and biomechanical abnormalities Some of these treatments are directed at a myofascial component, however little or no research is available to indicate a myofascial component to the syndrome.

Myofascial pain syndrome is a regional muscular disorder that results from myofascial trigger points within the muscle. The presence of these trigger points could result in lateral knee and or hip pain, pain during and after activity, weakness of the affected muscle and a possible change in gait which may present as Iliotibial Band Friction Syndrome.

Therefore this study was structured as a pilot non-intervention clinical assessment study, which included sixty participants from the greater Durban area. Each participant underwent a case history, relevant physical and knee and hip regional examination. Data was collected at the first consultation after which two free treatments were offered. The subjective measurement used was the Numerical Pain Rating Scale. The objective measurements used included the Myofascial Diagnostic Scale and algometer readings. The Iliotibial band Pain Severity Scale provided both subjective and objective readings. The duration of condition and the location of the myofascial trigger points were also noted.

Descriptive statistics were performed using frequency distribution tables, various graphs and charts such as the bar and pie charts and appropriate measures of central location and dispersion such as the arithmetic mean and standard deviation. Finally correlation statistics were run using Spearman's rank correlation coefficient with a significance level of <=0.05. Categorical and dichotomous variables where cross-tabulated using the eta functions.

The results show that there is indeed a muscular component involved in ITBFS. It has been shown that the muscles that are most affected in patients suffering with ITBFS are the iliopsoas, vastus lateralis and tensa fascia lata muscles. The gluteus maximus, medius and minimus muscles are occasionally affected and the biceps femoris and gastrocnemius muscles are rarely affected. There is a direct correlation between the pain experienced by the patients with active and latent myofascial trigger points in these muscles and the symptoms that patients suffering from ITBFS experienced.

This study and observations made by the author with respect to ITBFS are hoped to improve the management and treatment of ITBFS and contribute new information to the available literature regarding this syndrome.

CHAPTER ONE

INTRODUCTION

Iliotibial Band Friction Syndrome (ITBFS) is characterised as an overuse injury caused by friction between the underlying bursa and the lateral femoral epicondyle, the iliotibial band and the underlying periosteum, thus resulting in inflammation of the band (Renne, 1975; Orava,1978; Noble,1979; Noble et al 1982 and Lindenberg et al 1984).

ITBFS has been considered a predominantly running based injury (Noble, 1979; Noble,1980; Lindenberg et al,1984; Baker,1985), this is due to the fact that during long distance running results in repeated flexion and extension, which causes inflammation due to friction at the lateral femoral epicondyle (Noble, 1980). This condition is also found in cyclists (Noble 1985; Holmes et al, 1993), weightlifters (Orava 1978), skaters and cross country skiers (Orava, 1978; Noble, 1979 and Noble, 1985).

Iliotibial band friction syndrome refers to a syndrome comprising of the following signs and symptoms: (Norris 1998, Nicholas and Hershman 1995, Noble; 1980)

- Pain on the lateral side of the knee and / or hip
- Pain on running or walking downhill,

- Pain after running
- Pain on stair climbing,
- Tenderness over the lateral epicondyle,
- Positive Noble compression and Ober's tests,
- Swelling and possible crepitus
- Weak hip abductor muscles, quadriceps, gastrocnemius, hamstring, gluteus maximus and tensa fascia lata contractures are common. In addition to this, Norris (1998) observed a mild Trendelenberg gait during the stance phase of walking or running.

ITBFS presenting in the above manner, accounts for one third to one fifth of all knee injuries (Noakes and Granger, 1990), and in addition to this Noble (1979,1980) noted a prevalence of ITBFS between the ages of 20-50 years of age, with an average age of 31.

Approaches to diagnosing ITBFS, the mechanism of dysfunction and recognising the signs and symptoms are fairly routine and widely concurring among practitioners, however treatment protocols are less consistent (Baker 1995, Reid 1992, McBryde et al, 1985 and Noble, 1980). Treatment parameters are dependant on the causative and perpetuating factors of ITBFS (viz. training errors, running on uneven surfaces, inadequate shock absorption, tight ITB, genu varum, leg length inequality and lateral pelvic tilt (Sanders, 1990; Noakes 1992; Lindenberg et al 1984, Noble 1980)). In addition to the above, weak abductors, hamstrings, gluteus maximus and a tight tensa fascia lata are also stated among well-known causes of ITBFS (Noakes, 1992). This is in congruence with the findings of Norris (1998), Baker (1995), Zuluaga (1995) and Fu and Stone (1994). Garrick and Webb (1990) go further to state that quadriceps insufficiency also predisposes ITBFS.

Many treatment protocols are followed in order to treat ITBFS successfully:

According to Noakes et al (1992) the most common treatments for ITBFS are directed at treating the joint and biomechanical abnormalities.

These protocol includes RICES (rest, ice, compression, elevation, support and strapping), orthotics, anti-inflammatories, stretching, dry needling, electromodalities (ultrasound, TENS, interferential currents etc) and as a last resort, surgery.

Although some of these modalities are directed at a perceived myofascial component in the ITBFS, there is little or no research is available to suggest a myofascial component to the syndrome actually exists.

According to Travell, Simons and Simons (1999), myofascial pain syndrome is a regional muscular disorder that results from myofascial trigger points (Lee et al., 1997). According to Chaitow and Delany (2002), Fischer (1987) and Travell and Simons (1983), myofascial trigger points are defined as a hyperirritable spots in skeletal muscle that are associated with hypersensitive palpable nodules in a taut band(s). The spot(s) is/ are painful on compression and can give rise to characteristic referred pain, referred tenderness, motor dysfunction and autonomic phenomena. Sandman (1981), Travell and Simons (1983) and Bennett (1986) report that myofascial trigger points are amongst the most common causes of musculoskeletal pain seen in medical practices, yet they are poorly recognised and treated, and according to Gatterman (1990), may persist for decades if left untreated, yet with the correct treatment, the prognosis is excellent (Sandman 1981).

According to prevailing literature, (Chaitow and Delany, 2002; Travell and Simons; 1983), the presence of myofascial trigger points (MTrp's) in tensa fascia lata, vastus lateralis, gluteus maximus, gluteus medius and gluteus minimus, gastrocnemius, biceps femoris and iliopsoas muscles could result in a combination of the following signs and symptoms:

- Pain on the lateral aspect of the knee and / or hip,
- Increased pain on walking or running downhill, cycling or any physical activity,
- Pain after activity,
- Pain on stair climbing,
- Tenderness over the lateral aspect of the knee,
- Weakness of the affected muscle,
- Swelling of the affected muscle and

- Weak abductors or MFTP's in the abductors results in a mild Trendelenberg gait if severe enough.

Chaitow and Delany (2002) and Travell and Simons (1983) state that a tight tensa fascia latae (TFL) as seen when tensa fascia latae trigger points are present, could contribute to iliotibial band tightness. According to Baker (1995), Reid (1992), McBryde et al (1985) and Noble (1980), an increased tightness in the iliotibial band causes an increased incidence of ITBFS. These hypotheses suggest that there may be a myofascial component to ITBFS (Baker, 1995; Reid, 1992; McBryde et al, 1985 and Noble, 1980).

This along with what appears to be a clinical overlap between the two syndromes, in terms of clinical presentation and signs and symptoms (Table 1.1), further strengthens the hypothesis of a myofascial component to ITBFS.

Table 1.1

ITBFS	**MFPS**
Pain on the lateral side of the knee, and or hip.	Pain on the lateral aspect of the knee and or hip.
Pain on running or walking downhill, Pain after running or any activity.	Increased pain on walking or running downhill, cycling or any physical activity. Pain after activity.
Pain on stair climbing.	Pain on stair climbing.
Tenderness over the lateral epicondyle of femur.	Tenderness over the lateral aspect of the knee.
Swelling and possible crepitus.	Swelling of the affected muscle.
Weak hip abductor muscles, quadriceps, gastrocnemius, hamstring, gluteus maximus and tensa fascia lata contractures are common. In addition to this, Norris (1998) observed a mild Trendelenberg gait during the stance phase of walking or running.	Weakness of the affected muscle. Weak abductors or MFTP's in the abductors results in a mild Trendelenberg gait if severe enough.

Therefore according to referral patterns, clinical signs and symptoms as well as the development of the injury there seems to be a clinical overlap between the two syndromes.

Thus the purpose of this study is to determine the role myofascial trigger points (MFTP's) of the tensa fascia lata, vastus lateralis, gluteus maximus, gluteus medius and minimus, gastrocnemius, biceps femoris and iliopsoas muscles in the clinical presentation of ITBFS.

AIMS AND OBJECTIVES

Therefore the aim of the investigation is to evaluate the role of lower extremity MFTP's (viz of the tensa fascia lata, vastus lateralis, gluteus maximus, gluteus medius and minimus, gastrocnemius, biceps femoris and iliopsoas muscles) in the clinical presentation of ITBFS.

Sub problem 1:

To observe and quantify the following:

1. The specific location of the MFTP;s within the muscles.
2. The severity of the MFTP's.
3. The severity of the ITBFS.
4. The acuteness or chronicity of ITBFS.

Sub problem 2:

To assess correlations between the objective (the Myofascial Diagnostic Scale and the ITB severity scale) and subjective (Numerical rating scale and the ITB severity scale) clinical findings in terms of ITBFS and myofascial dysfunction syndrome.

BENEFITS OF THE STUDY:

This research aims to provide information regarding the role of myofascial trigger points of the tensa fascia lata, vastus lateralis, gluteus maximus, gluteus medius and minimus, gastrocnemius, biceps femoris and iliopsoas muscle groups as a possible etiology or perpetuating factor in the clinical presentation of iliotibial band friction syndrome.

A better understanding of the etiology of ITBFS will allow for further research considering and comparing alternate treatment protocol(s) for ITBFS.

With knowledge of specific conservative therapies, myofascial trigger points (MFTP's) could then be employed for the treatment of ITBFS and their benefits may alter some of the current treatment methods as well as alleviate the trauma, costs and complications of other treatment protocols and or possible surgical intervention.

CHAPTER 2

INTRODUCTION

This chapter provides a review of the available literature on Iliotibial band friction syndrome (ITBFS) and Myofascial Pain Syndrome and attempts to highlight the areas of overlap between the two syndromes. The information reviewed will provide a clearer understanding of the current concepts in the etiology, diagnosis and treatment of both conditions highlighting on the similarities and differences between the two.

2.1 AETIOLOGY OF ILIOTIBIAL BAND FRICTION SYNDROME

Renne (1975), Lindenberg et al (1984) and Reid (1992) state that friction is caused by repetitive flexion and extension of the knee, which in turn causes the thickest part of the band, which lies adjacent to the lateral femoral epicondyle to become inflamed. When the knee is extended, the fascia lies anterior to the lateral femoral epicondyle, but on flexion, the fascia moves posteriorly towards the femoral epicondyle. When the knee is bent more than 30 degrees, the fascia may contact the femoral epicondyle, which results in lateral knee pain. Pena (1991) states that in cycling, flexion and extension occurs approximately four thousand eight hundred times an hour, at an average cadence of eighty revolutions per minute, therefore increasing the prevalence and susceptibility of ITBFS.

During running, skiing and skating, external rotation of the hip occurs, which causes increased friction at the greater trochanter, resulting in hip pains (Reid 1992).

2.2.1 A TIGHT ILIOTIBIAL BAND

Genu varum and leg length discrepancies are stated as causes of a tight iliotibial band, which in turn predisposes ITBFS (Mcbryde et al 1985; Jones and James 1987; Reid 1992). Jones and James (1987) state too, that leg length inequality resulting in a lateral pelvic tilt causes subsequent stretching of the ITB which results in increased friction over the lateral femoral epicondyle, therefore causing and perpetuating ITBFS.

In this respect Lindenberg et al (1984) state that 56% of runners in a study conducted by them had a significant leg length inequality. However not all the sides of inequality concurred with the injured side. Further to this the authors did not state whether the athletes constantly ran in the same direction and camber was not discussed. The conclusion attained in spite of these factors was that leg length inequality does not contribute to ITBFS.

Noble (1980) states that a tight ITB may be due to structural or functional abnormalities. Noble (1980) states that excessive internal rotation of the tibia on the femur results in increased ITB tension. Excessive toeing in or hyperpronation of the foot on walking and running could also cause this tightening of the ITB (Noble 1980).

Genu varum is also a leading cause of ITBFS, due to the increased tension placed on the lateral femoral epicondyle due to the stretching of the ITB itself (Noble 1980).

Sutker et al (1981;1985) state that a cavus foot results in an increased varus stress on the knee therefore causing ITBFS. This could also help to explain the findings in Lindeberg's (1984) study where the side of leg length inequality did not always correspond to the side experiencing ITB.

2.2.2. CAMBERED SURFACES

According to Noble (1979), Lindenberg et al (1984), Noakes (1984;1992) and Reid (1992), runners usually develop ITBFS on the same side of the body as the side of the road upon which they run; e.g.: runners running on the left hand side of the road, usually develop ITBFS on the left hand side of the body. Lindenberg et al (1984) reports that 70% of the twenty-three runners in his study using the right side of the road developed right side injuries, and the only runner using the left side of the road developed ITBFS on the left. Therefore 71% of runners favoring a particular side, sustained injuries to that side's leg, that leg being the leg on the down sloping camber. Firer (1989) states that right sided ITBFS is dominant and particularly in South Africa as right hand drive occurs, therefore resulting in driving on the left, which forces the runners to run on the left as a safety precaution to run facing on coming traffic, therefore developing right sided ITBFS.

2.2.3 INADEQUATE SHOCK ABSORPTION

Jones and James(1987), Noakes and Granger (1990) all concur that inadequate shock absorption is a major cause of ITBFS. Baker (1995) states that change in shoes and excessive wear leads to inadequate shock absorption predisposes the runner to ITBFS. Sutker et al (1985), Noakes and Granger (1990) and Noakes (1992) all state that high arched cavus feet are unable to absorb adequate shock, thus transferring the shock to the ITB, therefore resulting in injury. However pes planus runners are equally at risk as they too are unable to absorb shock (Noakes 1990). Running on hard surfaces and with hard shoes also exacerbates the incidence of ITBFS (Noakes 1992).

A study conducted by Noakes (1992) concluded that decreased ankle pronation was present in 70% of runners presenting with ITBFS. He states that the decreased ankle pronation resulted in the inability of the lower limb to adequately absorb shock, thus leading to ITBFS. Lindenberg et al (1984) state that inadequate pronation may be worsened during treatment protocols that encourage the wearing of soft shoes, which do not control pronation adequately. Therefore Noble et al (1982) suggests prescribing lateral heel wedges in order to stabilize the ankle adequately in the case of patients presenting with a tight ITB or ITBFS.

Jones and James (1987) state that the tibia internally rotates with pronation of the foot. If internal rotation of the tibia increases, pronation of the ankle increases resulting in increased rotational stress being absorbed at the knee joint. On increased internal rotation of the tibia, the iliotibial band is pulled anteromedially resulting in increased ITB tightness across the lateral femoral epicondyle of the femur, causing excessive irritation to the ITB and the underlying bursa and periosteum (Jones and James 1987).

Lindenberg et al (1984) stated statistically, that 72% of the sample group had previous running injuries associated with excessive ankle pronation. Thus they concluded that excessive and inadequate ankle joint pronation contributes to ITBFS.

2.2.4 TRAINING ERRORS

- Sudden and dramatic increases in mileages and training. Noakes and Granger (1990) state that a sudden increase in mileage and a more intense training regime will predispose ITBFS. This predominantly occurs at peak performance levels or just prior to racing after intense training sessions. In South Africa ITBFS is commonly seen in April to June each year due to the increase in training prior to the Comrades Marathon. Noble (1979), Noble (1980), Jones and James (1987) and Reid (1992) all concur with Noakes (1992) on these causes.

- Sudden increases in distance and speed. (Noble 1979; Noble 1980; Jones and James 1987; Noakes 1992; Reid 1992).

- Inadequate warm up. (Noble 1979; Noble 1980; Jones and James 1987; Noakes 1992; Reid 1992).

- Alteration in terrain. Excessive hill training, especially long down hill running, cambered surface running, and running on hard surfaces predisposes ITBFS. Noble (1980) states that 22% of runners participating in his study developed symptoms of ITBFS due to excessive hill training. Holmes et al (1993) also saw a significant increase in ITBFS in cyclists who had increased their hill training.

- Incorrect cleat positioning. Holmes et al (1993) states that cyclists exhibiting a toe in cleat position, cause external tibial rotation greater than twenty degrees, which places significant stress on the distal iliotibial band as it crosses the lateral femoral condyle, therefore perpetuating ITBFS.

- Incorrect saddle height:. Saddle height determines the degrees of flexion and extension of the knee while pedaling. A saddle that is too high results in knee extension beyond 150 degrees, causing the ITB to cross the lateral femoral epicondyle resulting in friction. A saddle that is too far back causes a constant stretch on the ITB as the cyclist is constantly reaching for the pedals (Holmes et al 1993).

2.2.5 MUSCLE WEAKNESS

Muscle weakness has been shown to perpetuate and be a major causative factor in ITBFS. Weak abductors, hamstrings, gluteus maximus and a tight tensa fasciae lata muscle are stated as causes of ITBFS (Noakes 1992). Fu and Stone (1994), Baker (1995), Zuluaga (1995) and Norris (1998) all confirm this. Garrick and Webb (1990) state that quadriceps insufficiency predisposes ITBFS.

2.3 PREVALENCE AND INCIDENCE OF ILIOTIBIAL BAND FRICTION SYNDROME.

Noakes and Granger (1990) states that ITBFS accounts for between one third and one fifth of all knee injuries in runners. Noble (1980) states that either knee can be affected, but very rarely are both affected.

Lindenberg et al (1984) found that runners most susceptible to ITBFS had been running for four years or less, having run at least one marathon and training more than forty kilometers a week. Orava (1978), Noble(1979) and Sutker et al (1981) concurred with these findings. According to Noakes (1992) and Reid (1992), ITBFS occurs in any age group, however, Lindenberg et al (1984) found that the prevalence of ITBFS was between the ages of twenty and fourty years of age, with an average age of thirty-one. Noble (1980), Sutker et al (1981) and Sutker et al (1985) are all in agreement of this achieving age ranges of 20-40 respectively.

Sutker et al (1981) and Sutker et al (1985) reported that in their studies, that 75% of the patients were male. Lindenberg et al (1984) reported that of the 36 patients in their study, 30 were male and 6 female. This was due to the fact that running was a male dominated sport. No other significant reason was stated. Women are also thought to have a less distinct ITB, greater knee valgus, more ligament laxity and more subcutaneous fat than men, therefore reducing the prevalence of ITBFS. However, Noakes et al (1990) states that ITBFS is not gender specific.

Sutker et al (1985) state that ITBFS rarely occurs in endomorphs. This may be attributed to the fact that they are unable to run as far, or that there is increased fatty tissue around the knee, providing insulation and lubrication of the knee joint complex, therefore also lowering the incidence of ITBFS (Sutker et al; 1981 and 1985).

Noble (1980) cited slippery surfaces and cool climates as causing a higher incidence of ITBFS, therefore South African runners are at a higher risk than in many other countries, such as the certain areas in the USA and Australia.

Weiss (1985) noted only four cyclists out of one hundred and thirty two presented with ITBFS symptoms while on an eight-day cycle tour. Holmes et al (1984) states that the number of cyclists complaining of ITBFS has increased since the introduction of cleats in 1985.

2.4 PATHOLOGY OF ILIOTIBIAL BAND FRICTION SYNDROME

Southmoyd and Hoffaman (1981) defined Iliotibial band friction syndrome as lateral knee pain related to inflammation and irritation of the distal portion of the iliotibial band at a point distal to where it crosses the lateral femoral epicondyle.

Orava (1978) noted a brown bursal thickening under the ITB adjacent to the prominence of the lateral femoral epicondyle, whereas Renne (1975) noted 3ml of yellow viscous fluid that was aspirated from the bursa in a patient suffering from ITBFS. These findings concur with those of Martens et al (1989), who states that during surgical procedures, macroscopic inflammation of the tissue is found over and around the lateral femoral epicondyle. Histologically, the tissue revealed fibrous tissue with a synovial like structure showing areas of mucoid degeneration or fibrinoid necrosis (Noble 1979; Noble 1980; Martens et al 1989).

2.5 CLINICAL PRESENTATION OF ILIOTIBIALBAND FRICTION SYNDROME

Iliotibial band friction syndrome refers to a syndrome comprising of the following signs and symptoms (Renne (1975), Noble (1979), Lindenberg et al (1984); Jones and James (1987), Henderson (1989), Noakes (1992); Holmes et al (1993) and Baker (1995):

- Pain on the lateral side of the knee and / or hip,
- Pain on running or walking downhill,
- Pain after running,
- Pain on stair climbing,
- Tenderness over the lateral epicondyle,

- Positive Noble compression and Obers tests,
- Swelling and possible crepitus (Noble; 1980).
- Weak hip abductor muscles, quadriceps, gastrocnemius, hamstring, gluteus maximus and tensa fascia lata contractures are common. (Nicholas et al; 1995). In addition to this, Norris (1998) observed a mild Trendelenberg gait during the stance phase of walking or running.

2.5.1 SYMPTOMS OF ILIOTIBIAL BAND FRICTION SYNDROME

According to Renne (1975), Noble (1979), Lindenberg et al (1984); Jones and James (1987), Henderson (1989), Noakes (1992); Holmes et al (1993) and Baker (1995), patients experience a stabbing pain directly over the lateral femoral epicondyle, approximately 3 cm proximal to the joint, which is related to activity. Lindenberg et al (1984), Noakes and Granger (1990) and Noakes (1992) agree that the patient is able to play other sports that do not involve distance running e.g. rugby, squash, without experiencing discomfort. ITBFS is most often associated with sports requiring constant running (Orava 1975;Noble 1979;Noble 1980, Sutker et al 1985; Reid 1992) Other sports that require constant knee flexion and extension without weight bearing are also at risk such as cycling and skiing due to the repetition (Holmes et al (1993) and Baker (1995)).

Lindenberg et al (1984), Noakes and Granger (1990) and Noakes (1992) all state that once the patient becomes symptomatic, further running is prevented as repetitive trauma will cause continued inflammation of the ITB, therefore delaying the healing process. However, the pain subsides immediately on cessation of running, but should the patient attempt to commence running again, the pain will return immediately (Noakes 1992).

Noble (1980) and Reid (1992) state that if an athlete persists in pushing through the pain and continues running, the pain will continue and worsen. In mild cases of ITBFS, the pain may improve after the athlete has warmed up adequately (Noble 1980, Jones and James 1987). In moderate and severe cases even prolonged rest will not eliminate the pain (Noble 1980). While running, the pain becomes so severe that it limits running distance to between 100 meters to 16 kilometers (Sutker et al 1981, Sutker et al 1985; Noakes 1992).

Nicholas et al (1995) and Norris (1998) also include post running and exercise pain as symptomatic in all moderate and severe cases of ITBFS. Pain on descending stairs is common in severe cases of ITBFS (Lindenberg et al, 1984; Noakes and Granger, 1990; Noakes, 1992; Nicholas et al, 1995; Norris, 1998).

Nicholas et al (1995); Baker (1995) and Norris (1998) all include lateral hip pain, soft tissue swelling over the lateral femoral epicondyle and “wet leather” crepitus as potential symptoms in severe cases of ITBFS.

Pain associated with ITBFS radiates to the calf, to the lateral aspect of the thigh and to the knee (Orava, 1975; Noble, 1979; Noble, 1980, Sutker et al, 1985; Reid 1992).

Downhill running or excessive striding aggravates the symptoms (Noble 1979; Noble, 1980; Noakes and Granger 1990; Noakes, 1992).

Increased compression caused by lateral heel wear in running shoes increases the incidence of ITBFS(Noakes, 1992). Walking stiff legged may provide relief (Noble, 1979, Lindenberg et al, 1984; Jones and James, 1987, Henderson, 1989, Noakes, 1992), as the iliotibialband remains anterior to the epicondyle with the knees in extension (Renne, 1975, Henderson, 1989).

2.5.2 SIGNS OF ILIOTIBIAL BAND FRICTION SYNDROME

The most important clinical finding with respect to ITBFS is exquisite tenderness on palpation of the lateral femoral epicondyle and lower third of the iliotibial band (Noble, 1979; Sutker et al, 1981; Noble, 1985; Sutker et al, 1985; Noakes, 1992; Holmes et al, 1993).

Nicholas et al (1995); Baker (1995) and Norris (1998) state that soft tissue swelling over the lateral femoral epicondyle and "wet leather" crepitus are common in severe cases of ITBFS.

Diagnosis is confirmed clinically by Nobles compression test (Noble 1979; Noble, 1985). Noakes and Granger (1990) state that the test may be negative if the runner has not run for a few days as inflammation may have subsided due to rest, therefore it is imperative to do the clinical examination shortly after activity (Martens et al, 1989).

2.6 DIAGNOSIS

Diagnosis of ITBFS was dependant on the following criteria:

(Nicholas 1995; Reid, 1992; Sanders, 1990; Noble 1980 and 1979)

History

- A history of pain over the lateral aspect of the knee aggravated by running or cycling, particularly on cambered courses or on running downhill, discomfort relived by rest.

On examination/ signs and symptoms

- Tenderness is elicited over the lateral epicondyle just above the joint line.
- Repeated flexion and extension may reproduce the patient's symptoms, particularly at 30 degrees of flexion.
- A positive Ober's test for a tight iliotibialband.
- A positive Noble's compression test (Noble, 1979).
- Decreased range of motion of the knee, are all characteristic of ITBFS.
- Taut fibrous bands in the iliotibial tract.
- Intense focal tenderness of the ITB when pressure is applied.

