

THE RELATIVE EFFECTIVENESS OF INTERMITTENT PERCUSSION AS OPPOSED TO DRY NEEDLING IN THE TREATMENT OF MYOFASCIAL TRIGGER POINTS OF QUADRATUS LUMBORUM AND GLUTEUS MEDIUS MUSCLES

A dissertation submitted to the Faculty of Health Services, Technikon Natal, in partial compliance with the requirements for the Master's Degree in Technology: Chiropractic.

by

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I, Cherelyn Theresa Drew, do hereby declare that this dissertation is representative of my own work, both in concept and execution, except where otherwise indicated in the text.

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DEDICATION.

This dissertation has been dedicated to my parents,

Nick and Shen Drew.

Your love, support, wisdom and strength have inspired me to be the best I can.

PS. I made it!

ACKNOWLEDGEMENTS.

DR GREG PARKIN-SMITH: Thank you for bearing with me. It has not been easy but this is the result of our combined effort. Your time, energy and effort are appreciated.

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I love you.

ABSTRACT.

The purpose of this clinical trial is to evaluate the relative effectiveness of intermittent percussion versus dry needling in patients with low back pain of quadratus lumborum and gluteus medius myofascial origin, in terms of objective and subjective clinical findings. The objective of the study is to evaluate if either of the two treatments are effective and which of the two has the greater effect.

This randomized comparative clinical trial consisted of a sample size of thirty patients, all suffering from low back pain of quadratus lumborum and gluteus medius myofascial origin. Patients were obtained by consecutive sampling, whereby, any patient presenting to the Technikon Natal Chiropractic Day Clinic suffering from low back pain was carefully assessed. Only patients that conformed to the strict inclusion criteria were accepted into the study. The patients were randomly divided into two groups of fifteen patients each. Group A received dry needling and Group B received intermittent percussion performed on all the active trigger points of the quadratus lumborum and gluteus medius muscles.

Each patient received five treatments over a four week period, followed by a re-evaluation consultation one month after the last treatment to determine the long term effects of the treatments. Objective data was collected using the goniometer (BROM II) and the algometer (Wagner Force Dial FDK 20) while subjective data was collected from three questionnaires: the Numerical Rating Scale 101, the Oswestry Low Back Pain Disability Questionnaire and the Short-Form McGill Pain Questionnaire. Data was collected at the beginning of the initial, the final and the follow-up consultation.

A statistical analysis was conducted using the non-parametric tests: Wilcoxon Signed Rank test for the intragroup analysis; and the Mann-Whitney U Test for the intergroup analysis. All analyses used the two-tailed test at a 95% level of confidence. The mean, standard deviation and standard error were also employed to further strengthen the results of the study.

Dry needling was shown to be ineffective with regard to objective clinical findings but showed a reduction in the level of disability that the patients experienced. This was not maintained over the one month follow-up period. Intermittent percussion was also found to be ineffective with regard to the objective clinical findings. With regard to the subjective clinical findings, intermittent percussion was shown to be effective in terms of reducing the quantity of pain, pain intensity and the level of disability. This was maintained over the one month follow-up period. The intergroup analysis showed that neither treatment was found to be more effective than the other.

In conclusion, neither dry needling nor intermittent percussion was found to be effective with regard to objective clinical findings. Intermittent percussion was effective in reducing the subjective clinical findings where dry needling was not. Neither treatment was shown to be more effective than the other.

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CHAPTER ONE

INTRODUCTION

CHAPTER 1.

INTRODUCTION.

1.1. BACKGROUND TO THE PROBLEM.

Forty percent of the body comprises skeletal musculature and this organ undergoes wear and tear daily (Gatterman 1990:285). Even though this is the largest organ in the human body, the least amount of research is performed in this field (Gatterman 1990:285). Pain in the skeletal musculature is largely due to the presence of myofascial trigger points (Rubin 1981), and as Travell and Simons (1983:5) indicate, myofasciitis affects everyone at some time in their lives.

A confusing situation has arisen as myofascial pain syndrome has gone by many names throughout the years and recording of the trigger points in medical journals dates back as early as the mid-1800's . The syndrome has been known as muscular rheumatism, myalgia, myogelosis and fibromyositis as well as many other names. (