2.6.1 Nobles compression test:

The patient lies supine with knees flexed to ninety degrees. Pressure is placed over the proximal part of the lateral femoral epicondyle. The knee is gradually actively extended. At thirty to forty degrees of flexion, as the band moves over the lateral femoral epicondyle directly under the examiner's finger, the pain felt on activity is reproduced (Noble, 1979; Noble, 1980 and Noakes, 1992). The pain is located over the lateral femoral epicondyle and the lower third of the iliotibial band (Holmes et al, 1993).

2.6.2 Ober's test

The patient is in a side lying position, with the injured side up. The patient flexes the lower leg at the hip and the knee to stabilize the body. The examiner then passively abducts and extends the upper leg with the knee straight or flexed to ninety degrees. The examiner then slowly lowers the lower limb and if contractures are present in the ITB, the leg remains abducted and will not fall to the bed. The hip is slightly extended, so that the ITB passes over the greater trochanter of the femur. Originally Ober's described the test with the knee flexed, which is adequately positive in neurologically involved patients. However in young active patients, the test is more effective when performed with the knees extended as it places more stretch on the ITB and more likely to reveal a subtle tightness in the band (Noble et al, 1982; Lindenberg et al, 1984; Magee,1997).

2.6.3 Other

Renne (1975) described a maneuver in which the patient stands on the affected leg with the knee flexed to thirty degrees, this brings the iliotibial band in tight contact with the lateral femoral epicondylar prominence, which induces pain. This may be accentuated by having the patient hop with the knee in the flexed position.

2.7 DIFFERENTIAL DIAGNOSIS OF ILIOTIBIAL BAND FRICTION SYNDROME

Southmoyd (1981), Jones and James (1987), Noakes (1992) and Holmes et al (1993) all describe iliotibial band friction syndrome as lateral knee pain related to inflammation and irritation of the distal portion of the iliotibial band at a point slightly distal to where it crosses the lateral femoral epicondyle. Therefore if the pain is more diffuse and near the joint line the following conditions must be considered (Noble, 1985 and Holmes et al, 1993):

2.7.1 Popliteal Tendonitis:

Noble (1980) defines popliteal tendonitis as pain localised to the lateral aspect of the knee on weight bearing, while flexing the knee to 30 degrees, where pain is localised over the popliteus tendon. Popliteal tendonitis is considered an overuse injury that presents as lateral knee pain, aggravated by running downhill, knee flexion with ninety degrees abduction and external rotation of the hip (Noble, 1985).Patients complain of lateral knee pain that is aggravated by running, hill running and descending stairs. The distinguishing feature that separates it from ITBFS is tenderness anterior to the fibular collateral ligament as well as continuation of symptoms on walking (Reider 1999) . Radio-densities on MRI around the popliteus tendon are also present.

2.7.2 Lateral Meniscal Tear:

This condition occurs due to the overloading of the lateral meniscus. This is particularly seen in rugby, soccer, hockey, squash and tennis. Pain is localised over the lateral knee, but radiates superiorly and inferiorly. Pain is worse on full flexion and extension (Noble, 1985). There is a higher incidence of lateral meniscal tears in the Eurasian population as they are more subject to congenital variations and more prone to degenerative cysts in the peripheral margins (Reider 1999). On internal rotation and when a valgus force is applied to a hyperflexed knee pain occurs which is localised to the lateral joint line as the knee is extended (Reider 1999).

Positive tests for meniscal tears include Andersons medial to lateral grind, lateral Mc Murray test and varus stress test (Reider 1999).

2.7.3 Biceps Femoris Tendonitis

Biceps femoris tendonitis is diagnosed by its location along the course of the tendon. The most common site is at the insertion of the tendon or more proximal when associated with crepitation of the sheath. A palpable biceps femoris tendon is indicative of this condition (Reider 1999). This is also considered an overuse injury and is common in running and cycling. The patients present with pain over the fibula head (Noble 1980; Noble, 1985). Tenderness near the fibula head distinguishes this condition from ITBFS (Reider 1999). Tenderness increases by flexion of the knee against resistance, and on internal rotation when a valgus force is applied to a hyperflexed knee (Reider 1999)

2.7.4 Bursitis of the knee

Bursitis is defined as inflammation of the bursa, secondary to trauma, athletic or occupational overuse. This may be due to infection, metabolic disorders, degenerative disease, arthritis or neoplasms (Reider 1999). Signs and symptoms include burning or aching pain at a certain point during activity and persists from one activity session to another. Local tenderness is experienced at the joint line, but lower than the ITBFS.There may be heat or redness over the bursa if trauma related (Reider 1999). There is bursal tissue deep to the lateral ligament, which results in lateral knee pain. Popliteal bursitis and tendonitis merge into one and are clinically indistinguishable. Treatment includes ice, cross friction, NSAIDS and steroids (Reider 1999). Renne (1975) and Noble (1980) describe the development of a bursitis that is related to the fibular collateral ligament.

2.7.5 Trochanteric bursitis

Trochanteris bursitis is characterised as a burning or deep aching sensation located over or posterior to the tip of the greater trochanter. Unlike ITBFS, trochanteric bursitis may be painful on walking early during its course. Pain increases on activity, with a dull ache in the hip, with sharp pain on hip flexion and extension (Reid 1992). Pain may refer down the lateral aspect of the thigh with pain on movement. Popping and crepitation is occasionally felt with flexion and extension of hip. Ober's test may be positive, as a tight ITB is associated with trochanteric bursitis (Reid 1992, Reider 1999).

2.7.6 Patella femoral pain syndrome:

Patients are usually young, active and complains of peri and retropatella pain precipitated by sitting for prolonged periods of time. Pain is proportional to activity and evident on squatting and descending stairs (Reid 1992). Positive tests for patella femoral pain syndrome include Clarke's sign, waldron's test, and passive patella tilt test. Treatment includes correction of training errors, modification of activity, alteration of biomechanics, muscle strengthening exercises, drug therapy and surgery (Reid 1992, Reider 1999).

2.7.7 Other

Other possible differential diagnosis include lateral retinacular injuries, lateral facet irritation, discoid meniscal cysts, lateral meniscus or capsular strains, avulsions, patello-femoral pain syndrome, popliteus inflammation, lateral ligament strains, degenerative joint disease, metabolic conditions (e.g. Gout, Rheumatoid arthritis or SLE) and pathological conditions of the iliotibial tract must all be considered (Orava,1975; Sutker et al, 1981; Sutker et al, 1985; Jones and James, 1987; Reid, 1992 and Holmes et al, 1993).

2.8 TREATMENT PROTOCOLS FOR ITBFS:

The treatment protocol for ITBFS is commonly used and widely accepted. Noakes et al (1992) states that the most common treatments for ITBFS are directed at treating the joint and biomechanical abnormalities. The treatment includes RICES (rest, ice, compression, elevation, stretch, support), orthotics, anti-inflammatories, stretching, dry needling and the use of electromodalities and as a last resort, surgery.

2.8.1 R.I.C.E.S:

REST:

Rest allows for a decrease in inflammation, resulting in the desensitisation of nerve endings, and a decrease in oedema and swelling. Noble (1980) and James and Jones (1987) state that as ITBFS is an overuse syndrome resulting in inflammation, therefore cessation of activity should subside symptoms immediately. Thus it is advised that patients take a rest period of four to six weeks (Noble, 1980).

ICE: Orava (1975), Noble et al (1982) and Baker (1995) all recommend the use of ice in the treatment of ITBFS. Ice reduces the inflammatory response and decreases the pain associated with myofascial trigger points (Noble 1980; Martens et al, 1989). Further to this McMaster (1982) states that ice also reduces adverse reactions to inflammation, e.g: ice decreases oedema, inflammation and causes an anaesthetizing effect on pain.

The local application of ice causes a decrease in muscle spasm (Knight, 1995), and also causes a decrease in peripheral nerve sensitivity (Prentice, 1986). Therefore ice causes a decrease in muscle spasm, and decreases inflammation of the ITB in the treatment of ITBFS.

COMPRESSION AND ELEVATION: This causes a decrease in initial trauma and inflammation, which results in a decrease in oedema. Compression and elevation results in an increase in lymphatic flow, which aids in the resolution of oedema as the osmolarity gradient between the capillaries and tissue is reduced (Reid 1992). Due to the lymphatic vessels having valves, range of motion induced during elevation causes a milking action that increases lymphatic flow up to 5 – 15 times the resting level. Therefore the rational for early application of pressure and elevation is advised in the treatment of ITBFS (Reid 1992).

SUPPORT: The use of orthotics is commonly used in the treatment of ITBFS (Noakes, 1992). Lateral wedges are built into the midsole of the shoe for severe genu varum or very high arched feet (Jones and James 1987; McBryde et al, 1989; Noakes, 1992; Reid, 1992). Rigid cavus feet are unable to absorb shock adequately (Sutker et al, 1981; Noakes 1992) therefore a wedge is used to force the foot to pronate, therefore increasing shock absorption capacity by 25%. Leg length inequality also requires orthotics to compensate for the shortness (Noakes 1992). Lindenberg et al (1984) states that both inadequate pronation and excessive pronation are aetiological factors of ITBFS, thus orthotics should be used to resist or increase pronation.

STRETCH: Stretching of the ITB occurs through the tensa fascia lata muscle. Jones and James (1987), Firer (1989) and Baker (1995) all recommend stretching in the treatment of ITBFS. Travell, Simons and Simons, (1999) and Chaitow and Delany, (2002) emphasize that stretching techniques are important for returning the muscle to its original maximum length.

According to Noakes (1992) and Travell and Simons, (1983) the most effective stretch is as follows: The patient lies on the unaffected side, the upper thigh is abducted, and the clinician extends the abducted thigh and then adducts it. The clinician stabilises the lumbar spine and pelvis by holding the knee of the untreated limb on the examining table

ORAL ANTIINFLAMMATORIES:

Oral anti-inflammatories may be useful in reducing inflammation that is found in ITBFS (Renne, 1975; Noble, 1980; Noble et al, 1982; Jones and James, 1987; Baker, 1995). Jones and James, (1987) state that the physician must inform the patient that even acute, milder cases may take up to six weeks to resolve. Anti-inflammatories may reduce that period of time.

DRY NEEDLING:

Hall (1997) found that dry needle insertion into the tensa fascia lata muscle was effective in the treatment of ITBFS. Needling is performed in order to interrupt the abnormal neural circuits responsible for perpetuating pain-spasm, pain-cycle. The needle mechanically disrupts the dysfunctional nerve endings or contractile elements of the muscle, which sustain trigger point activity (Melzack, 1981). The effect of needling results in alleviating the patient's symptoms (Travell and Simons 1983).This then supports the quoted hypothesis that dry needling is effective in the treatment of iliotibial band friction syndrome, therefore in order for that to occur there has to be a myofascial component to the syndrome.

ELECTROMODALITIES

The use of electromodalities in the treatment of ITBFS has shown to be effective short term.

Ultrasound:

Ultrasound:

Ultrasound causes physiologic and therapeutic effects at a cellular and tissue level (Reid 1992). The heating effects of ultrasound aids in oxygen delivery being facilitated, microcirculation is enhanced, pain and spasm is decreased and the plasticity of collagen is increased (Reid 1992).
The therapeutic effects of ultrasound cause a decrease in inflammation, accelerated hematoma resorption, promotion of healing, increased extensibility of scar tissue and it performs phonophoresis (Reid 1992).

Transcutaneous Electrical Neural Stimulation (TENS):

TENS overcomes reflex inhibition, minimizes atrophy with immobilization and can be used as an adjunct to strengthening programmes. TENS also allows for the maintainance of paralysed muscles, reinforces voluntary contraction, increases range of motion and breaks down adhesions in the muscles which assist in relieving pain and spasm (Reid 1992).
In subacute injuries, treatment with high frequency TENS allows for rapid pain relief. After 10 –20 minutes low frequency TENS causes a longer lasting effect as there is less nerve accommodation (Reid 1992). TENS is particularly effective during periods of modified activity and decreases the muscle wasting effect of swelling (Reid 1992). TENS superimposed on voluntary contraction minimizes wasting and reduces loss of strength.

Surgery is based on the fact that at thirty degrees of flexion the posterior fibers of the ITB cross the lateral femoral epicondyle. Firer (1989) and Martens et al (1989) state that not all cases of ITBFS can be cured by conservative methods, and that surgery is then indicated when conservative treatment fails. Noble (1980) recommends surgery but only once a four to six week rest period and a series of corticosteroid injection have failed to alleviate the symptoms. Surgery is limited to soft tissue release by a transverse incision across the line of the fibers of the iliotibial band (Noble, 1980) and is only perfomed after conservative treatment has failed.

2.9 INTRODUCTION TO MYOFASCIAL PAIN SYNDROME:

Myofascial Pain Syndrome is an extremely common type of muscular condition that frequently presents to primary health care practitioners and is of a multi-factorial origin (Gatterman, 1990:287; Hubbard, 1998:16; Chaitow and Delany, 2002:18-20).

Muscular pain is the second most common cause of visits by patients to physicians (in general) (Hubbard, 1998:16). In a review article written by Han and Harrison (1997:90) the incidence of Myofascial Pain Syndrome is reported as high as 85% at certain American pain clinics, yet it remains to be one of the least understood conditions, often being misdiagnosed, mistreated or simply unrecognized (Auleciems, 1995:18).

According to Fricton (1990), the confusion surrounding this syndrome seems to stem from the:

- Lack of obvious organic findings,

According to Fricton (1990), the confusion surrounding this syndrome seems to stem from the:

- Lack of obvious organic findings,
- The lack of unified theory to explain it and
- Inconsistencies in the literature defining the syndrome.

2.9.1 DEFINITIONS:

A myofascial trigger point (MFTP's)

A myofascial trigger point is defied as "*a hyperirritable spot in skeletal muscle that is associated with a hypersensitive palpable nodule in a taut band. Snapping or palpation of the band may produce a local twitch response. The spot is painful on compression and can give rise to characteristic referred pain, referred tenderness, motor dysfunction and autonomic phenomena*" (Travell, Simons and Simons, 1999; Chaitow and Delany, 2002).

2.9.1.1 An active myofascial trigger point :

A MFTP that causes a clinical pain complaint, thus by definition "it is a focus of hyperirritability in a muscle or it's fascia that is symptomatic with respect to pain; it refers to a pattern of pain at rest and / or in motion that is specific for the muscle. An active trigger point is always tender, prevents full lengthening of a muscle, weakens the muscle, usually refers pain on direct compression, mediates a local twitch response of the muscle fibers when adequately stimulated and often produces specific autonomic phenomena, generally in its referral zone" (Travell, Simons and Simons, 1999:1).

2.9.1.2 A latent myofascial trigger point:

A MFTP that is clinically silent and is thus by definition "a focus of hyperirritability in a muscle or its fascia that is clinically quiescent with respect to spontaneous pain: it is only painful when palpated. A latent myofascial trigger point may have all the other clinical characteristics of an active trigger point, from which it is to be distinguished" (Travell, Simons and Simons, 1999).

Chaitow and Delany (2002) and Travell, Simons and Simons (1999), agree that the main difference between active and latent MFTP's is that only active MFTP's spontaneously refer pain.

Table 2.9.1.3

Latent myofascial trigger points	Active myofascial trigger points
Commonalities	
Decreased stretch range of motion.	Decreased stretch range of motion.
Muscular stiffness.	Muscular stiffness.
Local twitch response.	Local twitch response
Painful and weak muscle on contraction.	Painful and weak muscle on contraction.

Differences	
Localized pain on manual compression.	Localized and referred pain on manual compression.
No spontaneous pain referral.	Spontaneous pain referral.
Recognition of an unfamiliar or previous pain.	Recognition of current pain.

As compiled by Wilks (2003:21).

2.9.1.4 Myofascial Pain Syndrome:

Myofascial Pain Syndrome (MPS) is a regional muscular disorder that results from MFTP's (Lee et al., 1997; Chaitow and Delany, 2002). Both active and latent MFTP's can result in MPS (Hou et al., 2002).

2.9.2 INCIDENCE OF MYOFASCIAL PAIN SYNDROME:

The literature available on MPS concentrates on the postural muscles of the lower back and neck with little information available on the tensa fasciae lata, vastus lateralis, biceps femoris, iliopsoas, gastrocnemius,gluteus maximus, medius and minimus muscles.

American study based at pain clinics indicate that the incidence of MPS may be as high as 85 % (Han and Harrison, 1997).

Reports of the prevalence of MFTP's in patient populations can be found as early as the 1950's where physicians noted MPS as one of the most common frequent problems seen by physicians (Sola, Rodenberger and Getty, 1955).

Goldberg (1987), states that latent MFTP's are more common than active MFTP's. This opinion is shared by Gatterman (1990) and Travell, Simons and Simons (1999).

MPS occurs in both sexes but appears to be more prevalent in females (2:1) (Han and Harrison, 1997:89). Travell, Simons and Simons (1999 1:13) and Han and Harrison (1997:90), suggested that individuals in their later years (30-49) are more likely to suffer from MPS however, Travell and Simons (1983) state that MFTP's are extremely common and can develop in individuals of any age or sex.

Bruce (1995) explains that, currently, the majority of research conducted in the field of epidemiology of MPS has been completed in a clinical setting. As a result the prevalence with regard to MPS in the general population can only be estimated indirectly.

2.9.3 HISTORY OF MYOFASCIAL PAIN SYNDROME:

According to Travell, Simons and Simons (1999), with adequate rest and in the absence of perpetuating factors an active trigger point may revert spontaneously to a latent state. Pain symptoms disappear but reactivation of the MFTP by exceeding the muscles stress tolerance can account for the history of recurrent episodes of the same pain over a period of years.

2.9.4 ETIOLOGY OF MYOFASCIAL PAIN SYNDROME:

There is still uncertainty over the etiology of MPS as no studies conducted indicate positive predictive values for any one combination of factors, however Travell, Simons and Simons (1999) and Chaitow and Delany (2002), agree that several primary factors may result in the development or activation of MFTP's:

Primary Factors:

(Baldry 1993)

- Mechanical stresses: acute sustained or repetitive muscle overload i.e.: prolonged muscle contraction.

- Trauma: in the form of direct injury to the muscle or from sudden strain as it is subjected to abnormal exercise or movements, this includes the precipitation of MFTP's by means of a local inflammatory response. Baldry (1993) states that repetitive microtrauma is a leading cause for the gradual activation of trigger points.

- Leaving the muscle in shortened position for a prolonged period of time: especially if the muscle is contracted in the shortened position.

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- Nerve compression: Due to the damage of small blood vessels resulting in the release of platelets and in turn, serotonin. Histamine is released from damaged mast cells and connective tissue and metabolites such as prostaglandins aggregate due to the sustained contraction preventing blood flow. This can cause identifiable neuropathic electromyography changes and results in disturbed microtubule communication between the neuron and the endplate

- Adverse environmental conditions: this includes but is not limited to excessive heat, cold or dampness.

- Systemic biochemical imbalances: this could include hormonal disturbances.

Secondary factors:

(Baldry, 1993)

- Compensation of synergistic or antagonistic muscles to those housing MFTP's may as a result develop MFTP's.

- Satellite MFTP's can evolve in referral zone of primary trigger points.

- Low oxygenation of tissues.

- The development of active and latent MFTP's occur as a result of the same factors mentioned above (primary and secondary) but to varying degrees (Travell, Simons and Simons, 1999).

Fricton et al. (1985), suggested a multi-factorial etiologic basis for MPS and suggested that the development of MFTP's can be divided into two basic groups:

1) Factors that directly traumatize by direct injury, repetitive microtrauma from habits that produce muscle tension.
2) Factors that weaken a muscle and predispose it to the development of MFTP's through such factors as nutritional deficiencies, structural disharmony, lack of exercise, sleep disturbances or the presence of other disorders such as joint problems.

Rosen (1993) feels that the primary cause of skeletal imbalance is a muscle imbalance between the agonist and the antagonist muscles, which become overloaded. He (Rosen, 1993) feels this overload may be due to improper use or abnormal loads causing dysfunction to occur when exceeding the critical load capacity resulting in fatigue.

According to Auleciems (1995), the event that activates a trigger point is usually quite different from the factors that perpetuate them. Therefore the long-term prognosis improves with treatment of perpetuating factors, not just pain relief.

Perpetuating factors may include any of the following, as outlined by Travell, Simons and Simons (1999):

- Mechanical stresses: such as skeletal asymmetry (short leg or small hemi pelvis), poor posture, prolonged immobility or muscular abuse.

- Nutritional inadequacies: commonly occur with mechanical stresses. Low levels of vitamin B1, B6, B12 folic acid and iron aggravate MFTP's. Inadequate levels of calcium, potassium, and several trace minerals can cause abnormal muscle functioning.

- Metabolic and endocrine inadequacies: hypoglycemia, hyperuricemia and hypothyroidism all perpetuate MFTP's.

- Chronic infection: viral, bacterial or parasitic.

- Psychological factors: such as anxiety or depression can delay recovery of MFTP's.

- Pathological processes: Awad (1973) and Mance et al (1986) state that an increase concentration of mucopolysaccharides, water, chloride and mast cells accumulate at the point of contracture, as well as a decrease in blood supply and an accumulation of metabolites.

- Miscellaneous factors: such as fatigue, cold or damp weather, allergy, chronic visceral disease or radiculopathy.

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2.10 PRESENTATION OF TRIGGER POINTS

2.10.1 PHYSICAL SIGNS OF TRIGGER POINTS

Travell, Simons and Simons (1999), state that MFTP's can be identified clinically by the following common characteristics:

1) **A palpable taut band.** By gently rubbing across the direction of the muscle fibers of a superficial muscle, the examiner can feel a ropelike induration. The taut band can be snapped or rolled under the fingers in accessible muscles. Gerwin and Shannon (2000), state that the presence of a taut band is the most important factor in the physical examination as it distinguishes MFTP's from other muscle pains such as Fibromyalgia.

2) **Tender nodule**: Palpation along the taut band reveals a nodule exhibiting a highly localized exquisitely tender spot that is characteristic of a MFTP..

3) **Weakness of the muscle**. This may reflect reflex inhibition of the muscle by the MFTP's (Borg-Stein and Stein, 1996).

4) **Restricted stretch range of motion**: (Simons, 2000).

5) **Increased pain** on active and /or passive stretch: Passive stretching results in greater restrictions. This may be due to reciprocal inhibition.

6) **Referred pain on manual compression**: digital pressure on either a active or latent MFTP can elicit a referred pain pattern characteristic for that muscle.

7) **Local twitch response**: Snapping palpation of the MFTP frequently evokes a transient twitch response of the taut band fibers (Kuan et al., 2002).

8) **Painful contraction**: When a muscle with an active MFTP is strongly contracted against resistance the patient feels pain. This effect is most marked when an attempt is made to contract the muscle in a shortened position.

[Travell, Simons and Simons, 1999].

2.10.2 The presentation of MFTP's in the tensor fasciae lata, vastus lateralis, biceps femoris, iliopsoas, gastrocnemius,gluteus maximus, medius and minimus muscles.

Presentation of MFTP's in the Iliopsoas Muscle:

This muscle is labelled as the "hidden prankster" by Travell and Simons (1983), as it often causes pain and is reasonably inaccessible. MFTPs are found in three locations in this muscle,

(a) The lateral aspect of the femoral triangle over the lesser trochanter,

(b) The inner border of the ilium behind the anterior superior iliac spine and

(c) The beneath the rectus abdominus muscle (Travell and Simons, 1983, Chaitow and Delany, 2002).

These MFTPs refer pain along the ipsilateral aspect of the spine, from the thoracic to the sacroiliac area, the anterior thigh and groin (Travell and Simons, 1983, Chaitow and Delany, 2002).

Patients often have difficulty in rising from a chair, difficulty in walking, are unable to do sit ups and are often reduced to crawling on hands and knees. Tightness of the iliopsoas results in a loss of extension of the hip and lumbar spine resulting in a reduced turn out at the hip. The groin and thigh pain is aggravated by weight bearing and relieved by lying recumbant (Travell and Simons, 1983).

While jogging, walking and running the iliacus is active, the thigh is flexed, therefore aggravating thigh and groin pain if activities continue. The psoas and iliacus are both active during standing and sitting (Travell and Simons, 1983, Chaitow and Delany, 2002).

Presentation of MFTP's in the Gluteus Maximus muscle:

This large muscle is predominantly made up of slow twitch, type one fibers. The myofascial trigger points develop in three distinct areas of this muscle, namely :

(a) In the superomedial aspect of the muscle;

(b) The lower midportion, overlying the posterior surface of the ischial tuberosity; and lastly,

(c) In the medioinferior portion of the muscle.

These MFTP's refer pain to the buttock region and may extend to the lateral thigh (Travell and Simons, 1983, Chaitow and Delany, 2002).

MFTP one of gluteus maximus, is found adjacent to the sacrum and refers pain to the gluteal cleft, the sacroiliac joint, and the posterior thigh.

Trigger point two, is found above the ischial tuberosity and refers pain across the lower sacrum and laterally to the ilium (Travell and Simons, 1983, Chaitow and Delany, 2002).

Symptomatically, this muscle causes pain on sitting, increased pain on hill walking and swimming crawl. These MFTP's are activated by direct blows to the muscle, walking uphill or any activity that results in vigorous lengthening contraction of the muscle (Travell and Simons, 1983, Chaitow and Delany, 2002).

<u>Presentation of MFTP's in the Gluteus Medius muscle:</u>

This muscle characteristically develops trigger points along and below the iliac crest.

(a) The anterior and middle trigger points lie between the skin and bone and

(b) The posterior trigger point is located deep to the gluteus maximus muscle.

These trigger points characteristically refer pain along the posterior crest of the ilium to the sacrum, the posterior and lateral aspects of the buttock and the upper thigh posteriorly and laterally (Travell and Simons, 1983, Chaitow and Delany, 2002).

There is often associated reduced adduction of the thigh at the hip and patients complain of pain on walking, sitting slouched, lying on their back and sacroiliac dysfunction (Travell and Simons, 1983, Chaitow and Delany, 2002).

Presentation of MFTP's in the **Gluteus Minimus Muscle:**

The MFTP's in this small muscle are characteristically located in the anterior fibers of this muscle by identifying the borders of the tensa fasciae lata muscle distal to the anterior superior iliac spine, then palpating deep to the tensa fasciae lata. To locate posterior MFTP's, the lower border of the gluteus minimus muscle is palpated for exquisite tenderness (Travell and Simons, 1983, Chaitow and Delany, 2002).

Referred pain patterns for this muscle arise mainly from the anterior trigger points, which refer to the lower aspect of the buttock, lateral aspect of the thigh and knee and to the peroneal aspect of the leg to the ankle. Ordinarily it does not include the ankle but may include the dorsum of the foot. The posterior MFTP's refer pain over the buttock and posterior thigh and calf. This referral may also include the back of the knee (Travell and Simons, 1983, Chaitow and Delany, 2002).

Symptomatically patients complain of pain on rising from a chair and on walking. Pain is similar to that caused by radiculopathy (Travell and Simons, 1983, Chaitow and Delany, 2002).

Presentation of MFTP's in the **Tensor fascia lata Muscle:**

The Tensor Fascia Lata (TFL) muscle MFTP's characteristically refer 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). Trigger points in the TFL are located by palpating the muscle as the patient rotates the thigh medially against resistance.

Patients complain of pain deep in the hip and down the thigh as far as the knee. The pain prevents walking rapidly or lying on the side of the trigger points. Pain referral is often confused for gluteus minimus, gluteus medius and vastus lateralis muscle trigger points or trochaneric bursitis (Travell and Simons, 1983, Chaitow and Delany, 2002).

Presentation of MFTP's in the **Vastus lateralis (VL) muscle:**

This large muscle characteristically develops multiple MFTP's along the lateral aspect of the thigh from the pelvis and the greater trochanter to the lateral side of the knee (Travell and Simons, 1983). The five areas in which the MFTP's can occur are spread out along the length of the muscle. They refer pain throughout the full length of the thigh laterally, to the outside of the knee (Chaitow and Delany, 2002). The deeper the MFTP's are, the more explosive the pain that refers up and down the thigh. Patients are often unable to sleep on the affected side.

(a) Pain from trigger point one may refer pain into and posterior to the knee.
(b) Trigger point two refers extensively up the lateral aspect of the thigh and down the lateral aspect of the leg, while
(c) Trigger point three refers along the length of the posterolateral thigh and popliteal space.
(d) Trigger point four refers pain around the lateral border of the patella, and
(e) Trigger point five refers pain locally to the lateral aspect of the thigh (Travell and Simons, 1983, Chaitow and Delany, 2002).

The distinctive feature of MFTP's in the distal muscle is a "stuck patella" in combination with pain around the lateral boarder of the patella (Travell and Simons, 1983) therefore activation of this MFTP's can result in immobilization of the patella and loss of normal patella movement (Chaitow and Delany, 2002).

Presentation of MFTP's in the Biceps Femoris Muscle:

This important hamstring muscle refers pain to the back of the knee, extending up the posterolateral area of the thigh, as far as the crease in the buttock (Travell and Simons, 1983, Chaitow and Delany, 2002). The pain is characterised as a deep aching pain that wakes the patients at night, is increased by walking and sitting (Travell and Simons, 1983, Chaitow and Delany, 2002).

The trigger points are located by lying the patient lateral recumbant, and applying the principals of pincer palpation along the distal aspect of the muscle (Travell and Simons, 1983, Chaitow and Delany, 2002).

Presentation of MFTP's in the **Gastrocnemius Muscle:**

This large muscle refers pain from the instep of the ipsilateral foot, over the posteromedial aspect of the ankle, over the calf, and back of the knee to the thigh (Travell and Simons, 1983, Chaitow and Delany, 2002).

Trigger point two and four are found near the lateral border of the belly of the lateral head and refer pain to the lateral aspect of the leg, the back of the knee and the lower thigh (Travell and Simons, 1983). Patients complain of nocturnal calf cramps and intermittent claudication. Pain is aggravated by walking on uneven surfaces (Travell and Simons, 1983, Chaitow and Delany, 2002).

2.11 DIAGNOSIS OF MYOFASCIAL PAIN SYNDROME:

It is the opinion of Travell, Simons and Simons (1999), that no one diagnostic examination alone is a satisfactory criterion for the identification of a trigger point. According to Travell and Simons (1983), the signs of a trigger point are as follows:

- Referred pain in the zone of reference
- Local twitch response
- Palpable taut band and

The recommended criteria for identifying a latent or active trigger point according to Travell, Simons and Simons (1999:35), are as follows:

<u>Essential criteria:</u>

1. Taut palpable band
2. Exquisite spot tenderness of a nodule in a taut band
3. Painful limit to full stretch range of motion.
4. Subject's recognition of current pain complaint by pressure on the tender nodule.

Confirmatory Observations:

1. Visual or tactile identification of local twitch response
2. Pain or altered sensation on compression of the tender nodule.

For the diagnosis of MFTP's all 4 essential criteria must be present (Travell, Simons and Simons, 1999; Murphy, 1989). The presence of the confirmatory signs serves to reinforce the diagnosis.

The minimum criteria for identifying a MFTP according to Chaitow and DeLany (2002) are as follows:

Minimal criteria:

The minimum criteria for identifying a MFTP according to Chaitow and DeLany (2002) are as follows:

Minimal criteria:

- -Taut palpable band
- -Exquisite spot tenderness of a nodule in a taut band.
- -Subject's recognition of pain.

Compression of the MFTP may result in:

- The person's recognition of a current pain complaint, which indicates an active MFTP.
- The person's recognition of an unfamiliar or previous pain, which indicates a latent MFTP.

2.12 DIFFERENTIAL DIAGNOSIS:

Pain in the region of the knee may arise from articular degeneration or dysfunction, meniscal tears, ligamentous injury, tendonitis or trochanteric bursitis. L4 Peripheral neuropathy and lateral femoral nerve entrapment are common differentials.

2.13 MANAGEMENT OF MYOFASCIAL PAIN SYNDROME:

Patient management is dependant on recognizing the underlying problems that influence the patient's pain by increasing the tension and irritability of the involved muscle (Fomby and Mellion, 1997). The treatment protocol must therefore take into consideration the contributing and perpetuating factors, so that long-term relief can be obtained (Esenyl et al., 2000).

Rosen (1993) is of the opinion that the most important goal of successful rehabilitation is not that of pain relief but rather restoration of normal range of motion to the tissues and achievement of strength and endurance. Bruce (1995) suggests a multidisciplinary approach to treatment is important and that treatment should first be directed towards correct diagnosis and elimination of perpetuating factors.

However Esenyl et al. (2000), feels the main goal of treatment is to relieve the muscle pain and spasm of the involved muscle.

Previous treatment for MPS includes: myofascial trigger point injection, dry needling, exercise, massage, transcutaneous electrical nerve stimulation (TENS), medication and stretch and spray (Han and Harrison, 1997; Hubbard, 1998).

Of these numerous techniques available it seems that the choice of treatment is based more on personal preference than on clinical evidence (Anderson, 1997). Rosen (1993), states that the most commonly used treatment techniques include spray and stretch and MFTP injecting. Some of the many treatment techniques are discussed below.

Trigger Point Pressure Release

Travell, Simons and Simons (1999:140), found that the pressure release seems to be clinically more effective than ischemic compression. To perform the technique the involved muscle must be stretched or lengthened to a point of increased resistance within the patient's comfort zone. Pressure is then gradually applied until the finger encounters an increase in tissue resistance. The patient should experience discomfort but not pain. The pressure is maintained until a decrease in tension under the finger is felt. Pressure is then increased until a new point of tension is felt and then maintained until the tension releases again.

This approach appears to be more patient friendly and less invasive and therefore more likely to be used by the patient at home (Travell, Simons and Simons, 1999:140).

Modalities

Transcutaneuos electrical nerve stimulation (TENS) has been successfully used in the treatment of MPS; however it does not have any long-term effect on the condition (Han and Harrison, 1997:97). Tsolakis(2001) proved that interferential current therapy is effective in the treatment of mechanical thoracic back pain.

Gam et al. (1998:73) in a randomized control trial found that ultrasound gave no pain reduction and was ineffective in the treatment of MPS.

effective treatment for MPS by Hubbard (1998). The aim of this method is to decrease pain, increase range of motion and restore the muscle to its normal length. The sudden drop in skin temperature results in a temporary anaesthesia by blocking the spinal stretch reflex and the sensation of pain in the higher centres of the brain (Han and Harrison, 1997).

MFTP injection and Dry Needling:

Trigger point injections have been widely used to inactivate MFTP's (Esenyl, 2000) and are commonly used in the management of MPS with wide spread clinical acceptance (Alvarez, 2002:657).

According to Han and Harrison (1997:96), MFTP injection is preferred to dry needling because of the analgesic effect that the local anesthetic agent offers to the surrounding muscle tissue.

However Garvey et al. (1989), conducted a randomized double-blind study comparing four different treatment methods in 63 patients with active MFTP's. The results of the study show that dry needling and acupressure are more effective than transcutaneous injection of either local anesthetic or local anesthetic and steroids. This led the researchers to believe that the relief is likely due to the mechanical stimulation of the MFTP by the needle as oppose to the substance injected.

Hong (1994:256), share this opinion in stating that the long term therapeutic effect of MFTP injection and dry needling appears to be attributed to the needle rather than any substance injected into the MFTP.

Tschopp and Gysin (1996:306) and Hong (1994:256), share this opinion in stating that the long term therapeutic effect of MFTP injection and dry needling appears to be attributed to the needle rather than any substance injected into the MFTP.

Han and Harrison (1997:96), propose the following mechanism by which both needling and MFTP injection relieve the MFTP pain:

1. Mechanical disruption of muscle fibers, causing a release of potassium, which results in depolarization of nerve fibers
2. Mechanical disruption of nerve fibers
3. Interruption of central feedback mechanism that perpetuates pain.
4. Local dilution of nociceptive substances by the local anesthetic or saline that is infiltrated.
5. Vasodilatory effect of local anaesthetics, which increase the removal of metabolites.

These hypotheses suggest that there may be a myofascial component to ITBFS (Baker, 1995; Reid, 1992; McBryde et al, 1985 and Noble, 1980).

Table 2.14

	ITBFS	MPS
etiology	Repetitive trauma	Repetitive trauma
	Decrease in abductors, quadriceps, gastrocnemius, hamstring, gluteus maximus and tensa fasciae lata muscle strength	Abductors, quadriceps, gastrocnemius, hamstring, gluteus maximus and tensa fasciae lata muscle weakness
	Flexibility deficits of the abductors, quadriceps, gastrocnemius, hamstring, gluteus maximus and tensa fasciae lata muscles.	Restricted stretch range of motion of the abductors, quadriceps, gastrocnemius, hamstring, gluteus maximus and tensa fasciae lata muscles
	Significant muscle inhibition in the abductors, quadriceps, gastrocnemius, hamstring, gluteus maximus and tensa fasciae lata muscles	Reflex inhibition of the muscle by the MFTP's

	Athletes who participate in sports that involve jumping or running activities are at greater risk of developing Iliotibial band friction syndrome.	A muscle is likely to develop MFTP's as a result of strenuous athletic activity such as running, Speed walking, football,rugby, cross country skiing or waterskiing.
	A history of repetitive microtrauma may predispose one to ITBFS.	A history of a fall or direct trauma to the area

	ITBFS	MPS
Signs and Symptoms	Pain on the lateral aspect of the knee and hip.	Pain on the lateral aspect of the knee and hip
	Pain on running or walking downhill.	Increased pain on running or walking downhill, cycling or any other physical activity.
	Pain worsened with descending stairs	Pain on climbing stairs

	Pain worsened with physical activity	MFTP's are likely to be aggravated by strenuous athletic activity such as running, rugby, speed walking, football, cross country skiing or skiing.
	Pain after activity	Pain after activity
	Tenderness over the lateral femoral epicondyle	Tenderness over the lateral aspect of the knee.
	Weakness of the hip abductors, hamstring, tensa fascia lata, gastrocnemius, gluteus maximus and quadriceps muscles.	.Weakness of the affected muscle
	Mild Trendellenberg gait observed if severe during stance phase of walking and running	Trendellenberg gait if MFTP's in the hip abductors.
	Swelling and possible crepitus	Swelling of the affected muscle.

Diagnostic Approach	A history of pain over the lateral aspect of the knee aggravated by running or cycling, particularly on cambered courses or on running downhill, discomfort relived by rest.	Referred pain in the zone of reference (Travell, Simons and Simons, 1999; Murphy, 1989)
	Tenderness is elicited over the lateral epicondyle just above the joint line	Local twitch response (Travell, Simons and Simons, 1999; Murphy, 1989)

	Repeated flexion and extension may reproduce the patient's symptoms, particularly at 30 degrees of flexion.	Palpable taut band (Travell, Simons and Simons, 1999; Murphy, 1989)
	A positive Ober's test for a tight iliotibialband. .	Focal tenderness (Travell, Simons and Simons, 1999; Murphy, 1989).
	A positive Noble's compression test (Noble, 1979).	Exquisite spot tenderness of a nodule in a taut band. Subject's recognition of current pain complaint by pressure on the tender nodule.
	Decreased range of motion of the knee, are all characteristic of ITBFS.	Painful limit to full stretch range of motion..

	ITBFS	MPS
Treatment Procedures	Rest	Trigger Point Pressure Release
	Ice	Modalities
	Compression	Dry Needling
	Elevation	Spray and Stretch
	Support	MFTP Injection
	Stretch	Stretch
	Dry Needling	
	Electromodalities	
	Surgery	

The above ITBFS table is compiled with references from: Noble 1980; Baker 1995; Zuluaga 1995; Nicholas et al 1995; Norris 1998;

CHAPTER THREE

MATERIALS AND METHODS

3.1. INTRODUCTION

The aim of this research is to provide a greater insight into the role of myofascial trigger points of selected musculature of the lower extremity and the clinical presentation of iliotibial band friction syndrome using a modified pain severity rating scale.

Therefore this chapter gives a description of:

- The primary and secondary data,
- The subjects,
- The design,
- The interventions,
- The data collection modalities and
- Statistical analysis utilized to analyse the data gained.

3.2. THE DATA:

The data consisted of primary and secondary data.

3.2.1. THE PRIMARY DATA:

The primary data consisted of the following:

- Case history
- Relevant regional examination
- Knee regional examination
- Hip regional examination
- Iliotibial band Pain Severity Scale
- Myofascial Diagnostic Scale
- Duration of Condition in Weeks and Months
- Patients subjective perception of their pain using a Numerical Pain Rating Scale
- Location of the MFTP's in the Tensor fascia lata, vastus lateralis, gluteus maximus, gluteus medius and minimus, gastrocnemius, biceps femoris and iliopsoas muscles
- Algometer readings for Pressure-pain Threshold over the MFTP's.

3.2.2. THE SECONDARY DATA:

The secondary data was obtained from various sources including journal articles, textbooks and medical search engines on the Internet (Mantis, Pubmed and Medscape).

3.3. STUDY DESIGN:

The design was that of a pilot non-intervention clinical assessment study of sixty participants.

3.4. THE SUBJECTS:

The subjects consisted of volunteers suffering from Iliotibial band friction syndrome residing in the Kwazulu-Natal province.

3.4.1. ADVERTISEMENTS FOR SUBJECT RECRUITMENT:

The public was informed of the study by advertisements placed at local gyms, schools, in local newspapers and on the DIT Campus advertising for free participation in a research program being conducted at the Durban Institute of Technology Chiropractic Day Clinic. (See Appendix 1).

The advert called on patients between the ages of 20 and 40 years of age suffering from lateral knee pain.

Upon reply all participants were required to undergo a cursory telephonic discussion (appendix 2) with the examiner to exclude subjects that did not fit the criteria for the study (page 6-8) .

3.4.2. SAMPLING AND GROUP ALLOCATION OF SUBJECTS:

As this study was not a clinical study, no patient groupings where necessary.

Sixty participants who symptomatically complied with the telephonic interview, were then asked to attend the Chiropractic Day Clinic for an assessment in terms of the inclusion and exclusion criteria, in order to be included or excluded from the study. Having complied with the criteria they were accepted into the study.

3.4.3. CLINIC ASSESSMENT PROCEDURE:

An initial consultation was scheduled during which a case history (appendix 3), relevant physical examination (appendix 4), knee regional examination (appendix 5) and hip regional examination (appendix 6) were conducted.

Acceptance of the candidate was dependent on whether or not they met the specific inclusion criteria indicated below:

3.4.3.1. INCLUSION CRITERIA:

Patients were included in the study for the following reasons:

- The study was gender non-specific. According to Noakes et al (1990) there is no specific gender that ITBFS affects more predominantly than the other.

- All applicants were diagnosed with ITBFS.

The inclusion criteria for diagnosis of ITBFS was (Nicholas et al 1995; Reid, 1992; Sanders, 1990; Noble 1980 and 1979):

History

- A history of pain over the lateral aspect of the knee aggravated by running or cycling, particularly on cambered courses or on running downhill, discomfort relived by rest.

On examination/ signs and symptoms

- Tenderness was elicited over the lateral epicondyle just above the joint line.

- Repeated flexion and extension reproduced the patient's symptoms, particularly at 30 degrees of flexion.

- A positive Ober's test for a tight iliotibialband, which is when the patient is in a side lying position, with the injured side up. The patient flexes the lower leg at the hip and the knee to stabilize the body. The examiner then passively abducts and extends the upper leg with the knee straight or flexed to ninety degrees. The examiner then slowly lowers the lower limb and if contractures are present in the ITB, the leg remains abducted and will not fall to the bed. The hip is slightly extended, so that the ITB passes over the greater trochanter of the femur. Originally Ober's described the test with the knee flexed, which is adequately positive in neurologically involved patients. However in young active patients, the test is more effective when performed with the knee extended as it places more stretch on the ITB and more likely to reveal a subtle tightness in the band (Noble et al, 1982; Lindenberg et al, 1984; Magee, 1992).

- A positive Nobles compression test (Noble, 1979), which is when the patient lies supine with knees flexed to ninety degrees. Pressure is placed over the proximal part of the lateral femoral epicondyle. The knee is gradually actively extended. At thirty to forty degrees of flexion, as the band moves over the lateral femoral epicondyle directly under the examiner's finger, the pain felt on activity is reproduced (Noble, 1979; Noble, 1980 and Noakes, 1992). The pain is located over the lateral femoral epicondyle and the lower third of the iliotibial band (Holmes et al, 1993).

OTHER FINDINGS:

- Decreased range of motion of the knee.
- Taut fibrous bands in the iliotibial tract.
- Intense focal tenderness of the ITB when pressure was applied.

The subjects accepted into this study were asked to sign an informed consent form and a letter of information. If patients refused to do so they were excluded from the study.

3.4.3.2. EXCLUSION CRITERIA:

Patients were excluded from the study for the following reasons:

- Applicants with broken and aesthetic skin in the area to be treated were excluded.

- Applicants suffering from local or systemic pathology (eg: RA, SLE etc) were excluded.

- Applicants using analgesic and anti-inflammatory or muscle relaxant medication were excluded from the study. However, after a 48 hour wash out period the applicant was able to participate in the study (Poul et al, 1993).

- Applicants receiving other treatment for the same condition were not included unless they ceased other such treatments and entered this study within a week

- Participants who presented with any of the following: bursitis, patella tendonitis or any systemic arthritide that affects the knee (Powers et al, 1996) were excluded.

- All patients received a letter of information and were required to sign an informed consent form before treatment commenced. Patients, who were not prepared to sign informed consent form, were excluded from the study.

3.4.4. CLINICAL TREATMENT PLAN:

All the relevant data was gathered at the initial consultation. There was no clinical treatment plan included in the research, however, two free treatments were offered on completion of the research.

3.5. STUDY ASSESSMENTS:

3.5.1. DIAGNOSIS AND ASSESSMENT READINGS RELATED TO THE MYOFASCIAL TRIGGER POINTS:

Once the participant was included in the study they were screened for myofascial trigger points.

It is the opinion of Travell, Simons and Simons (1999:34-35), that no one diagnostic examination alone is a satisfactory criterion for the identification of a trigger point. According to Chaitow and Delany (2002:20) and Travell, Simons and Simons (1999:21-36), the signs of a trigger point are as follows:

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

Lee et al. (1997), Gerwin et al. (1997), Banks et al. (1997) and Dippenaar (2003) all reported to using these criteria to identify trigger points.

The minimal criteria for identifying a MFTP according to Chaitow and DeLany (2002:18-19) are as follows:

Minimal criteria:

-Taut palpable band

-Exquisite spot tenderness of a nodule in a taut band.

-Subject's recognition of pain.

Confirmatory Observations:

-Visual or tactile identification of local twitch response.

-Pain or altered sensation on compression of the tender nodule.

-Painful limit to full range of motion.

-Pain on contraction of the muscle.

-Weakness of the muscle.

For the diagnosis of MFTP's all minimum criteria must be present (Chaitow and DeLany, 2002:18-19; Travell, Simons and Simons, 1999:35; Murphy, 1989). The presence of the confirmatory signs served to reinforce the diagnosis.

THE MYOFASCIAL TRIGGER POINTS WERE RECORDED AS FOLLOWS:

3.5.1.1. OBJECTIVE MEASUREMENTS:

3.5.1.1.A. LOCATION OF THE TRIGGER POINTS:

The specific location of the trigger point within the Tensor fascia lata, vastus lateralis, gluteus maximus, gluteus medius and minimus, gastrocnemius, biceps femoris and iliopsoas muscle groups, was noted as indicated by Chaitow and DeLany (2002:483-485) and Travell and Simons (1983:249-272):

- Trigger points in the iliipsoas muscle are found deep to the lateral border of the femoral triangle, over the lesser trochanter; over the inner border of the ilium, behind the anterior superior iliac spine; lateral to the rectus abdominis muscle.

- Trigger points in the vastus lateralis muscle lie deep in the muscle and are extensively distributed throughout the length of the muscle.

- The Gluteus maximus muscle trigger points are located in the superomedial portion of the muscle, the lower mid portion of the muscle over the ischial tuberosity, and lastly in the medial portion of the muscle.

- The Gluteus medius muscle trigger points are concentrated below and along the iliac crest, between the bone and the skin.

- The gluteus minimus muscle trigger points are located in the anterior aspect of the muscle, and deep to the tensa fascia lata muscle.

- The tensor fasciae lata muscle trigger points are located between the anterior superior iliac spine and the greater trochanter.

- The biceps femoris muscle trigger points are located in the distal part of the lateral side of the posterior thigh.

- The gastrocnemius muscle trigger points are found in the proximolateral mid belly of the muscle.

- The rectus femoris muscle trigger points are commonly located proximally in the muscle close to the anterior inferior iliac spine.

3.5.1.1.B. THE MYOFASCIAL DIAGNOSTIC SCALE (MDS):

(Chettiar 2001),

The purpose of this scale is to determine the extent to which a patient suffers from MFTP's.

The scale is rated out of 17 points. A score of 9 or above is considered indicative of an active trigger point. A score of less than 9 is considered indicative of a latent trigger point.

Even though the Myofascial Diagnostic scale is not yet fully validated, it appears from various studies to be the most appropriate tool that can be applied to achieve a consistent set of results (Dippenaar 2003, Cumming 2003, Walker 2002).

Due to the nature of the scale, it was only applied to one MFTP per subject. The MFTP that was deemed "worst" or most painful by both the researcher and the subject was chosen.

3.5.1.1.C. ALGOMETER:

Since the development of the pocket-sized pressure Algometer in 1986, this tool has been widely used to document the tenderness of myofascial trigger points (Fischer, 1986). Nussbaum and Downes (1998) reported reliability of clinical pressure pain algometeric measurements. Reeves et al. (1986) and Fischer (1987: 207) demonstrated the reliability and validity of the pressure algometer in measuring myofascial trigger point sensitivity.

The algometer chosen for this study is the force dial manufactured by Wagner Instruments: P.O. Box1217 Greenwich CT 06836 as its pressure range measures kilograms as opposed to Newton meters which is preferable for this study. The pressure range of the algometer was 11kg.

The MFTP was located through palpation of the specific muscle. The footplate was placed over the MFTP with the shaft exerting pressure in the direction of the pain produced on palpation. The gauge was then turned away from the patient and pressure was applied at a rate of approximately 1kg / cm squared / second. The patient was informed to indicate when pain was first perceived by saying "yes". At the patients response the instrument was removed and the reading recorded in kg per square centimetre. Three readings were taken on each MFTP from which an average was calculated.

The total number of MFTP's were noted and the mean weight in kg was calculated by dividing the average algometer reading by the number of MFTP's present.

3.5.1.2. SUBJECTIVE MEASUREMENTS:

3.5.1.2.A. THE NUMERICAL RATING SCALE (NRS):

The NRS assesses the patient's perception of their pain intensity.

The questionnaire consists of a numerical scale of eleven points with 10 representing pain at it's worst and 0 representing no pain. Liggins (1989), states that the NRS is the most appropriate method of rating pain intensity without comparison. Jenson et al. (1986), found it to be an accurate tool for the measurement of pain intensity in clinical trials.

3.5.2 DIAGNOSIS AND ASSESSMENT READINGS RELATED TO THE ITBFS

3.5.2.1 OBJECTIVE MEASUREMENTS:

3.5.2.1.A. DURATION OF THE CONDITION:

Magee (1997) describes chronic conditions as those that have been present for longer than 7 weeks. Acute conditions are those that are less than 7 weeks in duration. A sliding scale was applied. The scale comprises of 12 points representing the number of weeks, and a scale of 7 points representing the number of months the participant has been experiencing the pain. The purpose of this is to allow accurate recording of the duration of the condition.

3.5.2.2. COMBINED SUBJECTIVE AND OBJECTIVE MEASUREMENTS:

THE ILIOTIBIALBAND PAIN SEVERITY SCALE :

3.5.2.2.a: Background information

This scale was piloted to assess the extent to which a patient suffers from ITBFS both practically and economically. The scale was developed by the researcher as no satisfactory questionnaires, laboratory tests or imaging techniques are currently satisfactory questionnaires, laboratory tests or imaging techniques are currently available that may be clinically utilized as objective tools in the assessment of ITBFS severity.

The scale contains both a subjective and an object component.

In this respect, Yeomans (2000) states that subjective tools quantify a patient's disability and functional ability while objective tools or tests quantify a patient's functional losses or impairment, therefore the inclusion of both aspects is important.

In addition to this the objective measures are static reliable measures that can be used to communicate information between practitioners more readily. Portney and Watkins (1993) elaborate on this by stating that objectifying measures allows for communication of information in "real" terms in contrast to subjective measures that can be abstract or ambiguous, such as "the patient feels better".

However Triano et al (1992) state: "The principal value of instrumentation lies in its ability to focus on the patient's functional capacity and not the symptoms". And therefore the subjective component becomes more important as it reflects the patient's reality more closely. Deyo and Diehl (1983) and Vernon (1990) agree that self-reports or subjective tools can be equally if not better suited to measure a patient's current status than objective tools.

Therefore a need for the combination of objective and subjective measures is apparent in that the objective is more reliable and allows for ease of common

Thus the scale consisted of a subjective component answered by the patient and an objective component answered by the researcher.

It was suggested that the patient be allowed to answer the questionnaires first in this way and thus they will not be influenced by the researchers answer.

Subsections of the questionnaire

The section on history comprises of questions that pertain to activities that may result in lateral thigh and knee pain. The nature of these activities renders them impractical to testing in a consulting room environment. In this section each affirmative or positive (i.e. one that applies to the patient) answer given by the patient is assigned one point by the researcher.

The section on signs is comprised of simple tests the practitioner can perform in his/her consulting rooms that may aggravate the pain. In this section each positive test (i.e.: one that produces pain) is assigned one point by the researcher.

In the section on symptoms the patient's perception of their pain was rated. The patient may choose one of three options regarding the intensity and points were assigned accordingly.

The maximum number of points a patient may score is 10.

The maximum number of points a patient may score is 10.

3.5.2.2.b: Piloting procedure

This scale was piloted to assess the extent to which a patient suffers from ITBFS in both a practical and economical method. The scale was developed by the researcher as no satisfactory questionnaires, laboratory tests or imaging techniques are currently available that may be clinically utilized as objective tools in the assessment of ITBFS severity.

3.5.2.2.c: Face validity

5 Chiropractic consultants involved with the management of ITBFS evaluated the scale. Their recommendations were followed in order to develop the scale to its current form.

To further assess face validity the scale was administered to four patients currently under care for ITBFS and the results were recorded.

Finally piloting also included a measure of concurrent validity testing as the scale was compared to the Numerical Rating Scale –101 for the same four patients. The outcomes were correlated (appendix 7).

3.6. STATISTICAL ANALYSIS:

The SPSS statistical package (as supplied by SPSS Inc., Marketing Department, 444 North Michigan Avenue, Chicago, Illinois, 606611) was used for data entry and analysis.

Descriptive statistics were performed using frequency distribution tables, various graphs and charts such as the bar and pie charts and appropriate measures of central location and dispersion such as the arithmetic mean and standard deviation. Finally correlation statistics were run using Spearman's rank correlation coefficient with a significance level of <=0.05. Categorical and dichotomous variables where cross-tabulated using the eta functions (Robert 2003).

3.7. ETHICS:

The ethical procedures were adhered to in accordance with the Durban Institute of Technology guidelines.

Each patient was required to complete and sign an informed consent form. The research involved no more than minimal risk and all information was treated as confidential. Two free treatments were offered on completion of the research.

CHAPTER FOUR

RESULTS:

4.1 INTRODUCTION

This chapter tabulates the results obtained from the statistical analysis of the primary data collected during the research program. The measurement criteria included:

- *Numerical Rating Scale101 (NRS)*
- Pressure threshold algometer readings
- *Iliotibial band pain severity scale*

4.2 CRITERIA REGARDING THE ADMISSABILITY OF DATA

Data was collected from patients who met the research criteria and who participated in the research program. The objective pressure threshold readings recorded by the researcher *were used. The Iliotibial band severity scale readings were used and the subjective pain* perception data that was completed under the supervision of the researcher.

KEY

ABREVIATION	MEANING
RT1	*The scale depicting readings measured by the pressure algometer.*
RT2	*The scale depicting the severity of the* MFTP's, ie: active, latent and NAD
NAD	No Abnormalities Detected. No MFTP's were found.
MSL	Muscle
L	Latent MFTP's
N	NAD
A	Active MFTP's
Te	Tendonous
Pr	Proximal
Dt	Distal
Mb	mid belly
GRP	Group
bf	Biceps femoris muscle
ga	Gluteus maximus muscle
gc	*Gastrocnemius muscle*
gi	Gluteus minimus muscle
gm	Gluteus medius muscle
ili	Iliopsoas muscle
tfl	Tensa fascia lata muscle
vl	Vastus lateralis muscle
ITB	Iliotibial band
ITBFS	Iliotibial band friction syndrome

4.3 TABLES OF DATA

CASE PROCESSING SUMMARY

			CASES			
	VALID		*MISSING*		*TOTAL*	
	N	PERCENT	N	PERCENT	N	PERCENT
RT2 (active, *latent*, NAD).* GROUP * MUSCLE	1680	100%	0	.0%	1680	100.0%

TABLE ONE: CROSS TABULATION OF THE SEVERITY OF THE MYOFASCIAL TRIGGER POINTS WITHIN THE MUSCLE GROUPS AND BETWEEN THE MUSCLES:

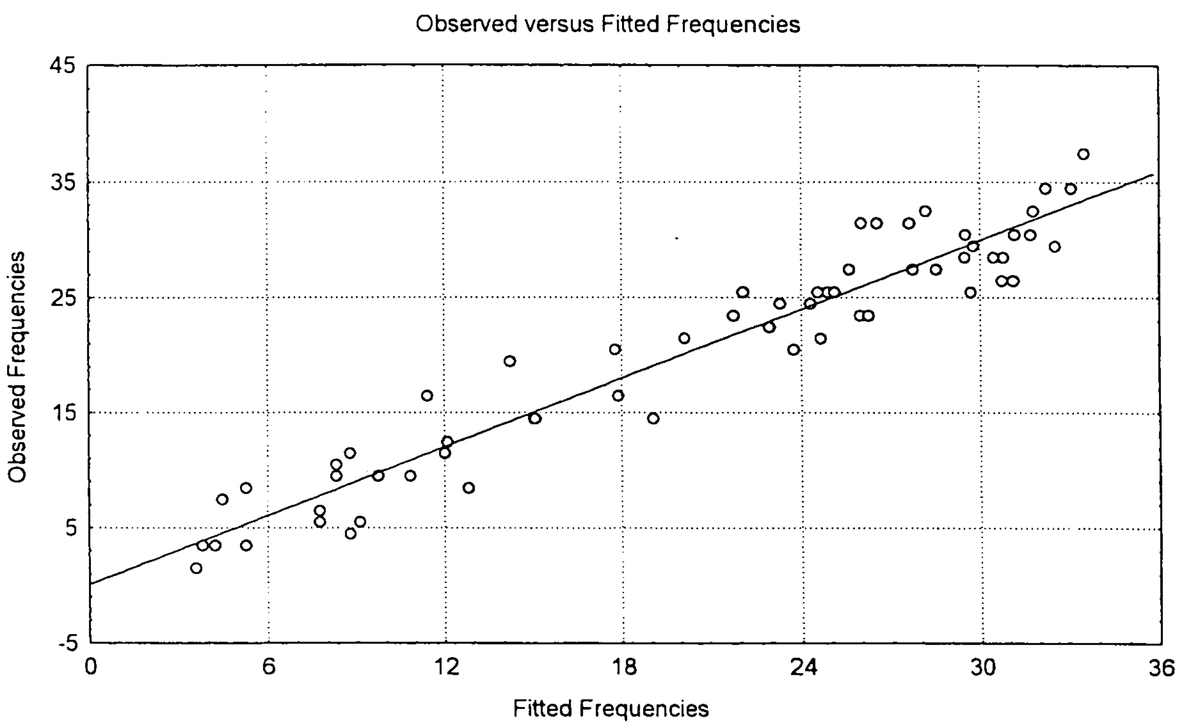
Muscle	*reading*	*GROUP*				*Total*
		Distal	Midbelly	Proximal	Tendon	
Biceps femoris	0	25	31	36	28	120
	1	24	24	21	23	92
	2	11	5	3	9	28
	total	60	60	60	60	240
Gluteus maximus	0	38	36	39		113
	1	17	18	17		52
	2	5	6	4		15
	total	60	60	60		180
Gastrocnemius	0	31	27	29	28	115
	1	25	27	23	22	97
	2	4	6	8	10	28

	total	60	60	60	60	240
Gluteus Minimus	0	11	8	14	19	52
	1	28	32	34	27	121
	2	21	20	12	14	67
	total	*60*	*60*	*60*	*60*	*240*
Gluteus Medius	0	13	5	17		35
	1	17	24	21		62
	2	30	31	22		83
	total	60	60	60		180
Iliopsoas	0	12		13		25
	1	32		37		69
	2	16		10		26
	total	60		60		120
Tensa Fascia lata	0	1	3	7	3	14
	1	30	34	37	25	126
	2	29	23	16	32	100
	total	60	60	60	60	240
Vastus Lateralis	*0*	*5*	*9*	*16*	*9*	*39*
	1	30	26	30	31	117
	2	25	25	14	20	84
	total	60	60	60	60	240

The MFTP's were rated as NAD (no abnormalities detected) (code = 0), latent (code = 1) or active (code = 2). This rating (denoted by RT2) was done for each group (there are 2, 3 or 4 groups) within each of the 8 muscles. For each group within each muscle 60 patients were rated.

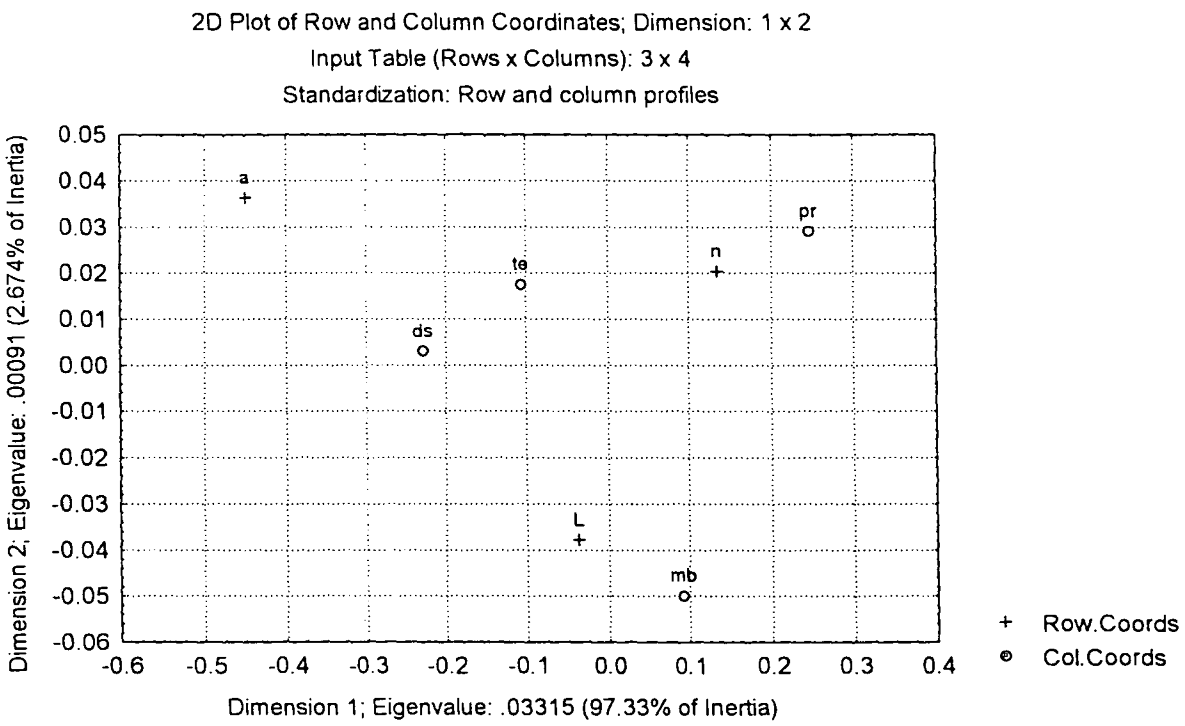
Table 1 shows a cross classification (counts for different categories) of the data on the basis of muscle (MSL), group (GRP) and RT2. A log-linear analysis of table 1 shows that the best *fitting model (to the data) is where RT2 is related to both MSL and GRP i.e. a model* with RT2*MSL and RT2*GRP interaction effects. A plot of the fitted (according to the model) versus observed frequencies is shown in figure 1. The plot suggests that this model fits the data quite well.

FIGURE ONE: PLOT OF OBSERVED VS FITTED FREQUENCIES FOR MODEL FITTED TO COUNTS IN TABLE ONE



In order to determine the association between RT2 and GRP, a correspondence analysis bi-plot was done for each of the 7 muscles that had 4 or 3 groups. In these plots the row co-ordinate is RT2 and the column co-ordinate GRP. The 3 RT2 ratings are represented in the plots by **n** (for NAD), **L** (for latent) and **a** (for active).

FIGURE TWO A: BI PLOT FOR THE BICEPS FEMORIS MUSCLE GROUPS AND RT2 (SEVERITY OF MFTP's)



Biceps femoris 2(a) **L** with mid belly ; **n** with proximal ; **a** (weakly associated) with distal and tendinous areas.

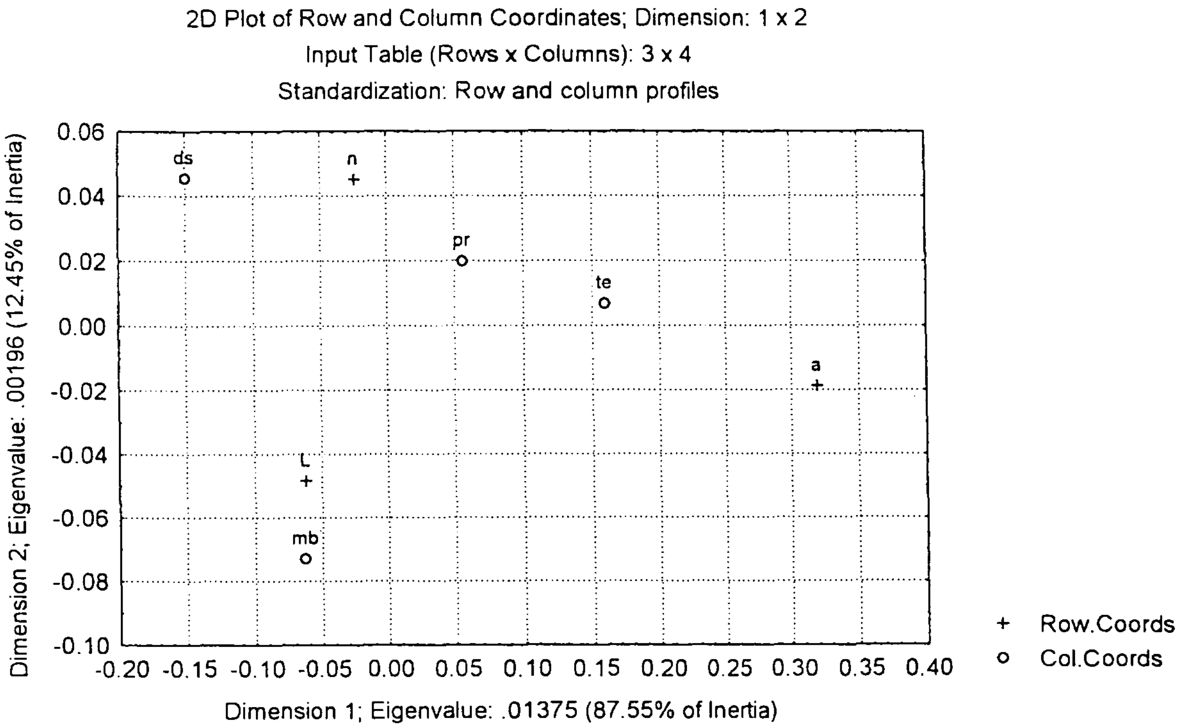


FIGURE TWO B: BI PLOT FOR THE GASTROCNEMIUS MUSCLE GROUPS AND RT2 (SEVERITY OF MFTP's)

Gastrocnemius 2(b) L with mid belly ; n (weakly associated) with proximal and distal ; a (weakly associated) with tendinous areas.

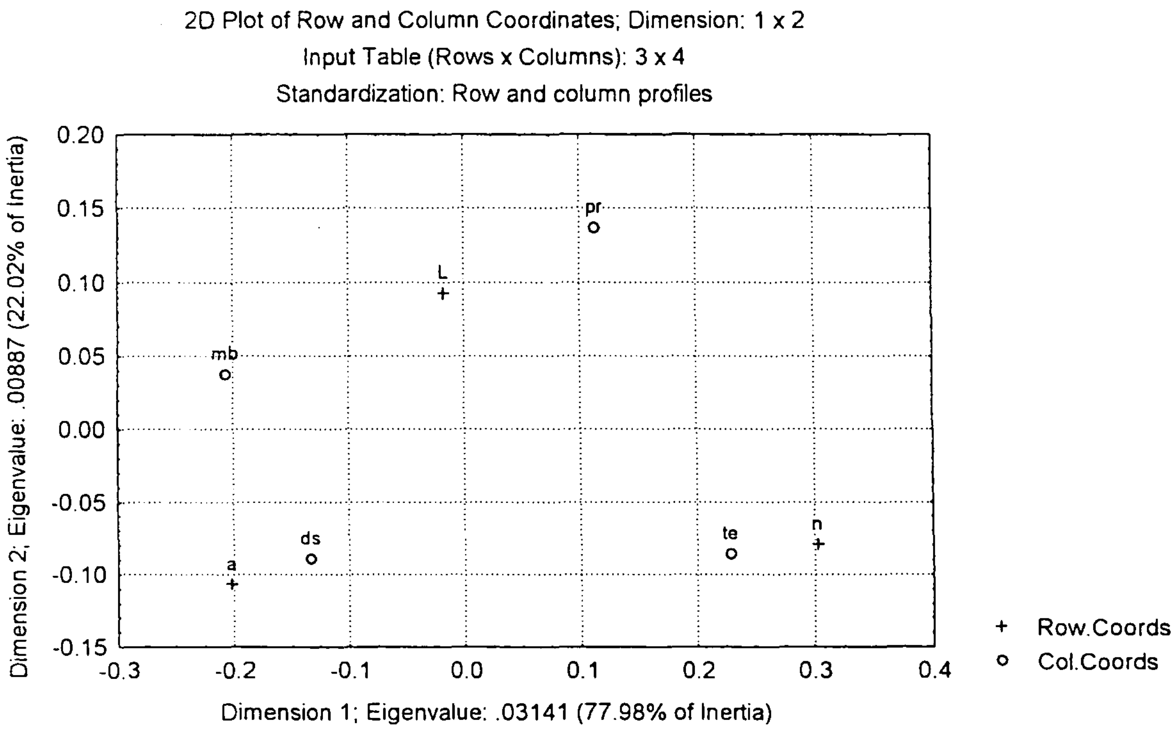


FIGURE TWO C: BI PLOT FOR THE GLUTEUS MINIMUS MUSCLE GROUPS AND RT2 (SEVERITY OF MFTP's)

Glut minimus 2(c) L (weakly associated) with mid belly and proximal ; n with tendonous ; a with distal areas

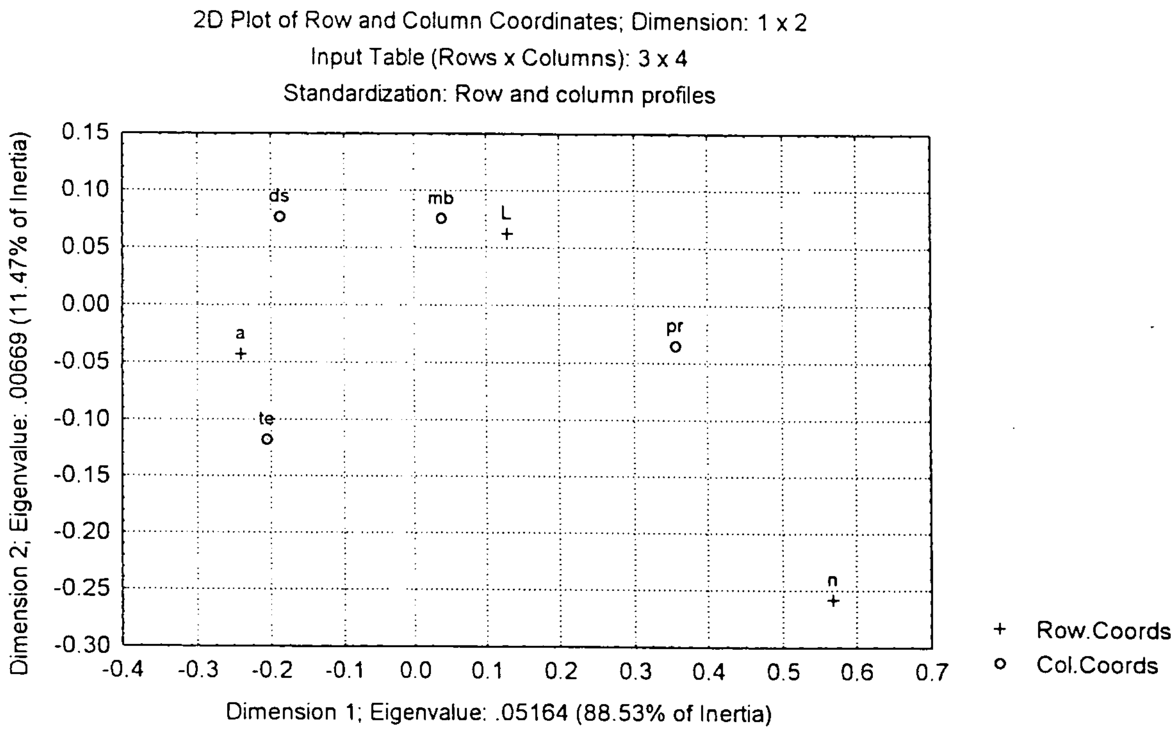


FIGURE TWO D: BI PLOT FOR THE TENSA FASCIA LATA MUSCLE GROUPS AND RT2 (SEVERITY OF MFTP's)

Tensa Fascia Lata 2(d) **L** with mid belly ; **n** not associated (closest to proximal) ; **a** with tendonous and distal areas.

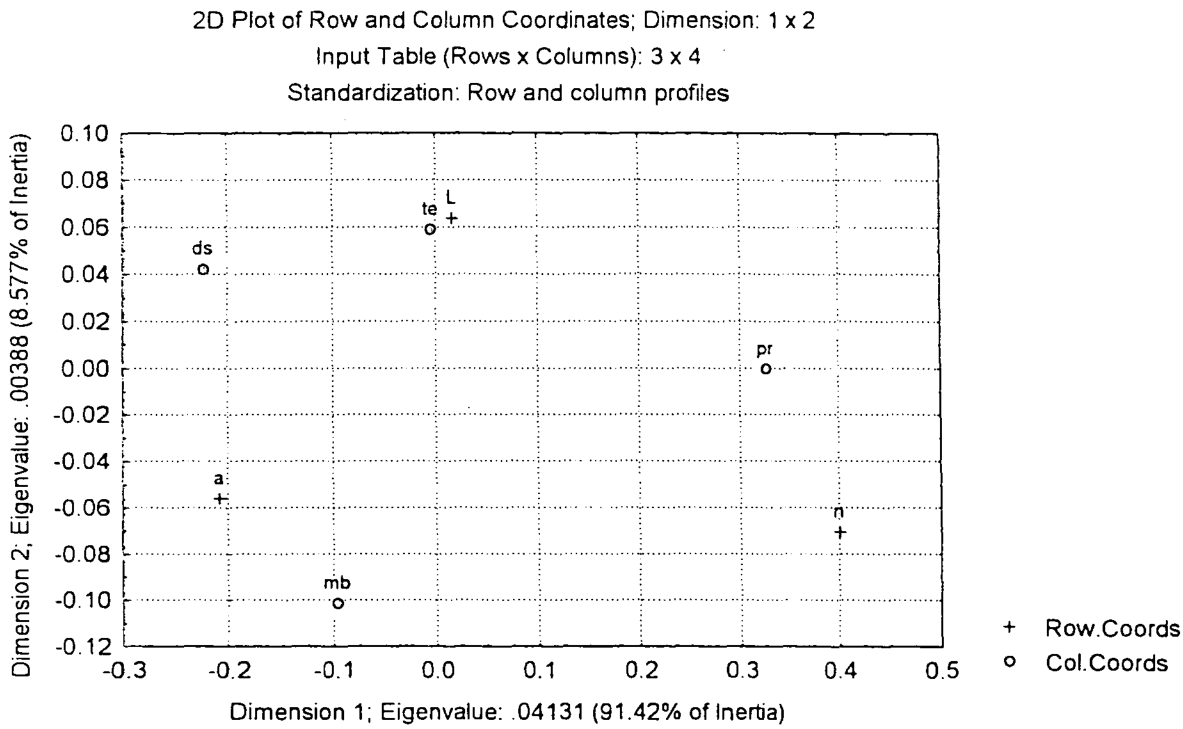


FIGURE TWO E: BI PLOT FOR THE VASTUS LATERALIS MUSCLE GROUPS AND RT2 (SEVERITY OF MFTP's)

Vastus Lateralis 2(e) L with tendonous ; **n** (weakly associated) with proximal ; **a** with mid belly

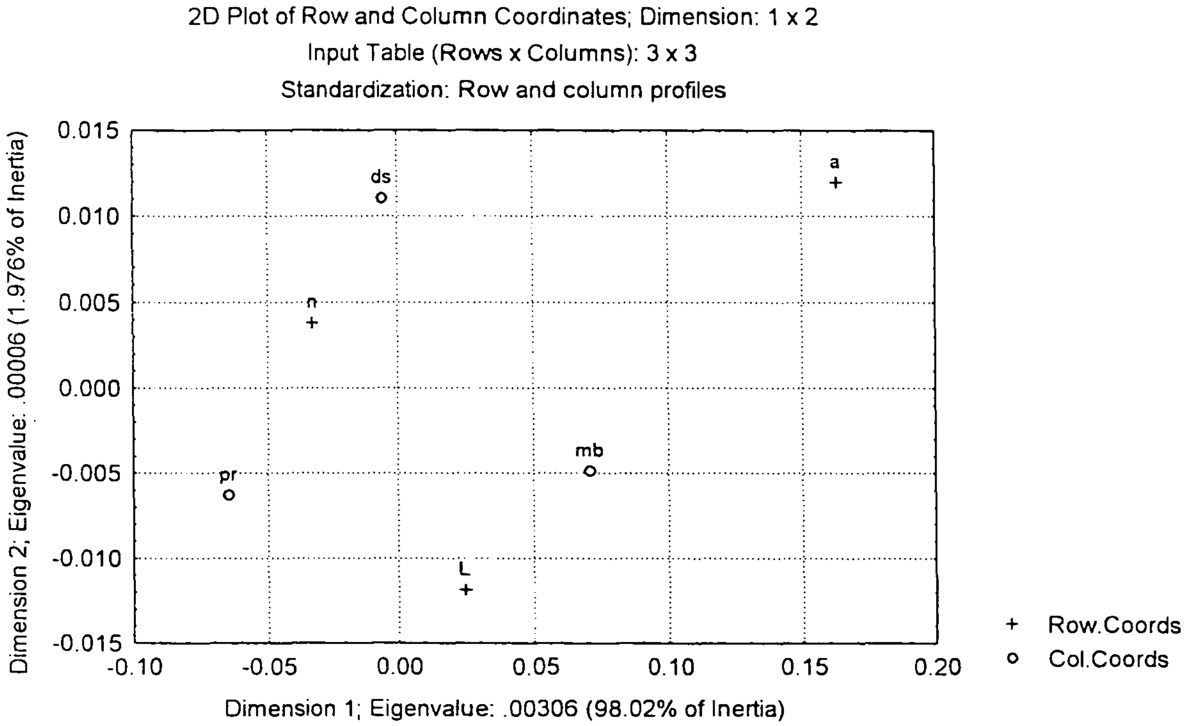
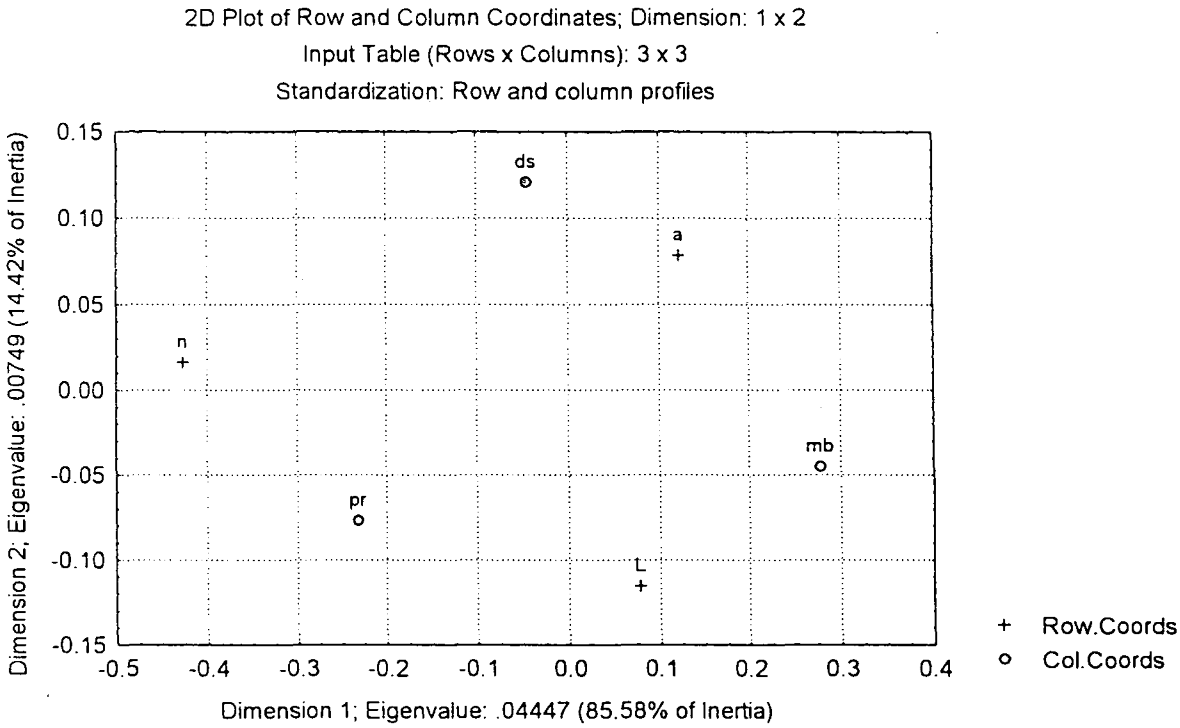


FIGURE TWO F: BI PLOT FOR THE GLUTEUS MAXIMUS MUSCLE GROUPS AND RT2 (SEVERITY OF MFTP's)

Glut maximus 2(f) **L** (weakly associated) with mid belly and proximal ; **n** (weakly associated) with proximal and distal ; **a** not associated



<u>FIGURE TWO G: BI PLOT FOR THE GLUTEUS MEDIUS MUSCLE GROUPS AND RT2 (SEVERITY OF MFTP's)</u>

Glut Medius 2(g) L (weakly associated) with mid belly and proximal ; **n** (weakly associated) with proximal; **a** (weakly associated) with distal.

A bi-plot for muscle iliopsoas (that has only 2groups) is not possible. This is due to the fact that the count patterns under distal and proximal are virtually identical.

UNIVARIATE ANALYSIS OF VARIANCE

Between subject factors

MUSCLE	*N*
Biceps femoris	240
Glut max	180
Gastrocnemius	240
Glut min	240
Glut med	180
Iliopsoas	120
Tensa fascia lata	240
Vastus lateralis	240
GROUP	
Distal (ds)	480
Midbelly (mb)	420
Proximal (pr)	480
Tendonous (te)	300

For each group within each muscle 60 patients were rated on a continuous scale. The rating score is denoted by RT1 which are the objective algometer readings. As for RT2 , 5 of the *muscles (biceps femoris, gastrocnemius, gluteus minimus, tensa fascia lata and vastus* lateralis) had ratings for 4 groups (distal, mid belly, proximal and tendonous) , two of the muscles (gluteus maximus and gluteus medius) had ratings for 3 groups (distal, mid belly and proximal) and the remaining muscle (iliopsoas) had ratings for only 2 groups (distal and proximal). This resulted in 1680 scores being recorded.

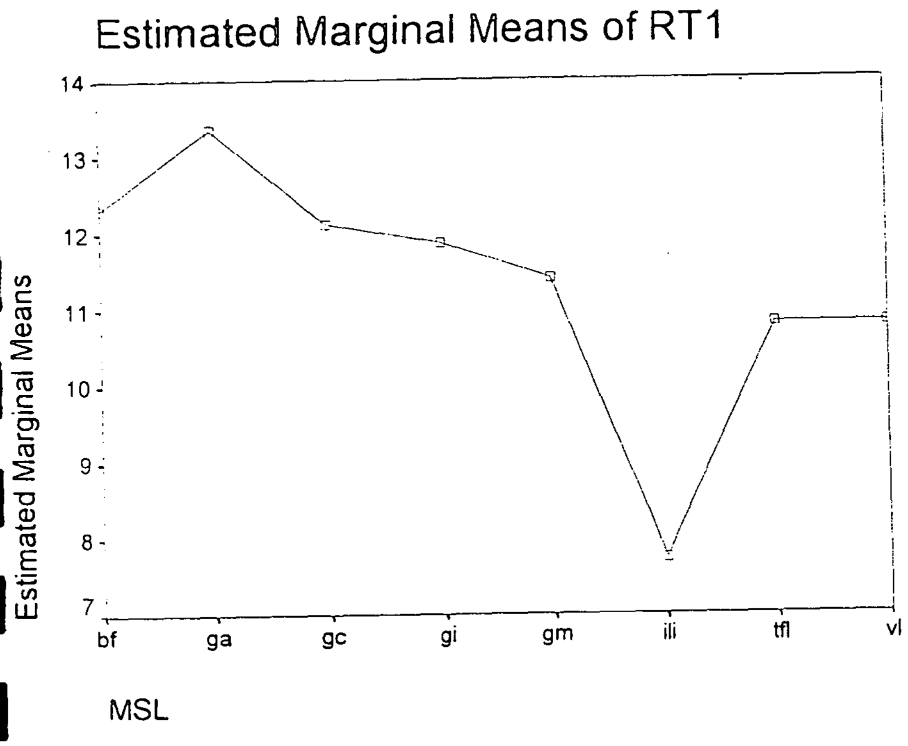
TABLE 2: ANALYSIS OF THE VARIANCE SUMMARY BETWEEN THE SUBJECTIVE EFFECTS FOR THE ALGOMETER READINGS:

Source	*Type III sum of squares*	*df*	*Mean square*	*F*	***Sig***
Corrected model	3029.163	27	112.191	8.970	.000
Intercept	202669.951	1	202669.951	16203.383	.000
Muscle	2800.693	7	400.099	31.988	.000
Group	61.527	3	20.509	1.640	.178
Muscle* Group	128.702	17	7.571	.605	.890
Error	20663.016	1652	12.508		
Total	244939.360	1680			
Corrected total	23692.179	1679			

Table 2 shows the results of the Analysis of Variance that were performed. From the table it can be seen that only differences between muscles are significant. Figure 3 shows a plot of *the means of the RT1 scores for each muscle.*

A post-hoc analysis, using the Scheffe formula for multiple comparisons, was carried out to determine the nature of these differences.

FIGURE THREE: PLOT OF ESTIMATED MEANS FOR ALGOMETER READINGS FOR THE DIFFERENTS MUSCLES.



UNIVARIATE ANALYSIS OF VARIANCE

Between subject factors

MUSCLE	*N*
Biceps femoris	240
Glut max	180
Gastrocnemius	240
Glut min	240
Glut med	180
Iliopsoas	120
Tensa fascia lata	240
Vastus lateralis	240
GROUP	
Distal (ds)	480
Midbelly (mb)	420
Proximal (pr)	480
Tendonous (te)	300

TABLE 3: ANALYSIS OF VARIANCE SUMMARY BETWEEN THE SUBJECTS EFFECTS FOR ACTIVE, LATENT AND NAD MFTP's

Dependant variable :RT2

Source	Type III sum of squares	df	Mean square	F	Sig
Corrected model	190.098	27	7.041	15.510	.000
Intercept	1433.759	1	1433.759	3158.515	.000
Muscle	169.180	7	24.169	53.242	.000
Group	10.115	3	3.372	7.428	.000
Muscle* Group	10.825	17	.637	1.403	.125
Error	749.900	1652	.454		
Total	2460.000	1680			
Corrected total	939.998	1679			

The data layout for the RT2 variable for the different muscles and groups is the same as that for the RT1 variable described in section 2.1. Table 3 shows the results of the Analysis of Variance that were performed. *It can be seen that differences between muscles as well as* between groups are significant. Figures 4 and 5 shows the plots of the means of the RT2 scores for the muscles and groups respectively

A post-hoc analysis, using the Scheffe formula for multiple comparisons, was carried out to determine the nature of these differences.

FIGURE FOUR: PLOT OF ESTIMATED MEANS FOR THE SEVERITY OF THE MFTP's (RT2) FOR DIFFERENT MUSCLES.

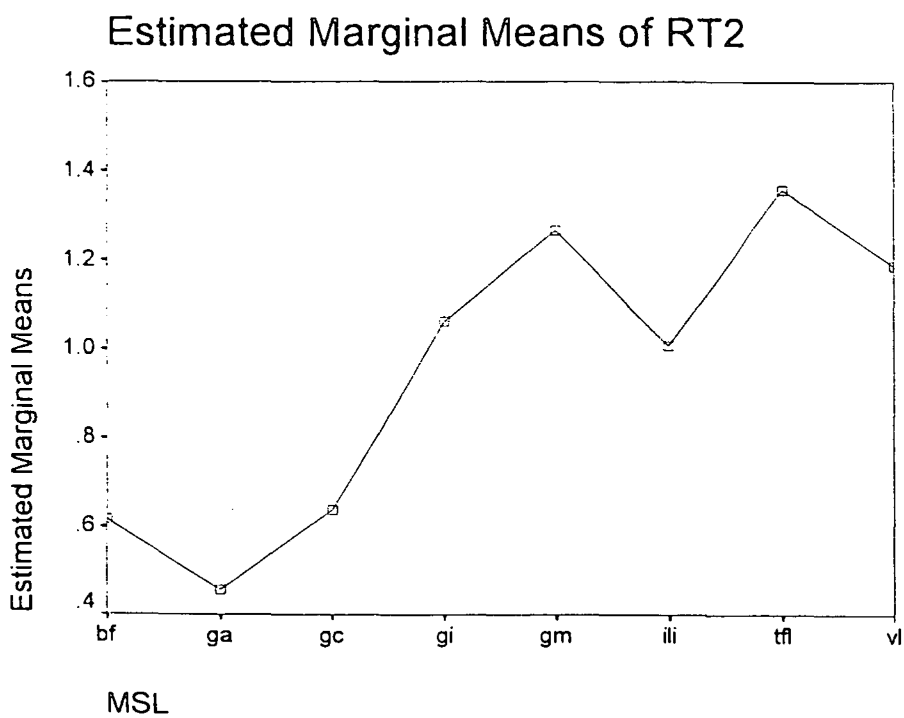
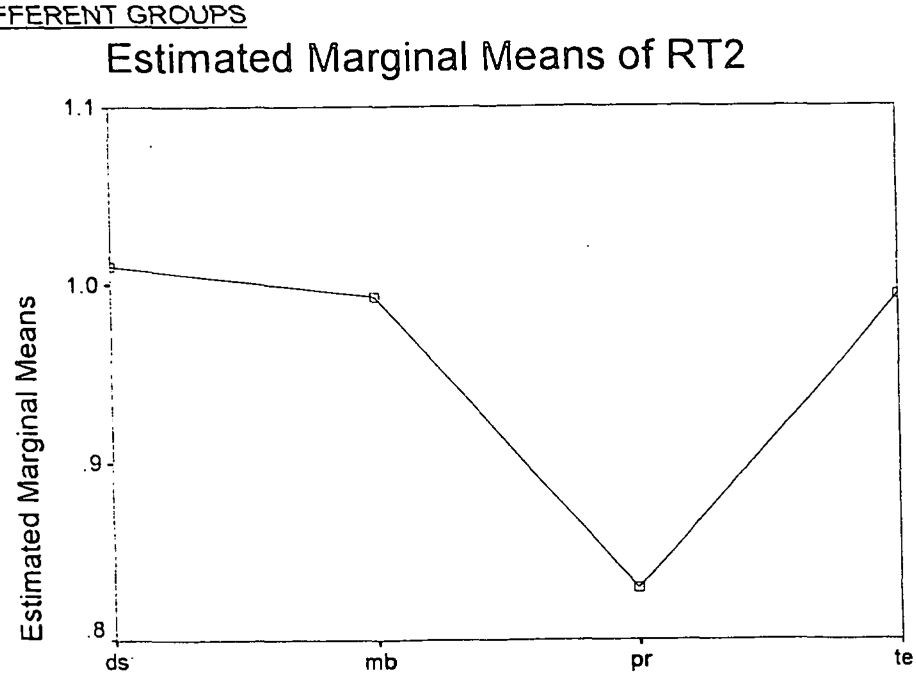


FIGURE FIVE: PLOT OF ESTIMATED MEANS OF RT2 (SEVERITY OF MFTP's) FOR THE DIFFERENT GROUPS



CASE PROCESSING SUMMARY

			CASES			
	VALID		*MISSING*		*TOTAL*	
	N	PERCENT	N	PERCENT	N	PERCENT
RT2 (active, *latent*, NAD).* GROUP * MUSCLE	1680	100%	0	.0%	1680	100.0%

TABLE FOUR: CROSS TABULATION OF CATEGORICAL RT1(ALGOMETER READINGS) AND RT2 (ACTIVE,LATENT, NAD MFTP's).

			RT2		
		0	1	2	TOTAL
NTILES of RT1	1	27	209	188	424
	2	*88*	*187*	*143*	*418*
	3	147	197	75	419
	4	251	143	25	419
TOTAL		513	736	431	1680

In order to investigate the relationship between the 2 variables, the values of RT1 were divided into 4 categories (done automatically by the SPSS program) and a cross tabulation *(counts for each cell) done for each of the 4 categories of RT1 combined with each* of the 3 categories RT2. The summary is shown in table 4. Since the nature of the relationship between the 2 variables is not obvious from the table, a correspondence analysis bi-plot was done (see figure 6). The plot shows that **n** (code 0 for RT2) is associated with category 4 of RT1, **L** (code 1 for RT2) is associated with category 3 of RT1 and **a** (code 2 for RT2) is associated with codes *1* and 2 of *RT1*. This shows that *RT1* and *RT2* are negatively correlated (the Pearson correlation coefficient is –0.491). This means that high (low) RT1 *scores are associated with* low *(high)* RT2 *codes.*

Therefore the more active the MFTP's, the lower the algometer reading, which is due to less

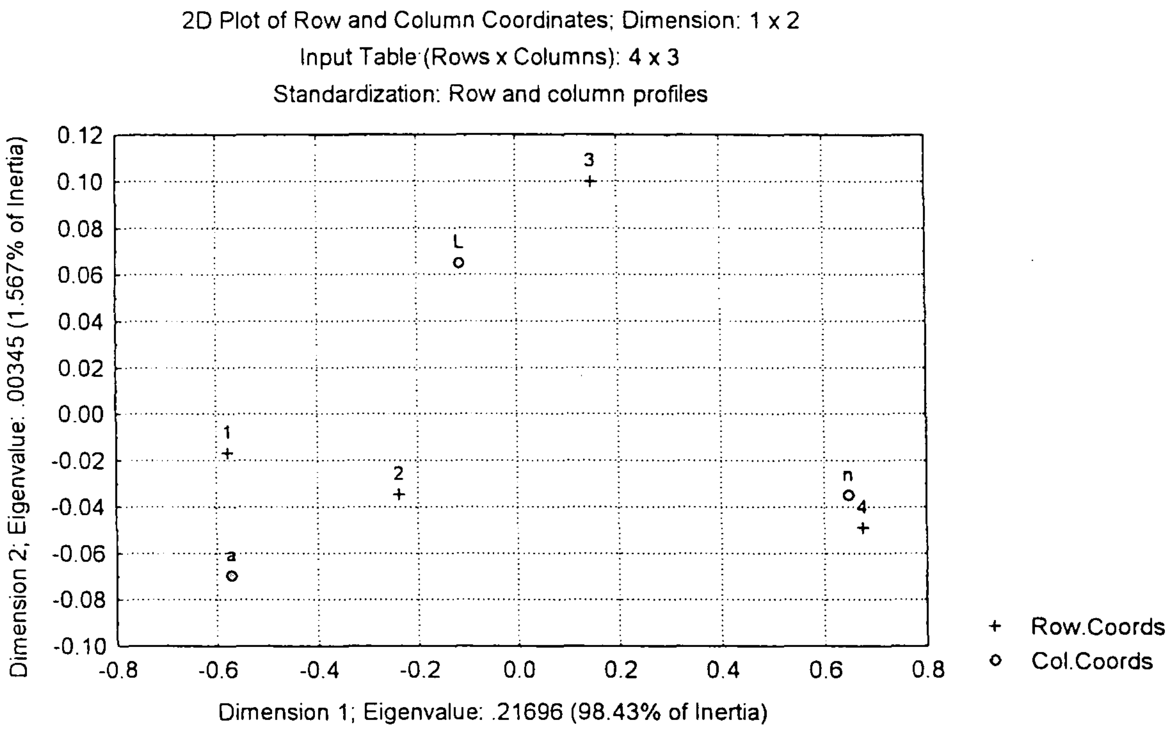


FIGURE SIX: BI- PLOT FOR CATEGORICAL ALGOMETER READINGS (RT1) AND SEVERITY OF MFTP's (RT2).

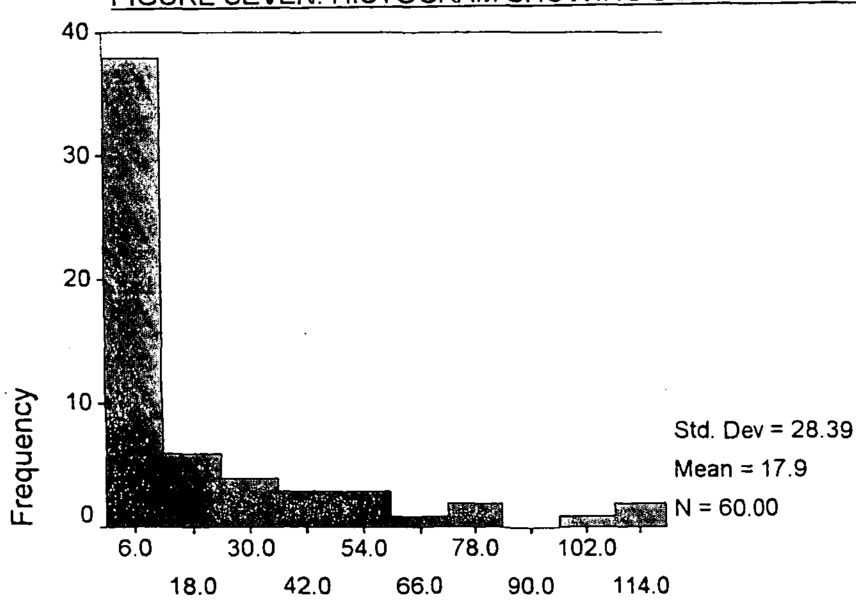
5 The severity and acuteness (or chronicity) of the ITBFS

A frequency distribution of the duration of the ITBFS (in months) is shown

Duration	Number	Cumulative %
over 0 to 12	43	72
over 12 to 24	5	80
over 24 to 36	3	85
over 36 to 48	3	90
over 48 to 60	1	92
over 60 to 72	2	95
over 72 to 84	0	95
over 84 to 96	1	97
over 96 to 108	0	97
over 108 to 120	2	100
Total	60	

A histogram of the data is shown in figure 7. The data are positively skew i.e. there is a considerable clustering of values at the lower end of the scale and a thin spread of values towards the upper end. From the table it can be seen that 43 of the 60 cases (72%) have a duration of less than 12 months (1 year). The general pattern is that as the duration gets longer, the number of cases get fewer and fewer.

FIGURE SEVEN: HISTOGRAM SHOWING DURATION FREQUENCIES OF ITB



6 Relationship between the Iliotibial band pain severity scale readings and Myofascial Diagnostic scale readings for the different muscles

The table below shows the means for each of the myofascial diagnostic scale muscle readings at ITBFS readings 7, 8, 9 and 10.

ITBFS reading

	7	8	9	10	Order of readings means
muscle\sample size	*11*	*34*	*12*	*3*	
Gluteus maximus	3.00	4.74	3.75	7.67	7 < 9 < 8 < 10
Gluteus *medius*	8.27	12.21	13.17	11.00	7 < 10 < 8 < 9
Gluteus Minimus	7.00	9.35	10.42	13.33	7 < 8 < 9 < 10
Biceps femoris	6.09	7.12	6.00	2.67	10 < 9 < 7 <8
Gastrocnemius	3.00	6.00	4.083	0	10 < 7 < 9 < 8
Iliopsoas	5.64	7.44	8.92	9.33	7 < 8 < 9 < 10
Vastus lateralis	11.09	11.44	11.33	9.33	10 < 7 < 9 < 8
Tensa Fasci lata	*10.45*	*10.79*	*10.67*	*14.67*	*7 < 9 < 8 < 10*

The unequal sample sizes (11, 34, 12 and 3) for the 4 ITBFS readings make reliable tests for differences between means difficult.

7 Comparison of MFDG values for the different muscles

In order to investigate differences between the means for the Myofascial diagnostic scale values for the muscles an Analysis of Variance was performed on their Myofascial diagnostic *scale values (the variable is dented by MFD). The results (shown in table 5) suggest* that the means for the muscles differ. A post-hoc analysis, using the Scheffe formula for multiple comparisons, was carried out to determine the nature of these differences. A summary of the results of the tests is shown in table 6. The following significant differences were observed.

iliopsoas < tensa fascia lata, vastus lateralis, gluteus medius, gluteus minimus, gastrocnemius, biceps femoris, gluteus maximus.

gluteus maximus< iliopsoas, tensa fascia lata, vastus lateralis, gluteus medius, gluteus minimus,

Gastrocnemius <tensa fascia lata, vastus lateralis, gluteus medius, gluteus minimus,

Iliopsoas< tensa fascia lata, vastus lateralis, gluteus medius,

UNIVARIATE ANALYSIS OF VARIANCE

Between subjects factors

MUSCLE	N
Biceps femoris	60
Glut max	60
Gastrocnemius	60
Glut min	60
Glut med	60
Iliopsoas	60
Tensa fascia lata	60
Vastus lateralis	60

TABLE 5: ANALYSIS OF VARIANCE SUMMARY BETWEEN THE SUBJECTS EFFECTS

FOR THE MYOFASCIAL DIAGNOSTIC SCALE

Dependant variable :myofascial diagnostic scale

Source	Type III sum of squares	df	Mean square	F	Sig
Corrected model	3565.331	7	509.333	29.130	.000
Intercept	32884.852	1	32884.852	1880.770	.000
Muscle	3565.331	7	509.333	29.130	.000
Error	8252.817	472	17.485		
Total	44703.000	480			

Corrected total	11818.148	479			

R squared=.302 (adjusted R squared = .291)

POST HOC TESTS

MUSCLE

Multiple comparisons

Dependant variable: myofascial diagnostic scale

Scheffe

Muscle Mus	Mean difference	Std error	sig	95% confidence lower bound	Interval Upper bound
Biceps fem					
Glut max	2.12	.763	.363	-.76	4.99
Gastrocnem	1.72	.763	.653	-1.16	4.59
Iliopsoas	-1.02	.763	.971	-3.89	1.86
Glut med	-5.13	.763	.000	-8.01	-2.26
Glut min	-2.85	.763	.055	-5.73	.03
TFL	-4.42	.763	.000	-7.29	-1.54
Vastus Lat	-4.77	.763	.000	-7.64	-1.89
Gluteus max					
Biceps Fem	-2.12	.763	.363	-4.99	.76
Gastrocnem	-.40	.763	1.000	-3.28	2.48
Iliopsoas	-3.13	.763	.020	-6.01	-.26
Glut med	-7.25	.763	.000	-10.13	-4.37
Glut min	-4.97	.763	.000	-7.84	-2.09
TFL	-6.53	.763	.000	-9.41	-3.66
Vastus Lat	-6.88	.763	.000	-9.76	-4.01

TABLE SIX: SUMMARY OF POST HOC TESTS FOR MYOFASCIAL DIAGNOSTIC SCALE FOR THE DIFFERENT MUSCLES.

			SUB	SET	
MUSCLE	N	1	2	3	4
Glut max	60	4.37			
Gastroc	60	4.77	4.77		
Biceps fem	60	6.48	6.48	6.48	
Iliopsoas	60		7.50	7.50	
Glut min	60			9.33	9.33
TFL	60				10.90
Vastus lat	60				11.25
Glut med	60				11.62
Sig		.363	.79	.055	.259

Means for groups in homogenous subsets are displayed

Based on type III sum of squares

The error term is Mean square (error)=17.485

a. Uses harmonic mean sample size=60.000

b. Alpha=.05

8 Comparison between ITB Pain severity scale and NRS readings

In order to compare the NRS (subjective) values at each ITBFS reading an Analysis of Variance was performed. The NRS variable is denoted by TDY. The results (shown in table 7) suggest that the NRS means for the different ITBFS readings differ. A post-hoc analysis, using the Duncan formula for multiple comparisons, was carried out to determine the nature of these differences. A summary of the results of the tests (shown in table 8) suggest that the TDY mean at ITBFS = 8 is less than that at ITBFS=10. None of the other means differ significantly. Beside this one difference observed there is little evidence of any pattern in the relationship between the ITBFS readings and the NRS values.

Univariate Analysis of Variance

Between-Subjects Factors

		N
ITB	7.00	11
	8.00	34
	9.00	12
	10.00	3

TABLE SEVEN: ANALYISIS OF VARIANCE SUMMARY OF BETWEEN SUBJECTS NRS RATING.

Tests of Between-Subjects Effects

Dependent Variable: TDY

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	15.239[a]	3	5.080	2.696	.055
Intercept	481.392	1	481.392	255.540	.000
ITB	15.239	3	5.080	2.696	.055
Error	105.494	56	1.884		
Total	884.000	60			
Corrected Total	120.733	59			

a. R Squared = .126 (Adjusted R Squared = .079)

Profile Plots

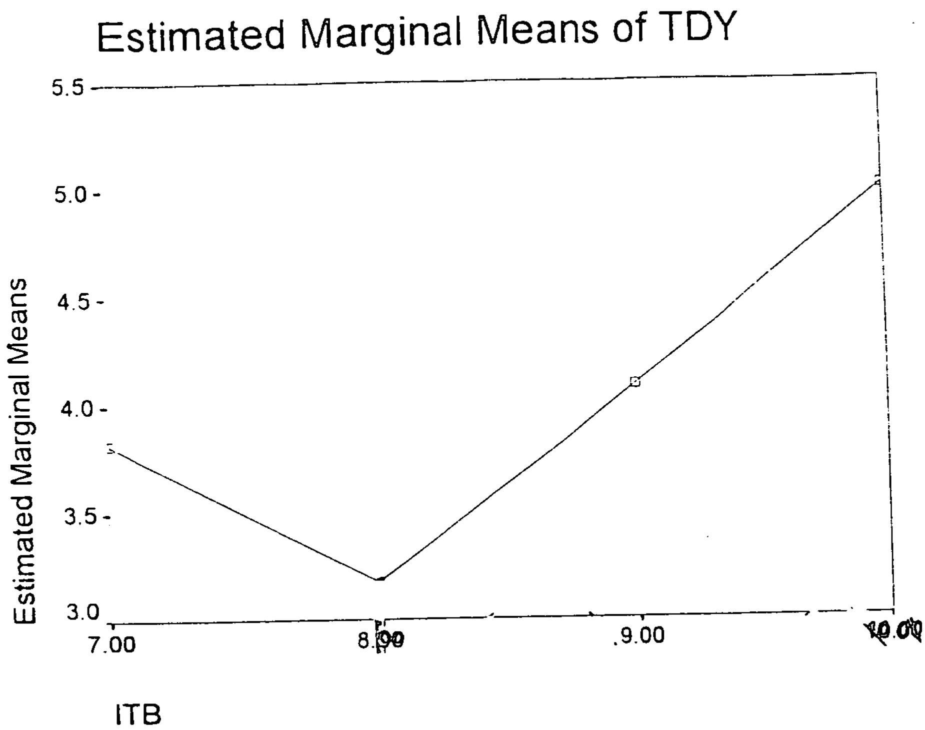


TABLE EIGHT: SUMMARY OF POST HOC TESTS FOR NRS TODAY(TDY), FOR THE DIFFERENT ITB PAIN SEVERITY SCALE READINGS.

Post Hoc Tests

ITB

Homogeneous Subsets

TDY

Duncan[a,b,c]

ITB	N	Subset 1	Subset 2
8.00	34	3.1765	
7.00	11	3.8182	3.8182
9.00	12	4.0833	4.0833
10.00	3		5.0000
Sig.		.235	.122

Means for groups in homogeneous subsets are displayed.
Based on Type III Sum of Squares
The error term is Mean Square(Error) = 1.884.

a. Uses Harmonic Mean Sample Size = 7.449.
b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.
c. Alpha = .05.

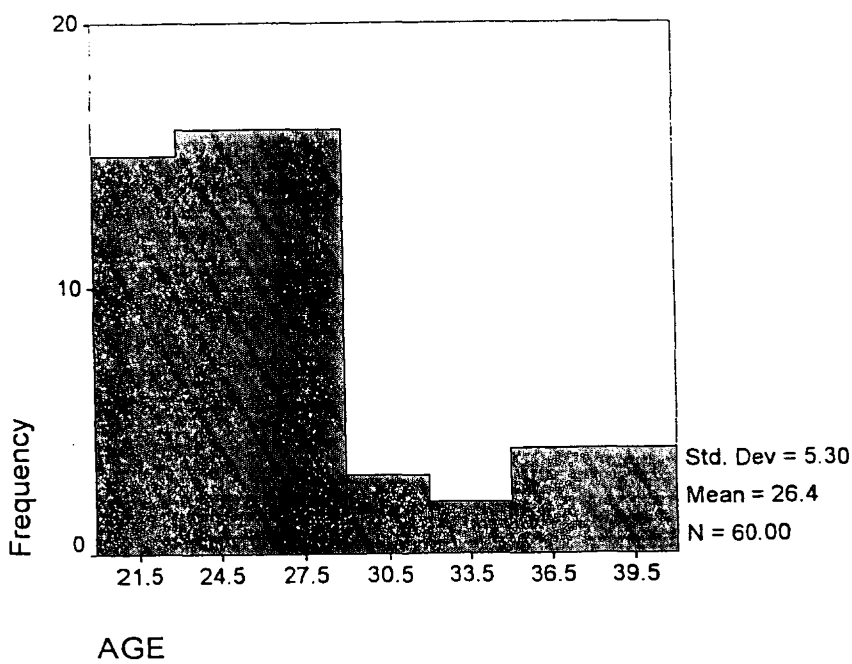
9 Distribution of ages

A frequency distribution of the ages (in months) is shown below.

Age	Number	Cumulative %
20-under 23	15	25
23-under 26	16	52
26-under 29	16	78
29-under 32	3	83
32-under 35	2	87
35-under 38	4	93
38-under 41	4	100
Total	60	

A histogram of the ages is shown in figure 9. The vast majority (78%) of the participants are 29 years or younger. The data are positively skew i.e. there is a considerable clustering of values at the lower end of the scale and less values towards the upper end.

FIGURE NINE- HISTOGRAM SHOWING AGE FREQUENCIES



10 Comparison of sides of leg affected

The hypothesis that the proportion of left sides of legs affected is 0.5 versus the alternative hypothesis that it is less than 0.5 is to be tested. For the purpose of the test the one case where both left and right sides were affected was discarded. Only one patient was affected bilaterally. Of the 59 cases that the test is based on, 22 left sides were affected, 37 right sides were affected. Using the binomial distribution formula with number of trials n=59 and probability (left hand side affected) = 0.5 gives

probability (22 or less out of 59 affected) = 0.0337.

Since this probability is less than 0.05, this is sufficient evidence to conclude that the proportion of left sides affected is less than 0.5 i.e. probably more right sides of legs than left sides are affected.

TABLE 9:

		Pain lat knee	Up & down stairs	Pain on act and rest	Pain on running	Pain after running	Nobles Test	Pain on lat knee when running	Mild Pain	Moderate Pain	Severe pain	NRS	Gluteus max	Gluteus medius	Gluteus min	Biceps femoris	Gastroc	Psoas	Vastus lateralis	TFL
Pain lat knee	Pearson Correlation	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Up and down stairs	Pearson Correlation	.	1.000	.	.	.	.	.	-.274*	.237	.109	.250	-.021	.207	.007	.003	.035	.158	.109	.065
	Sig. (2-tailed)	.	.	.	.	.	.	.	.034	.068	.408	.054	.871	.113	.960	.982	.792	.227	.409	.622
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Pain on act and rest	Pearson Correlation	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Pain on running	Pearson Correlation	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Pain after running	Pearson Correlation	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60

Nobles Test	Pearson Correlation	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Pain on lat knee when running	Pearson Correlation	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Mild pain	Pearson Correlation	.	-.274*	.	.	.	.	.	1.000	-.866**	-.397**	-.204	-.073	-.108	.062	-.048	.185	-.205	-.083	-.216
	Sig. (2-tailed)	.	.034	.	.	.	.	.	.	.000	.002	.119	.578	.411	.640	.716	.157	.116	.526	.098
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Moderate pain	Pearson Correlation	.	.237	.	.	.	.	.	-.866**	1.000	-.115	.241	.027	.134	-.057	.056	-.070	.168	.000	.052
	Sig. (2-tailed)	.	.068	.	.	.	.	.	.000	.	.383	.064	.835	.308	.665	.671	.593	.200	1.000	.696
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Severe Pain	Pearson Correlation	.	.109	.	.	.	.	.	-.397**	-.115	1.000	-.038	.095	-.031	-.017	-.007	-.239	.100	.166	.334**
	Sig. (2-tailed)	.	.408	.	.	.	.	.	.002	.383	.	.775	.470	.813	.895	.955	.066	.449	.205	.009
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
NRS	Pearson Correlation	.	.250	.	.	.	.	.	-.204	.241	-.038	1.000	-.031	.003	.123	.065	-.284*	.008	.076	-.053
	Sig. (2-tailed)	.	.054	.	.	.	.	.	.119	.064	.775	.	.813	.984	.351	.622	.028	.950	.565	.689
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60

Gluteus maximus	Pearson Correlation	.	-.021	.	.	.	.	.	-.073	.027	.095	-.031	1.000	.221	.301*	-.103	.030	.336**	.096	.143
	Sig. (2-tailed)	.	.871	.	.	.	.	.	.578	.835	.470	.813	.	.090	.019	.433	.821	.009	.467	.277
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Gluteus medius	Pearson Correlation	.	.207	.	.	.	.	.	-.108	.134	-.031	.003	.221	1.000	.391**	-.023	.042	.190	.249	.317*
	Sig. (2-tailed)	.	.113	.	.	.	.	.	.411	.308	.813	.984	.090	.	.002	.862	.751	.146	.055	.013
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Gluteus minimus	Pearson Correlation	.	.007	.	.	.	.	.	.062	-.057	-.017	.123	.301*	.391**	1.000	-.093	-.091	.281*	.246	.247
	Sig. (2-tailed)	.	.960	.	.	.	.	.	.640	.665	.895	.351	.019	.002	.	.480	.487	.029	.059	.057
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Biceps femoris	Pearson Correlation	.	.003	.	.	.	.	.	-.048	.056	-.007	.065	-.103	-.023	-.093	1.000	.316*	.018	.109	-.039
	Sig. (2-tailed)	.	.982	.	.	.	.	.	.716	.671	.955	.622	.433	.862	.480	.	.014	.894	.408	.766
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Gastroc	Pearson Correlation	.	.035	.	.	.	.	.	.185	-.070	-.239	-.284*	.030	.042	-.091	.316*	1.000	.122	-.022	-.158
	Sig. (2-tailed)	.	.792	.	.	.	.	.	.157	.593	.066	.028	.821	.751	.487	.014	.	.352	.870	.229
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Psoas	Pearson Correlation	.	.158	.	.	.	.	.	-.205	.168	.100	.008	.336**	.190	.281*	.018	.122	1.000	.363**	.211
	Sig. (2-tailed)	.	.227	.	.	.	.	.	.116	.200	.449	.950	.009	.146	.029	.894	.352	.	.004	.106
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Vastus lateralis	Pearson Correlation	.	.109	.	.	.	.	.	-.083	.000	.166	.076	.096	.249	.246	.109	-.022	.363**	1.000	.333**
	Sig. (2-tailed)	.	.409	.	.	.	.	.	.526	1.000	.205	.565	.467	.055	.059	.408	.870	.004	.	.009
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60

TFL	Pearson Correlation	.	.065	.	.	.	.	.	-.216	.052	.334**	-.053	.143	.317**	.247	-.039	-.158	.211	.333**	1.000
	Sig. (2-tailed)	.	.622	.	.	.	.	.	.098	.696	.009	.689	.277	.013	.057	.766	.229	.106	.009	.
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60

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

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

Blank spaces indicate areas where the correlation cannot be computed because at least one of the variables is constant.

TABLE NINE:

		Pain lat knee	Up & down stairs	Pain on act and rest	Pain on running	Pain after running	Nobles Test	Pain on lat knee when running	Mild Pain	Moderate Pain	Severe pain	NRS	Gluteus max	Glute mediu
Pain lat knee	Pearson Correlation	.	.	.	.	.	.	.	.	.	.	.	.	
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	
	N	60	60	60	60	60	60	60	60	60	60	60	60	6
Up and down stairs	Pearson Correlation	.	1.000	.	.	.	.	.	-.274*	.237	.109	.250	-.021	.2(
	Sig. (2-tailed)	.	.	.	.	.	.	.	.034	.068	.408	.054	.871	.1'
	N	60	60	60	60	60	60	60	60	60	60	60	60	6
Pain on act and rest	Pearson Correlation	.	.	.	.	.	.	.	.	.	.	.	.	
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	
	N	60	60	60	60	60	60	60	60	60	60	60	60	6
Pain on running	Pearson Correlation	.	.	.	.	.	.	.	.	.	.	.	.	
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	
	N	60	60	60	60	60	60	60	60	60	60	60	60	6
Pain after	Pearson	.	.	.	.	.	.	.	.	.	.	.	.	

running	Correlation													
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	
	N	60	60	60	60	60	60	60	60	60	60	60	60	6

Nobles Test	Pearson Correlation	.	.	.	.	.	.	.	.	.	.	.	.	
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	
	N	60	60	60	60	60	60	60	60	60	60	60	60	6
Pain on lat knee when running	Pearson Correlation	.	.	.	.	.	.	.	.	.	.	.	.	
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	
	N	60	60	60	60	60	60	60	60	60	60	60	60	6
Mild pain	Pearson Correlation	.	-.274*	.	.	.	.	.	1.000	-.866**	-.397**	-.204	-.073	-.1
	Sig. (2-tailed)	.	.034	.	.	.	.	.	.	.000	.002	.119	.578	.4
	N	60	60	60	60	60	60	60	60	60	60	60	60	6
Moderate pain	Pearson Correlation	.	.237	.	.	.	.	.	-.866**	1.000	-.115	.241	.027	.1
	Sig. (2-tailed)	.	.068	.	.	.	.	.	.000	.	.383	.064	.835	.3
	N	60	60	60	60	60	60	60	60	60	60	60	60	6
Severe Pain	Pearson Correlation	.	.109	.	.	.	.	.	-.397**	-.115	1.000	-.038	.095	-.0
	Sig. (2-tailed)	.	.408	.	.	.	.	.	.002	.383	.	.775	.470	.8
	N	60	60	60	60	60	60	60	60	60	60	60	60	6
NRS	Pearson Correlation	.	.250	.	.	.	.	.	-.204	.241	-.038	1.000	-.031	.0

	Sig. (2-tailed)	.	.054	.	.	.	.	.	.119	.064	.775	.	.813	.98
	N	60	60	60	60	60	60	60	60	60	60	60	60	6

Gluteus maximus	Pearson Correlation	.	-.021	.	.	.	.	.	-.073	.027	.095	-.031	1.000	.2
	Sig. (2-tailed)	.	.871	.	.	.	.	.	.578	.835	.470	.813	.	.0
	N	60	60	60	60	60	60	60	60	60	60	60	60	6
Gluteus medius	Pearson Correlation	.	.207	.	.	.	.	.	-.108	.134	-.031	.003	.221	1.0
	Sig. (2-tailed)	.	.113	.	.	.	.	.	.411	.308	.813	.984	.090	
	N	60	60	60	60	60	60	60	60	60	60	60	60	6
Gluteus minimus	Pearson Correlation	.	.007	.	.	.	.	.	.062	-.057	-.017	.123	.301*	.391
	Sig. (2-tailed)	.	.960	.	.	.	.	.	.640	.665	.895	.351	.019	.0
	N	60	60	60	60	60	60	60	60	60	60	60	60	6
Biceps femoris	Pearson Correlation	.	.003	.	.	.	.	.	-.048	.056	-.007	.065	-.103	-.0
	Sig. (2-tailed)	.	.982	.	.	.	.	.	.716	.671	.955	.622	.433	.8
	N	60	60	60	60	60	60	60	60	60	60	60	60	6
Gastroc	Pearson Correlation	.	.035	.	.	.	.	.	.185	-.070	-.239	-.284*	.030	.0
	Sig. (2-tailed)	.	.792	.	.	.	.	.	.157	.593	.066	.028	.821	.7
	N	60	60	60	60	60	60	60	60	60	60	60	60	6
Psoas	Pearson Correlation	.	.158	.	.	.	.	.	-.205	.168	.100	.008	.336**	.1
	Sig. (2-tailed)	.	.227	.	.	.	.	.	.116	.200	.449	.950	.009	.1

	N	60	60	60	60	60	60	60	60	60	60	60	60	6
Vastus lateralis	Pearson Correlation	.	.109	.	.	.	.	.	-.083	.000	.166	.076	.096	.2
	Sig. (2-tailed)	.	.409	.	.	.	.	.	.526	1.000	.205	.565	.467	.0
	N	60	60	60	60	60	60	60	60	60	60	60	60	6

TFL	Pearson Correlation	.	.065	.	.	.	.	.	-.216	.052	.334**	-.053	.143	.317
	Sig. (2-tailed)	.	.622	.	.	.	.	.	.098	.696	.009	.689	.277	.0
	N	60	60	60	60	60	60	60	60	60	60	60	60	6

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

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

Blank spaces indicate areas where the correlation cannot be computed because at least one of the variables is constant.

CHAPTER FIVE

DISCUSSION

1 LOCATION OF MFTP'S WITHIN THE MUSCLES

1.2 DATA LAYOUT AND PRELIMINARY ANALYSIS

The MFTP's were rated as NAD (no abnormalities detected) (code = 0), latent (code = 1) or active (code = 2). This rating (denoted by RT2) was done for each group, with there being 2, 3 or 4 groups of MFTPs' within each of the 8 muscles. This grouping analysis was done for each MFTP group within each muscle of each of the 60 patients. Each such MFTP group was rated in this data analysis.

Five of the muscles (biceps femoris, gastrocnemius, gluteus minimus, tensa fascia lata and vastus lateralis) had ratings for 4 groups (distal, mid-belly, proximal and tendinous), two of the muscles (gluteus maximus and gluteus medius) had ratings for 3 groups (distal, mid-belly and proximal) and the remaining muscle (iliopsoas) had ratings for only 2 groups (distal and proximal).

Table 1 in the chapter four shows a cross classification (counts for different categories) of the data on the basis of muscle (MSL), group (GRP) and RT2.

A log-linear analysis of table 1 shows that the best fitting model (to the data) is where RT2 is related to both MSL and GRP i.e. a model with RT2*MSL and RT2*GRP interaction effects. A plot of the fitted (according to the model) versus observed frequencies is shown in figure 1 of chapter four. The plot suggests that this model fits the data quite well, which shows that certain muscle groups had more groups of MFTP's than others

1.2 CORRESPONDENCE ANALYSIS RESULTS AND DISCUSSION

In order to determine the association between RT2 (rating) and GRP (group), a correspondence analysis bi-plot was done for each of the 7 muscles that had 4 or 3 groups. In these plots the row co-ordinate is RT2 and the column co-ordinate GRP. The 3 RT2 ratings are represented in the plots by **n** (for NAD), **L** (for latent) and **a** (for active). These bi-plots are shown in figures 2(a) – 2(g) in chapter four.

In such a plot, points that are in close proximity indicate a strong association between the values that represent the points **(n, a and L).** The further the points are removed, the weaker the association.

Therefore the conclusions for the different muscles are summarized below.

	Muscle	Figure	Summary of associations
1	Biceps femoris	2(a)	**L** with mid belly; **n** with proximal ; **a** (weakly associated) with distal and tendinous areas.
2	Gastrocnemius	2(b)	**L** with mid belly; **n** (weakly associated) with proximal and distal ; **a** (weakly associated) with tendinous areas.
3	Gluteus minimus	2(c)	**L** (weakly associated) with mid belly and proximal; **n** with tendonous ; **a** with distal areas
4	Tensa Fascia Lata	2(d)	**L** with mid belly; **n** not associated (closest to proximal); **a** with tendonous and distal areas.
5	Vastus Lateralis	2(e)	**L** with tendonous; **n** (weakly associated) with proximal; **a** with mid belly
6	Gluteus maximus	2(f)	**L** (weakly associated) with mid belly and proximal; **n** (weakly associated) with proximal and distal; **a** not associated
7	Gluteus medius	2(g)	**L** (weakly associated) with mid belly and proximal; **n** (weakly associated) with proximal; **a** (weakly associated) with distal.

A bi-plot for muscle iliopsoas (that has only 2 groups) is not possible. This is due to the fact that the count patterns under distal and proximal are virtually identical. This reduces the dimensions of the plot from 2 to 1. It is clear, from the patterns of the counts that mid belly and proximal are most strongly associated with L (highest count is next to code 1 which is L).

Biceps femoris muscle: The latent trigger points were associated with mid belly trigger points, which refer if activated, pain distally to the back of the knee, below the knee, into the calf and extends to the posterior thigh and buttock. (Travell and Simons, 1983; Chaitow and Delany, 2002). The active trigger points in muscle have a weak association in the distal and tendonous areas of the muscle and refer to the same areas the mid-belly MFTP's.

Gastrocnemius: The latent trigger points are found in the mid-belly. Trigger point 2 refers pain locally around the area in which it is. There was no prevalence of trigger points proximally and distally, and the most active MFTP's were found in the tendonous areas of the muscle, which refer pain to the lateral and medial aspect of the knee joint (Travell and Simons; 1983).

Gluteus minimus: The latent trigger points were found proximally and in the mid-belly. These trigger points, when activated, refer pain over the medial aspect of the buttock, down the back of the thigh and calf. The most active trigger points are found distally and refer pain to the lower lateral buttock, lateral aspect of the thigh, knee, leg and ankle (Travell and Simons 1983).

Tensa Fascia Lata: The latent trigger points found in the mid-belly may refer pain to the hip if activated. The active trigger points in the tendonous and distal areas refer pain to the anterolateral thigh, over the greater trochanter, down the thigh to the leg (Travell and Simons; 1983).

<u>Vastus Lateralis</u>: The most latent trigger points are found in the tendonous areas. Trigger points, when activated in this area, refer pain into the knee, to the patella, the lateral aspect of the thigh and to the lateral aspect of the leg (Travell and Simons; 1983). The active trigger points are found in the mid-belly and refer pain to the posterolateral region of the thigh, including half of the popliteal space, and may produce posterior knee pain. The well known "hornets nest" trigger points that are found at mid thigh level, refer pain over the entire length of the lateral thigh, anterior thigh pain, lateral border of the patella and may extend to the pelvic crest (Travell and Simons; 1983).

<u>Gluteus maximus</u>: The latent trigger points found in the mid-belly refer pain over the lower sacrum and laterally below the iliac crest. Other latent trigger points are found in the proximal area and refer to the gluteal cleft, posterior thigh and the sacroiliac joint. No significant trigger points were found in the distal areas (Travell and Simons; 1983).

<u>Gluteus medius</u>: The latent trigger points are found in the mid-belly and proximal areas of this muscle and refer pain to the buttock, posterior and lateral thigh. The active distal trigger points refer pain to the iliac crest, sacrum and sacroiliac regions (Travell and Simons; 1983).

Iliopsoas: The latent distal and proximal trigger points refer pain to the anterior thigh, groin, sacrum and sacroiliac joint, if activated. (Travell and Simons; 1983).

Most of the active and latent trigger points directly relate and or mimic the symptoms of ITBFS (Travell and Simons;1983), as can be seen from the table below. This is especially noteworthy when one considers the fact that the patients all presented with ITBFS.

TABLE 5.1

ITBFS	Pain over the lateral aspect of the knee, occasionally extending into the lateral aspect of the hip.
Biceps femoris	Pain referral to back of knee, calf, posterior thigh and buttock.
Gastrocnemius	Local pain and pain around the knee joint
Gluteus minimus	Pain over lateral aspect of thigh, knee, leg and ankle.
Tensa Fascia Latae	Pain in the hip, anterolateral thigh and down the thigh to the knee.
Vastus lateralis	Pain over the lateral aspect of thigh and leg.
Gluteus Maximus	Pain over the posterior thigh and sacroiliac (SI) joint.
Gluteus Medius	Pain over the posterior and lateral thigh and SI joint.
Iliopsoas	Pain over the anterior thigh, groin and SI joint.

2 SEVERITY OF MFTP'S

DATA LAYOUT

For each group of MFTP's within each muscle 60 patients were rated on a continuous scale. The rating score is denoted by RT1, which are the objective algometer readings. As for RT2, 5 of the muscles (biceps femoris, gastrocnemius, gluteus minimus, tensa fascia lata and vastus lateralis) had ratings for 4 groups (distal, mid belly, proximal and tendonous), two of the muscles (gluteus maximus and gluteus medius) had ratings for 3 groups (distal, mid belly and proximal) and the remaining muscle (iliopsoas) had ratings for only 2 groups (distal and proximal). This resulted in 1680 scores being recorded.

ANALYSIS OF VARIANCE RESULTS AND DISCUSSION

Table 2 in chapter four shows the results of the Analysis of Variance that were performed. From the table it can be seen that only the differences between muscles are significant. Figure 3 in chapter four shows a plot of the means of the RT1 scores for each muscle. The ranks of the means for the different muscles (rank 1 is largest and rank 8 the smallest) are shown below in table 5.2.

TABLE 5.2

Muscle	Gluteus maximus	Biceps Femoris	Gastrocnemius	Gluteus Minimus	Gluteus Medius	Tensa Fascia Lata	Vastus Lateralis	Iliopsoas
Rank	1	2	3	4	5	6	7	8

A post-hoc analysis, using the Scheffe formula for multiple comparisons, was carried out to determine the nature of these differences and the following significant differences were observed:

Iliopsoas < tensa fascia lata, vastus lateralis, gluteus medius, gluteus minimus, gastrocnemius, biceps femoris, gluteus maximus.

Tensa fascia lata, vastus lateralis < biceps femoris, gluteus maximus

Gluteus medius, gluteus minimus< gluteus maximus

The three most prevalent muscles will be discussed:

The more severe or active the trigger point, the lower the reading, due to less pressure being withstood by the patient (Fisher 1987). This is consistent with the findings, as it showed glut max was the least affected, followed by biceps femoris, gastrocnemius, glut min, glut med, TFL, vastus lateralis and lastly iliopsoas being the most affected.

Statistically it was shown that the groups within the muscles were not statistically significant, where as the muscles themselves were.

The **Iliopsoas muscle** was the most sensitive of all the muscles, having the lowest algometer reading. The referral pattern for this muscle is to the anterior thigh, groin, sacrum and sacroiliac joints (Travell and Simons, 1983; Chaitow and Delany, 2002) This muscle is referred to by Travell (1983) as the hidden prankster as it is often the cause of pain, when the patient abducts the thigh, laterally rotation and / or experiences pain during prolonged periods of sitting / standing and during running and jogging.

The sensitivity in this area may, however also be based on the fact that the psoas is a deep muscle, needing to be palpated through the abdominal wall, which in and of itself has pain sensitive structures passing through or around it (e.g. nerves - the femoral, lateral femoral cutaneous and genitofemoral nerve are all found in the lacuna muscularum which lies beneath the inguinal ligament (Travell and Simons 1983), as well as the iliohypogastric and ilioinguinal nerve may also penetrate the psoas major muscle, therefore increasing sensitivity (Travell and Simons;1983.Reid 1999)

However, in a patient suffering from ITBFS, the quadriceps muscle, which is a hip flexor (Travell and Simons, 1983; Chaitow and Delany, 2002) , is weakened, therefore overloading the iliopsoas muscle another principles flexor (Travell and Simons, 1983; Chaitow and Delany, 2002) becomes more possible, which could cause an increase in MFTP's in the iliopsoas and therefore the detected sensitivity in this study.

It is advised that more research is needed in order to identify the relationship between ITBFS and the iliopsoas muscle, with special emphasis on measures that can more accurately identify the MFTP's of iliopsoas muscle.

The **Tensa Fascia Lata (TFL) muscle** refers pain deep in the hip and to the anterolateral thigh, over the greater trochanter and extends down the thigh towards the knee (Travell and Simons, 1983; Chaitow and Delany, 2002). When present, the TFL can weaken the movements of flexion, abduction and medial rotation of the thigh, all of which are functions utilised by the body in order to stabilize the knee (Travell and Simons, 1983; Chaitow and Delany, 2002). The symptoms of TFL MFTP's are pain that prevents rapid walking, and pain on lying on the affected side.

This muscle is most closely linked with the iliotibial band (ITB) as the TFL attaches superiorly to the anterior superior iliac spine and the anterior iliac crest and distally to the lateral aspect of the lateral tubercle of the tibia via the ITB and to the lateral patella retinaculum (Travell and Simons, 1983; Chaitow and Delany, 2002).

Due to an overload of the ITB, trigger points are hypothesised to form in the TFL and vice versa.

It would however be interesting to note at what stages of the development of ITB this muscle becomes involved – is it a precursor to the syndrome or a consequence. When combining the results of this test, with the associations between the trigger point groups it seems to indicate that the TFL is not as integral as once thought. This is indicated by its relatively weak relationship with other muscle groups containing trigger points in patients with ITBFS (please see further discussion later).

Therefore more research is needed in order to understand its role and to establish whether MFTP's in the TFL are a result of ITBFS or whether ITBFS is a result of TFL MFTP's.

The **Vastus Lateralis muscle** is a strong extensor of the knee. MFTP's in the vastus lateralis muscle may disturb sleep and cause a locking of the patella with the knee extended or buckling of the knee (Travell and Simons, 1983; Chaitow and Delany, 2002). This muscle is often associated with patella femoral pain syndrome, knee joint pathology and tendonitis.

The vastus lateralis is the largest of the four quadriceps muscles and has five trigger point locations. The pain referral pattern for the superficial trigger points is along the lateral aspect of the thigh, to the outer aspect of the knee. The deep trigger points refer an explosive type pain up and down the thigh. The fibular collateral ligament harbours MFTP's, which refer to the lateral aspect of the knee (Travell and Simons; 1983).

This muscle attaches to the posterior aspect of the upper ¾ of the femur, to the lateral border of the patella and the retinaculum. In this way it shares attachments with the TFL and they are therefore highly interconnected and relative to each other. One of the major symptoms of MFTP's within vastus lateralis is pain on the lateral aspect of the knee when walking, which is casually associated with trigger points include gluteus minimus and the TFL (Travell and Simons, 1983; Chaitow and Delany, 2002). Due to the vastus lateralis attaching to the ITB on the lateral aspect of the thigh, a reasonable hypothesis would be that if one of the muscles or the band of the thigh, a reasonable hypothesis would be that if one of the muscles or the band is overloaded, the other will compensate, and due to overload cause MFTP's to form in the respective muscle. This relationship is further shown when one looks at the relationship of MFTP's between these muscles, the vastus lateralis is associated with the "leg" musculature of the gastrocnemius and the biceps femoris. This relationship however is weaker than that of the "hip" musculature discussed later under correlations.

3 COMPARISON OF RT2 MEANS

The data layout for the RT2 variable for the different muscles and groups is the same as that for the RT1 variable described in section 2.1.

Table 3 in chapter four shows the results of the Analysis of Variance that were performed. It can be seen that differences between muscles as well as between groups are significant. Figures 4 and 5 in chapter four shows the plots of the means of the RT2 scores for the muscles and groups respectively. The ranks for the muscles and the groups are shown here in table 5.3.

TABLE 5.3

For muscles:

Muscle	Tensa fascia lata	Gluteus Medius	Vastus Lateralis	Gluteus Minimus	Iliopsoas	Gastrocnemius	Biceps Femoris	Gluteus maximus
Rank	1	2	3	4	5	6	7	8

For groups:

Group	Distal	Mid belly	Tendonous	Proximal
Rank	1	2	3	4

A post-hoc analysis, using the Scheffe formula for multiple comparisons, was carried out to determine the nature of these differences. The following significant differences were observed:

For muscles:

gastrocnemius, biceps femoris, gluteus maximus<. Iliopsoas, tensa fascia lata, vastus lateralis, gluteus medius, gluteus minimus,

Iliopsoas< tensa fascia lata, gluteus medius.

Gluteus Minimus< Tensa Fascia Lata

For groups : proximal < distal, mid belly, tendonous

When comparing the means of the active, latent and NAD MFTP's, there was a difference between the individual muscles and the groups within these muscles. The three most prominent muscle groups will be discussed here:

The Tensa Fascia Lata (TFL) is the most prominent muscle. This means that it had the most active MFTP's in it, due to the hypothesized relationship with the ITB that has been previously discussed in chapter 5, number 2.

The second most prominent muscle was the Gluteus medius muscle. This muscle is a powerful abductor of the thigh and a pelvic stabilizer in single limb stance, such as running. This muscle can cause pain on walking, lying on the affected side and is often associated with sacroiliac dysfunction. Pain is generally referred to the ilium, sacrum, posterior and lateral buttock and upper thigh. The TFL is the only other major abductor of the hip, therefore if the TFL is affected; the gluteus medius is affected too, therefore overloading the muscle. Due to MFTP's in the gluteus medius muscle, there will be an associated weakness in the adductors, due to either overload or reciprocal pain inhibition in the antagonistic muscles.

This could result in compensating muscles such as vastus lateralis forming trigger points or causing excessive stress in the TFL which works together with gluteus medius. This causes an increased exacerbation of gluteus medius MFTP's and a perpetuating pain cycle.

According to table one in chapter four, the gluteus medius muscle and the vastus lateralis have the same number of active MFTP's, vastus lateralis have more latent MFTP's, which means that it could be compensating for gluteus medius weakness or functional inability.It may also indicate that due to the fact that the vastus lateralis is a bigger muscle, there is more area for trigger points to develop in.

There are two possible hypotheses that may explain the involvement of gluteus medius in ITBFS.

The first is the presence of adductor pathology, which causes the patient to be predisposed to the development of a high percentage of active MFTP's and latent MFTP's (the agonist-antagonist relationship of adductors and abductors). Gluteus medius has the highest percentage of active MFTP's, which results in the antagonistic TFL and vastus lateralis to develop or activate MFTP's within their muscles.

The second hypothesis is that if one of the three muscles, TFL, Vastus lateralis or gluteus medius are overloaded or have a primary pathology, they cause antagonistic muscles to develop MFTP's therefore creating a pain cycle where antagonists cause MFTP's to form in other muscles. Therefore developing a compensatory pain cycle.

Leg length inequality and gait abnormalities are all reliant on gluteus medius as a stabilizer. Therefore the link between structural biomechanical abnormalities causing pelvic inequality can now be linked to a myofascial component as well as a structural component. The myofascial component is the possible missing link that explains the causative factors in ITBFS.

The third muscle, the vastus lateralis, has been previously discussed in chapter 5, number 2.

4 THE RELATIONSHIP BETWEEN RT1 AND RT2

cross tabulation (counts for each cell) where done for each of the 4 categories of RT1 combined with each of the 3 categories RT2. The summary is shown in table 4 in chapter four. Since the nature of the relationship between the 2 variables is not obvious from the table, a correspondence analysis bi-plot was done (see figure 6 in chapter four). The plot shows that **n** (code 0 for RT2) is associated with category 4 of RT1, **L** (code 1 for RT2) is associated with category 3 of RT1 and **a** (code 2 for RT2) is associated with codes 1 and 2 of RT1.

This shows that RT1 and RT2 are negatively correlated (the Pearson correlation coefficient is –0.491). This means that high (low) RT1 scores are associated with low (high) RT2 codes.

Therefore, in terms of the clinical presentation of the patient, the more active the MFTP's, the lower the algometer reading, which is due to less pressure being withstood by the patient due to the pain being inflicted on the trigger point.

The higher the pound/kg pressure/ mm area, the higher the prevalence of NAD MFTP's and the lower the prevalence of active trigger points, as the relationship is inverse in nature.

Therefore this clinically shows that the algometer is a tool that should be utilized for the assessment of NAD and active MFTP's. However, this is not apparent for latent MFTP's which, show a decreased correlation with the algometer due to an average spread across all four algometer readings.

The latent MFTP's are defined as having no specific pain referral and therefore exist on a continuum between NAD and active and therefore will have a decreased affiliation with the algometer readings and be less predictable when using this tool.

This could also be as a result of the fact that the algometer is a tool better suited for pre and post intervention measurements (Fischer, 1987:207) on a single subject; and that intra-subject comparisons, as a baseline reading for the subjects under study can be achieved.

The inter-subject recording and comparison of the algometer readings, in this study, where potentially complicated by:

- Pain threshold of the various subjects
- Sensitivity of the subjects
- BMI of the subjects
- Psychosocial background of the subjects.
- No baseline reading being available for the subjects under study and therefore intra-patient comparisons cannot be captured and effectively compared. The use of inter-patient comparisons decreases the sensitivity and reliability of the algometer as different patients respond differently to the use of the algometer in once off readings.

Even though these readings indicate a correlation, the algometer is NOT a favoured tool in terms of comparative research (comparing individuals) as opposed to measuring improvement of the same individual.

It is thus recommended that future studies in this respect should not use the algometer as a measurement tool in the severity of MFTP's. Further to this, it is recommended that future studies look at developing another tool for the measurement of objective pain rating.

5 THE SEVERITY AND ACUTENESS (OR CHRONICITY) OF THE ITBFS

A frequency distribution of the duration of the ITBFS (in months) is shown below in table 5.4

TABLE 5.4

Duration/months	Number	Cumulative %
Over 0 to 12	43	72
Over 12 to 24	5	80
Over 24 to 36	3	85
Over 36 to 48	3	90
Over 48 to 60	1	92
Over 60 to 72	2	95
Over 72 to 84	0	95
Over 84 to 96	1	97
Over 96 to 108	0	97
Over 108 to 120	2	100

A histogram of the data is shown in figure 7 in chapter four. The data are positively skew i.e. there is a considerable clustering of values at the lower end of the scale and a thin spread of values towards the upper end. From the table it can be seen that 43 of the 60 cases (72%) have a duration of less than 12 months (1 year). The general pattern is that as the duration gets longer, the number of cases get fewer and fewer.

From the data it can be seen that 27 out the 60 cases (45%) are acute (of duration 3 months or less) and the remaining 33 cases (55%) are chronic.

Acute cases may be due to training errors, resulting in an increase in overload of the muscle, which causes activation of MFTP's, resulting in the pain.

Chronic cases could be as a result of latent MFTP's developing in muscles due to the MFTP's not being clinically active. Latent MFTP's cause inelasticity, stiffness yet no pain within the muscle, this muscle tightening and stiffness, it is hypothesised could lead to an increase in friction along the length of the ITB, which is one of the leading causes of ITBFS. Clinically lateral knee pain may be due to incorrect or no treatment of the latent MFTP's, which would the latent MFTP's to become a clinical entity especially when suddenly overloaded and therefore with a propensity to become active.

6 RELATIONSHIP BETWEEN THE ILIOTIBIAL BAND PAIN SEVERITY SCALE READINGS AND MYOFASCIAL DIAGNOSTIC SCALE READINGS FOR THE DIFFERENT MUSCLES

Table 5.5 below shows the means for each of the myofascial diagnostic scale muscle readings at ITBFS readings 7, 8, 9 and 10.

TABLE 5.5

ITBFS reading

	7	8	9	10	Order of readings means
Muscle\sample size	11	34	12	3	
Gluteus maximus	3.00	4.74	3.75	7.67	7 < 9 < 8 < 10
Gluteus medius	8.27	12.21	13.17	11.00	7 < 10 < 8 < 9
Gluteus Minimus	7.00	9.35	10.42	13.33	7 < 8 < 9 < 10
Biceps femoris	6.09	7.12	6.00	2.67	10 < 9 < 7 <8
Gastrocnemius	3.00	6.00	4.083	0	10 < 7 < 9 < 8
Iliopsoas	5.64	7.44	8.92	9.33	7 < 8 < 9 < 10
Vastus lateralis	11.09	11.44	11.33	9.33	10 < 7 < 9 < 8
Tensa Fascia lata	10.45	10.79	10.67	14.67	7 < 9 < 8 < 10

The unequal sample sizes (11, 34, 12 and 3) for the 4 ITBFS readings make reliable tests for differences between means difficult.

From the order column in the above table it can be seen that for muscles gluteus minimus and iliopsoas the magnitudes of the means follow the natural order (7, 8, 9, 10). This means that the readings for these muscles are positively related with the ITBFS readings i.e. as ITBFS readings increase so the values increase. For the muscles gluteus maximus and tensa fascia lata this relationship is also positive, but slightly weaker. The reason is that their order of magnitude (7, 9, 8, 10) differs slightly from the natural order. For gluteus medius values the order of magnitude of their means (7, 10, 9, 8) suggests that there is little or no relationship with the ITBFS readings. For the gastrocnemius and vastus lateralis muscles their order of magnitude of means (10, 7, 9, 8) also imply little or no relationship with the ITBFS readings. For the biceps femoris muscle the order of magnitude of the means (10, 9, 7, 8) implies that the values are negatively related with the ITBFS readings i.e. as ITBFS readings increase the values decrease. Correlation coefficients and scatter plots of ITBFS readings against the values for the various muscles suggest that none of the positive relationships that were identified are particularly strong and that the negative ones are insignificant.

The highest positive correlation coefficient of 0.316 is between the ITBFS readings and the gluteus minimus muscle values and the highest negative one of –0.117 is between the ITBFS readings and biceps femoris muscle values.

The TFL muscle readings are consistent until 10 (the maximum on the scale) on the ITB severity scale, as the MFTP's increase and become more active due to an increase in pain, there after the reading increases.

The Vastus Lateralis and gluteus medius muscles are consistent until 10, where they then decrease.

Due to these results, a hypothesis arises that majority of the time; gluteus medius, gluteus maximus, gluteus minimus and iliopsoas work together as pelvic stabilizers. When there is an overload of any of these muscles, the TFL and other leg muscles utilised during pelvic stabilization become activated as there is an alteration in gait due to the decrease ability of the clinically active muscles (gluteus medius, gluteus maximus, gluteus minimus and iliopsoas) to perform their function, resulting in an overload on the compensatory muscles or leg musculature assessed in this research.

A recommendation for further studies would be to compare clinically asymptomatic past sufferers of ITBFS and symptomatic patients based on gait and MFTP prevalence.

7 COMPARISON OF MFDG VALUES FOR THE DIFFERENT MUSCLES

In order to investigate differences between the means for the Myofascial diagnostic scale values for the muscles an Analysis of Variance was performed on their Myofascial diagnostic scale values (the variable is dented by MFD). The results (shown in table 5 in chapter four) suggest that the means for the muscles differ.

A post-hoc analysis, using the Scheffe formula for multiple comparisons, was carried out to determine the nature of these differences. A summary of the results of the tests is shown in table 6 in chapter four. The following significant differences were observed.

Iliopsoas < tensa fascia lata, vastus lateralis, gluteus medius, gluteus minimus, gastrocnemius, biceps femoris, gluteus maximus.

Gluteus maximus< iliopsoas, tensa fascia lata, vastus lateralis, gluteus medius, gluteus minimus,

Gastrocnemius <tensa fascia lata, vastus lateralis, gluteus medius, gluteus minimus,

Iliopsoas< tensa fascia lata, vastus lateralis, gluteus medius,

In order for a MFTP or muscle to be considered active according to the myofascial diagnostic scale, the total value of the scale for that particular muscle must be greater than 9.

The only muscles that this is applicable to is gluteus medius, minimus, TFL and vastus lateralis.

8 COMPARISON BETWEEN ITB PAIN SEVERITY SCALE AND NRS READINGS

In order to compare the NRS (subjective) values at each ITBFS reading an Analysis of Variance was performed (the NRS variable is denoted by TDY).

The results (shown in table 7 in chapter four) suggest that the NRS means for the different ITBFS readings differ.

A post-hoc analysis, using the Duncan formula for multiple comparisons, was carried out to determine the nature of these differences. A summary of the results of the tests (shown in table 8 in chapter four) suggest that the TDY mean at ITBFS = 8 is less than that at ITBFS=10. None of the other means differ significantly. Beside this one difference observed there is little evidence of any pattern in the relationship between the ITBFS readings and the NRS values.

The lower the ITB pain severity scale reading, the higher the NRS reading.

At 8; 9; 10 of the ITB pain severity scale, severity increased with an increase with NRS. The Numerical Rating scale (NRS) is a subjective measure, based on the patients perception of pain, and may be biased due to this. The majority of patients were rated at 7. The cumulative average is contrast to a lesser number of people, due to the majority being in this group. If the groups had more equal numbers, the graph would be more accurate.

9 DISTRIBUTION OF AGES

A frequency distribution of the ages (in months) is shown below in table 5.6.

TABLE 5.6

Age	Number	Cumulative %
20-under 23	15	25
23-under 26	16	52
26-under 29	16	78
29-under 32	3	83
32-under 35	2	87
35-under 38	4	93
38-under 41	4	100
Total	60	

between the ages of 20-40. Hall (1997) found that on average, the patients in her study were 30 years of age.

10 COMPARISON OF SIDES OF LEG AFFECTED

The hypothesis that the proportion of left sides of legs affected is 0.5 versus the alternative hypothesis that it is less than 0.5 is to be tested. For the purpose of the test the one case where both left and right sides were affected was discarded. Only one patient was affected bilaterally. Of the 59 cases that the test is based on, 22 left sides were affected, 37 right sides were affected. Using the binomial distribution formula with number of trials n=59 and probability (left hand side affected) = 0.5 gives probability (22 or less out of 59 affected) = 0.0337.

Since this probability is less than 0.05, this is sufficient evidence to conclude that the proportion of left sides affected is less than 0.5 (i.e. probably more right sides of legs than left sides are affected).

Firer (1989) and Lindenberg et al (1984) state that right sided ITBFS is dominant. This is due to the fact that both studies were conducted in South Africa where right hand driving occurs. Runners therefore run on the right hand side of the road facing on coming traffic for safety reasons, therefore resulting in right-sided injury. In contrast Saunders (1997) found that 57% of her sample had left sided injury. Noble (1979) Lindenberg et al (1984), Sutker et al (1985), Firer (1989), Noakes (1992) and

Firer (1989) and Lindenberg et al (1984) state that right sided ITBFS is dominant. This is due to the fact that both studies were conducted in South Africa where right hand driving occurs. Runners therefore run on the right hand side of the road facing on coming traffic for safety reasons, therefore resulting in right-sided injury. In contrast Saunders (1997) found that 57% of her sample had left sided injury. Noble (1979) Lindenberg et al (1984), Sutker et al (1985), Firer (1989), Noakes (1992) and Reid (1992) all state that injury occurs on the side of the body corresponding to the side of the road that the runner runs.

11. CORRELATIONS

FROM TABLE 9 IT CAN BE SEE THAT THE FOLLOWING POSITIVE AND SIGNIFICANT CORRELATIONS EXIST:

- With an increase in the MFDS for the gluteus maximus, there is a concomitant increase in the MFDS for the gluteus minimus. This relationship is significant at the 0.05 level.

- With an increase in the MFDS for the gluteus maximus, there is a concomitant increase in the MFDS for the psoas muscle. This relationship is significant at the 0.01 level.

- With an increase in the MFDS for the psoas muscle, there is a concomitant increase in the MFDS for the gluteus minimus. This relationship is significant at the 0.05 level.

- With an increase in the MFDS for the gluteus medius, there is a concomitant increase in the MFDS for the gluteus minimus. This relationship is significant at the 0.01 level.

- With an increase in the MFDS for the gluteus medius, there is a concomitant increase in the MFDS for the TFL. This relationship is significant at the 0.05 levels.

- With an increase in the MFDS for the TFL, there is a concomitant increase in the MFDS for the vastus lateralis. This relationship is significant at the 0.01 levels.

- With an increase in the MFDS for the psoas muscle, there is a concomitant increase in the MFDS for the vastus lateralis. This relationship is significant at the 0.01 levels.

- With an increase in the MFDS for the biceps femoris, there is a concomitant increase in the MFDS for the gastrocnemius. This relationship is significant at the 0.05 level.

Therefore it can be seen that there is a strong triad of muscles (gluteus maximus, gluteus minimus and psoas) that presents in patients with ITBFS and that all three muscles should be assessed in patients presenting therewith.

This also indicates that in patient s that present with recurrent or chronic ITBFS, that the psoas muscle, which is frequently overlooked, in clinical examination, due to its anatomical location that does not allow for thorough evaluation and normally causes discomfort for the patient (Chaitow and Delany,2002; Travell and Simons,1983) should be assessed. A possibility also exists that chronic or recurrent ITBFS could be perpetuated by untreated psoas muscle MFTP's.

It is of interest to note that the psoas muscle is an internal rotator of the femur and hence the thigh (Chaitow and Delany, 2002; Travell and Simons, 1983) and is supported in this function by the gluteus medius and minimus and opposed in this function by the gluteus maximus which is an external rotator (Chaitow and Delany, 2002; Travell and Simons, 1983).

Further to this there is a high correlation between the presence of MFTP's in the psoas and vastus lateralis muscles. This could be related to the fact that the vastus lateralis and the psoas are both hip flexors.

Thus it would seem that the psoas muscle is the "king pin" in the above presentation of myofascial trigger points in a patient with ITBFS.

In addition to the above, the correlations between the gluteus medius and the TFL as well as the TFL and the vastus lateralis, indicate that there is a significant contribution to ITBFS from a myofascial component, as this myofascial component could be one of the causes for the lateral knee pain experienced by runners with ITBFS, based on the referral pain pattern, which is indicated as follows ...

- Pain in the hip joint and anterolateral thigh
- Posterolateral knee and thigh pain

- Mid and lateral gluteal pain and posterior and lateral thigh pain
- Pain extending to the knee
- Lateral knee pain

by (Chaitow and Delany,2002; Travell and Simons,1983).

Based on the above positive correlations the following questions arise:

1. Is ITBFS a consequence of friction that results from the ITB rubbing against the lateral femoral condyle or is it as a result of myofascial overload ?
2. Is ITBFS a syndrome that represents an imbalance between the internal and external rotators of the hip, but presents as lateral knee pain ?

It is recommended that future research address these questions in order to establish clarity in this respect.

<u>FROM TABLE 9 IT CAN BE SEE THAT THE FOLLOWING NEGATIVE AND SIGNIFICANT CORRELATIONS EXIST:</u>

- The presentation of TFL MFTP's (as per the MFDS) and the objective recording of severe pain as per the ITBFS scale.

- The presentation of gastrocnemius MFTP's (as per the MFDS) and the subjective reporting of pain as per the NRS.

These indicate that with an increase in with an increase in the reported and recorded pain, that there is a decrease in the recorded findings as per the MFDS for both the gastrocnemius and TFL muscles.

It is significant to note that the NRS, which is a subjective measure of pain, does not correlate with the objective pain measures for ITBFS for the gastrocnemius muscle. The lack of correlation could lie in the fact that the objective measures of pain are centered around the reproduction of the lateral knee pain by means of orthopedic tests such as Noble's, Ober's tests as well as the palpation of structures around the lateral knee. If the pain is not truly a lateral knee pain (i.e. myofascial in origin), then the objectively recorded pain would be a lot less (due to irreproducibility) than that recorded subjectively (or experienced) by the patient. This significance would only be present at the extremes of the pain scales and therefore it is recommended that with increased numbers of subjects the relationship shown here may become a significant relationship.

The relationship between the MFDS and the objective recording of pain in terms of the ITBFS scale, indicates that the relationship between the measurement of pain for ITBFS and the MFDS does not correlate well.

Further to this, the TFL and gastrocnemius muscles could only initially be involved in the development of the syndrome, but as the syndrome becomes more severe and the patient may / could change their gait pattern, such that these muscles become less stressed / overloaded and therefore will record fewer active MFTP's even though they may still contain a large number of latent MFTP's.

Another reason for this could be that as the patients develop a threshold number of active MFTP's in other muscles and only then do the TFL and gastrocnemius become activated. Therefore the TFL may have a low myofascial reading, while the ITBFS scale has a higher reading due to MFTP's in the vastus lateralis which is causing active lateral knee pain and positive finding's on local palpation and orthopedic testing.

In further support of this hypothesis it must also be noted that there is a significant negative relationship between mild pain (lower levels of pain objectively) and pain when ascending and descending stairs (higher levels reported subjectively). It is during this process that the TFL is most utilized in order to stabilize the trunk and as a result of an increase in pain. This indicates that the assessment of the patient for ITBFS via standard clinical assessment is not a good indicator of the severity of the condition with which the patient presents.

FROM TABLE 9 IT CAN BE SEE THAT THE FOLLOWING NEGATIVE AND NON-SIGNIFICANT RELATIONSHIPS:

- NRS and mild pain
- NRS and severe pain
- NRS and TFL

Again, it is significant to note that the NRS, which is a subjective measure of pain, does not correlate with the objective pain measures for ITBFS. The lack of

- NRS and severe pain

- NRS and TFL

Again, it is significant to note that the NRS, which is a subjective measure of pain, does not correlate with the objective pain measures for ITBFS. The lack of correlation could lie in the fact that the objective measures of pain are centered on the reproduction of the lateral knee pain by means of orthopedic tests such as Noble's, Ober's tests as well as the palpation of structures around the lateral knee. If the pain is not truly a lateral knee pain (i.e. myofascial in origin), then the objectively recorded pain would be a lot less (due to irreproducibility) than that recorded subjectively (or experienced) by the patient. This significance would only be present at the extremes of the pain scales and therefore it is recommended that with increased numbers of subjects the relationship shown here may become a significant relationship.

In support of the negative correlation between the MFDS (objective) of the TFL and the NRS (subjective), it must also be noted that there is however a significant positive relationship between TFL and gluteus medius / vastus lateralis, these relationships are less significant that those between the gluteal muscles and the psoas and the psoas with the vastus lateralis. Therefore by implication, the TFL only becomes active in terms of MFTP's once the gluteal muscles, vastus lateralis and the psoas have already got active MFTP's. Therefore the patient will be experiencing more pain than can be objectively recorded on the MFDS.

The above therefore indicates that the assessment of the patient for ITBFS via standard clinical assessment is not a good indicator of the severity of :

1. Any one of the possible myofascial components and / or
2. The pain that the patient is experiencing at the time of evaluation.

- Gluteus maximus and mild pain
- Gluteus medius and mild pain
- Psoas and mild pain
- TFL and mild pain
- Vastus lateralis and mild pain
- Biceps femoris and mild pain

- Gluteus medius and severe pain
- Gluteus minimus and severe pain
- Gluteus medius and severe pain
- Gastrocnemius and severe pain

Here it is significant to note that the MFDS, which is a objective measure of pain relative to a specific set of muscles and that muscles MFTP's, does not correlate with the objective pain measures for ITBFS.

The lack of correlation could lie in the fact that the objective measures of pain are centered on the reproduction of the lateral knee pain by means of orthopedic tests such as Noble's, Ober's tests as well as the palpation of structures around the lateral knee.

- Gluteus minimus and moderate pain
- Gastrocnemius and moderate pain

As the above two muscles are not either directly attached to the ITB or strong antagonists / agonists in the internal and external rotation of the hip, they would only be active at the extreme ends of the spectrum in respect of pain. This means that they would only correlate positively at the lower end of the spectrum (i.e. Having no active MTFP's when there is no ITBFS – which would resulting a positive correlation. Or having active MFTP's when recruited due to gait changes or as a result of becoming a primary facilitator of movement due to compensations (a.r.o. pain due to ITBFS) – which would result in a positive correlation.

Therefore, due to this study necessitating the patients present with lateral knee pain or ITBFS, the lower limit (as in no to mild pain could not be well assessed) and the upper limit only had 3 severe patients, no inferences could be made as to whether the above hypothesis is valid.

Thus further research in this regard is recommended in order to establish why these 2 muscles in particular show a negative correlation (even though at this level it is insignificant).

- Gluteus maximus and ascending and descending stairs

The negative relationship between these two aspects under study is related to the function of the gluteus maximus muscle as well as the muscles referred pain pattern.

As active MFTP's result in an elevated reading on the MFDS, the patient may report an increase in perceived pain, but not necessary that of lateral knee pain (as requested in this study), as the referral pain pattern for the gluteus medius does not include the lateral knee (Chaitow and Delany, 2002; Travell and Simons, 1983).

Also as this muscle is responsible for extension of the thigh around the hip joint (Chaitow and Delany, 2002; Travell and Simons, 1983), its function during the descent of stairs is minimal; therefore very little pain would be recorded in this respect by the patient, however ithe muscle would be activated and cause pain on ascending stairs. The objective assessment revealed a high MFDS reading.

- Gluteus maximus and biceps femoris
- Gluteus medius and biceps femoris
- TFL and biceps femoris

- TFL and gastrocnemius
- Gluteus minimus and gastrocnemius
- Vastus lateralis and gastrocnemius

From the above negative correlations it would seem that, the lower extremity musculature (biceps femoris and gastrocnemius) only become involved once the hip musculature (gluteus medius, maximus, TFL and vastus lateralis) becomes less involved or vice versa.

- Gluteus minimus and gastrocnemius
- Vastus lateralis and gastrocnemius

From the above negative correlations it would seem that, the lower extremity musculature (biceps femoris and gastrocnemius) only become involved once the hip musculature (gluteus medius, maximus, TFL and vastus lateralis) becomes less involved or vice versa.

This indicates that the development of the ITBFS has two portions to its development. Either there is a change in the lower extremity such that the gastrocnemius and the biceps femoris are affected, which subsequently leads to the hip internal / external rotation muscles becoming involved (an example of this would be an athlete that changes their shoes or inserts a anti-supination or anti-pronation device) or alternatively, there is a another predisposing factor to the development of ITBFS, which results in the hip musculature becoming involved initially (as could be the case with a patient who has had chronic sacro-iliac syndrome). This is then followed by a gait change to decrease the pain experienced and results in the development of the lower limb MFTP's.

The above hypotheses are supported by the results of the muscle rankings as per;

ITBFS reading

	7	8	9	10	Order of readings means
Muscle\sample size	11	34	12	3	
Gluteus maximus	3.00	4.74	3.75	7.67	7 < 9 < 8 < 10
Gluteus medius	8.27	12.21	13.17	11.00	7 < 10 < 8 < 9

Gluteus minimus	7.00	9.35	10.42	13.33	7 < 8 < 9 < 10
Biceps femoris	6.09	7.12	6.00	2.67	10 < 9 < 7 <8
Gastrocnemius	3.00	6.00	4.083	0	10 < 7 < 9 < 8
Iliopsoas	5.64	7.44	8.92	9.33	7 < 8 < 9 < 10
Vastus lateralis	11.09	11.44	11.33	9.33	10 < 7 < 9 < 8
Tensa fascia lata	10.45	10.79	10.67	14.67	7 < 9 < 8 < 10

Where it indicates that the muscles of the lower extremity are present together and the hip musculature present together. However it is interesting to note from the above table that the lower extremity muscles play a role in a reportedly less painful presentation of the condition, whereas the hip musculature play a greater role in the more acutely painful clinical presentation. Inferences can therefore be made that the leg musculature possibly the causative agents as well as the perpetuators of the ITBFS syndrome, whereas the hip musculature only becomes apparent in the stages of acute exacerbation of the condition, where compensations have reached their maximum compensation ability. This inference however is untested and further research in this respect is needed in order to quantify the relationship of the two muscle groups and then also to identify their role in the pathogenesis of the condition in order to lend insight into better treatment and clinical management of the condition.

CHAPTER SIX

CONCLUSION

The research has shown that the muscles that are most active in symptomatic ITBFS patients are Iliopsoas, tensa fascia lata, vastus lateralis, with a significant contribution by muscles that have previously not been thought to be involved in this syndrome (i.e. psoas, gluteus maximus).

This introduces the possibility that there could be a hip internal – external rotation imbalance as the causative factor in the development of ITBFS, which needs to be further researched, with emphasis on the relationship between these muscles.

In this respect, the lower extremity muscles play a role in a reportedly less painful presentation of the condition, whereas the hip musculature plays a greater role in the more acutely painful clinical presentation. Inferences can therefore be made that the leg musculature are possibly the causative agents as well as the perpetuators of the ITBFS syndrome, whereas the hip musculature only becomes apparent in the stages of acute exacerbation of the condition, where compensations have reached their maximum compensation ability. This inference however is untested and further research in this respect is needed in order to quantify the relationship of the two muscle groups and then also to identify their role in the pathogenesis of the condition in order to lend insight into better treatment and clinical management of the condition.

Further to this there is a large correlation between myofascial pain dysfunction syndrome and ITBFS. There is an overlap in the signs and symptoms of the two syndromes, according to the clinical presentation of the patients and the literature (Travel and Simons, 1983 and Noakes and Granger, 1990). Even though there was a large correlation between the two syndromes, no individual factors could be recognised in either the MFDS or the ITBFS scale that had a strong correlation in order for the clinician to be able to utilise specific clinical interventions to identify the cause as being myofascial in origin or not.

RECOMMENDATIONS

a. During the course of this research it was noted that a large majority of the MFTP's were located in the vastus lateralis muscle. This muscle is closely associated with the Iliotibial band (Moore and Dalley. 1999: 564). As a result the researcher questions whether the diagnosis of Iliotibial band friction syndrome is precipitated by, concomitant with or a cause of the MFTP's. Further research to isolate these individuals factors is recommended as it would facilitate improved identification of indicators for the development of the syndrome. This would result in improved preventative care for patients that are then likely to develop ITBFS.

b. The palpation of the MFTP's was performed by the researcher, a sixth year chiropractic student. Inexperience may have been a factor in determining the accuracy of trigger point identification, whereas an experienced chiropractor would have been able to provide more reliable palpation findings.

c. Further studies should try to focus on specific populations. For example limit the study to long distance runners or cyclists.

d. The Myofascial Diagnostic Scale should have been applied to each trigger point individually as it would have give deeper insight into the extent of the MFTPs.

e. The vague criteria required to diagnose ITBFS is a problem. Many other knee conditions are likely to be diagnosed as ITBFS due to the non-specific nature of the diagnostic criteria. More sensitive and accurate measures such as diagnostic ultrasound, radiographic examination should be considered for use in further studies.

f. Future studies could look at flexibility deficits of the muscles as a possible objective measure as it relates to the presence of myofascial trigger points and their shortening effect on musculature.

g. This study was structured such that it only addressed the functional component(s) of ITBFS, therefore no inferences can be made as regards the affect of structural changes on ITBFS. Therefore it is suggested that future studies include or further examine or compare these structural factors to myofascial involvement. (i.e. Measurement of the feet should be taken in order to establish the significance of hyper pronation in patients with ITBFS. In a study done by Lindenberg et al (1984), 83% of patients with ITBFS showed a varum alignment of the foot. This is a definitive causative factor, which should be investigated in further studies. The involvement of a podiatrist may be of value in further studies by supplying specific orthotics with conservative treatment versus conservative treatment alone).

h. The study should be repeated with the same sample size, but with treatment included. An investigative study comparing the treatment of the tensa fascia lata muscle and the iliotibial band versus all the muscles involved in this study should be conducted in order to confirm the studies findings and establish a myofascial component of the syndrome and redefine the treatment protocol.

i. Statistically it was difficult to assess the patients pain threshold as there was only one set of readings taken for the study, and as pain is a subjective measurement, we were unable to obtain an accurate representation of the specific sensitivity of the patients, as they were compared with other patients and not with themselves.

CHAPTER SEVEN:

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APPENDICES:

APPENDIX 1

Are you suffering from Pain on the outside of the knee/ITB?

You are invited to participate in research being conducted at Durban Institute of Technology

CHIROPRACTIC DAY CLINIC

FREE TREATMENT

is available should you qualify for the study
For more information contact:

MICHELE

031-2042205 or 031-2042512

APPENDIX 2

Questions to be asked during telephonic interview:

Inclusion Criteria

Are you between the ages of 20 and 40?

Is the pain you are experiencing on the lateral (outside) of the knee?

Do any of the following aggravate your pain:

- Running
- Descending stairs,
- prolonged sitting then walking or running
- physical activity

Exclusion Criteria

Have you had any history of any of the following that you know of?

- Local or systemic pathology,
- any neurological problem effecting the way you walk,
- have you undergone any knee surgery over the past 2 years,
- Knee bursitis, patella tendonitis.
- arthritis in your knees

Are you pregnant or breast feeding at present? Are you receiving any treatment for this condition at present?

APPENDIX 1b

Telephonic interview in zulu pending approval

DURBAN INSTITUTE OF TECHNOLOGY
CHIROPRACTIC DAY CLINIC
CASE HISTORY

Patient: .... Date: ....

File # : .... Age : ....

Sex : .... Occupation: ....

Intern : ....Signature: ....

FOR CLINICIANS USE ONLY:

Initial visit

Clinician: Signature :

Case History:

Examination:

Previous: Current:

X-Ray Studies:

Previous: Current:

Clinical Path. lab:

Previous: Current:

CASE STATUS:

PTT:	Signature:	Date:

CONDITIONAL:

Reason for Conditional:..

....

....

Signature: Date:

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

Case History signed off:	Date:

6. **Current health status and life-style:**

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

7. **Immediate Family Medical History:**

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

8. **Psychosocial history:**

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

Appendix 4

DURBAN INSTITUTE OF TECHNOLOGY

22/10/2002

PHYSICAL EXAMINATION
SENIOR & RESEARCH

Patient:________________________________**File#:**____________**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

COMMENTS

NEUROLOGICAL EXAMINATION: See regionals

Clinician: **Signature:**

Appendix 5

DURBAN INSTITUTE 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__________

Appendix 6

HIP REGIONAL EXAMINATION

TECHNIKON NATAL

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:

Iliac crests ____________________
Greater trochanter ____________________
Pubic symphysis and tubercle ____________________
Femoral head ____________________
Femoral Δ - femoral artery ____________________
- lymph nodes ____________________

ASIS's ____________________
Inguinal ligament ____________________
Inguinal hernia ____________________
Muscles - Quadriceps ____________________
- Adductors ____________________
- Abductors ____________________
- Psoas ____________________

- Posterior aspect:

Iliac crests posteriorly ____________________
Ischial tuberosity ____________________
Muscles - Piriformis ____________________
- Gluteals ____________________
- Hamstrings ____________________

PSIS's ____________________
Sciatic notch ____________________
SI joints ____________________
Lumbar Spine ____________________
Sacrum + coccyx ____________________

Active Movements (note ROM and pain)

Flexion (110-120°) ____________________
Extension (10-15°) ____________________
Adduction (30°) ____________________
Abduction (30-50°) ____________________
Medial rotation (30-40°) ____________________
Lateral rotation (40-60°) ____________________

Appendix 7

COMPARISON BETWEEN NRS-101 AND THE ILIOTIBIALBAND PAIN SEVERITY SCALE.

Symptomatic ITBFS:

	Iliotibialband Pain Severity Scale		NRS-101
1	8 – 10	80%	80%
2	9 – 10	90%	80%
3	9 - 10	90%	90%
4	9 – 10	90%	80%

Asymptomatic:

	Iliotibialband Pain Severity Scale		NRS-101
5	0 – 10	0%	0%
6	0 - 10	0%	0%
7.	0 – 10	0%	0%
8.	0 – 10	0%	0%

Appendix 8

Iliotibialband Pain Severity Scale

Name ______________________________ File ___________

Date ______________________________

Iliotibialband Pain Severity Scale	Yes (tick if applicable)	No (tick if applicable)	Points awarded by researcher
History:			
I experience pain on the lateral aspect of my knee when running or walking fast			1
I experience pain on the lateral aspect of my knee when ascending or descending stairs			1
My pain is worsened with physical activity and relieved by rest.			1
Signs:			
The patient experiences pain on running or walking fast			1
The patient experiences pain after running or walking fast			1
The patient experiences pain on the outside of my knee when bending my knee to 30 degrees and compressing it 3cm above the knee.			1
Symptoms:			
I experience pain on the outside of my knee when running or walking fast.			1
My pain is mild when running or walking fast.			1
My pain is moderate when running or walking fast.			2
My pain is severe when running or walking fast.			3
Total out of 10 points			

Appendix 9

Myofascial Diagnostic Scale

Patient name: File no.:
Muscle affected: Treatment no.:

Trigger point signs

1	Soft Tissue Tenderness			
	Grade:	0	No tenderness	0
		I	Tenderness to palpation WITHOUT grimace or flinch	1
		II	Tenderness to palpation WITH grimace or flinch	2
		III	Tenderness with WITHDRAWAL (÷ Jump sign)	3
		IV	Withdrawal (÷Jump sign) to non-noxious stimuli (ie. Superficial palpation, gentle percussion)	4
2	Snapping palpation of the trigger point evokes a local twitch response.			4
3	The trigger point is found in a palpable taut band.			4
4	Moderate, sustained pressure on the trigger point causes or intensifies pain in the reference zone.			5
			TOTAL	17

NUMERICAL PAIN RATING SCALE 101

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**

Myofascial Diagnostic Scale (Chettiar 2001)

Name ______________________________ File __________

Date ______________________________

Active MTrp's	Latent MTrp's

Numerical Rating Scale:

0	1	2	3	4	5	6	7	8	9	10

Appendix 11

Name ______________________________ File __________

Date ______________________________

Duration of condition: number of weeks

1	2	3	4	5	6	7	8	9	1 0	1 1	>1 1

Number of months:

1	2	3	4	5	6	6+

Appendix 12

Location of trigger points:

	Tensor fascia lata	Vastus lateralis	Biceps femoris	Iliopsoas
Tendonous portion				Not applicable
Distal muscular portion				
mid belly of muscle				Not Applicable
Proximal muscular portion				
Other				

	Gluteus Maximus	Gluteus Medius	Gluteus Minimus	Gastrocnemius
Tendonous portion	Not Applicable	Not Applicable		
Distal muscular portion				
mid belly of muscle				
Proximal muscular portion				
Other				

Appendix 13

Algometer readings:

Name ______________________________ File ___________

Date ______________________________

	Tendonous Portion				Distal muscle				Mid-belly				Proximal muscle				Other				Total
Tensor facia lata																					
Vastus Lateralis																					
Biceps Femoris																					
Iliopsoas		N	A						N	A											
		N	A						N	A											

	Tendonous Portion				Distal muscle				Mid-belly				Proximal muscle				Other				Total
Gluteus Maximus	N	A																			
Gluteus Medius	N	A																			
Gluteus Minimus																					
Gastrocnemius																					

Total number of MTrp's ______________________

Mean weight (kg) ______________________

Informed Consent Form

Date June 2003

Title of research project an investigation into the association between the role of myofascial trigger points of the lower extremity and the clinical diagnosis of iliotibial band friction syndrome.

Name of supervisor:	Dr. C. Korporaal,	(031-2042205)
Name of research student:	Michele Broadhurst	(031-2042205)
Name of institution:	Durban Institute of Technology	

This study involves research on 60 patients, assessing whether people with a condition commonly known as iliotibial band friction syndrome have any myofascial trigger points in the lateral aspect of the leg, ie: tensor fascia lata, gluteus maximus, gluteus medius, gluteus minimus, gastrocnemius, vastus lateralis, biceps femoris and iliopsoas muscles.

Please circle the appropriate answer

1. Have you read the patient information sheet? YES / NO
2. Have you had opportunity to ask questions regarding this study? YES / NO
3. Have you received satisfactory answers to your questions? YES / NO
4. Have you had an opportunity to discuss this study? YES / NO
5. Have you received enough information about this study? YES / NO
6. Who have you spoken to?____
7. Do you understand the implications of your involvement in this study? YES / NO
8. Do you understand that you are free to withdraw from this study? YES / NO
   a) at any time?
   b) Without having to give a reason for withdrawing, and
   c) Without affecting your future health care.
9. Do you agree to voluntarily participate in this study? YES / NO

PATIENT/SUBJECT* Name____________________________
Signature__________________
(in block letters)

WITNESS Name____
Signature__________________
(in block letters)

RESEARCH STUDENT Name___________________________
Signature__________________
(in block letters)

If you have answered NO to any of the above questions, please do not hesitate to contact my supervisor who will be able to assist you.

Appendix 15

LETTER OF INFORMATION.

This letter will be translated into Zulu pending approval.

Dear Patient

Welcome to my study. Thank you for your interest. The title of my study is an investigation into the association between the role of myofascial trigger points of the lower extremity and the clinical diagnosis of iliotibial band friction syndrome.

Name of Supervisor:	Dr C Korporaal,	(031-2042205)
Name of student:	Michele Broadhurst	(031-2042205)
Name of institution:	Durban Institute of Technology	

Purpose of the study : This study will involve research on 60 patients assessing whether people with a condition commonly known as iliotibialband friction syndrome (ITBFS) have any hyperirritable knots in the muscles of the lower limb.

Procedure: You will be required to undergo a consultation during which a case history, relevant physical and knee and hip regional examinations will be performed. These examinations will assist in identifying any knots in the muscles of the outer side of the leg. You will also be required to fill out a pain questionnaire and answer some questions regarding your knee pain. The consultation will take approximately an hour and a half. This information will be gathered for the purpose of establishing correlations between the hyperirritable knots within the muscles and the condition commonly known as ITBFS.

Risks/discomfort: You may experience slight transient discomfort during or after the examination, however the utilisation of an algometer (a tool used to measure your pain levels) may also be beneficial as it mimics a therapeutic intervention.

Benefits: Two free treatments are offered at the Chiropractic Day Clinic subsequent to the completion of your participation in the study.

All treatment is free of charge and your participation is voluntary and you are free to withdraw at any point in time.

All patient information is confidential and the results will be used for research purposes only, although supervisors and senior clinic staff may be required to inspect records. You have the right to be informed of any new findings that are made. You may ask questions of an independent source if you wish to (my supervisor is available on the above numbers). If you are not satisfied with any area of the study please feel free to forward any concerns to my supervisor.
Thank you for your interest and participation.

Yours faithfully,

Michele Broadhurst (Chiropractic Intern) Dr C Korporaal (supervisor)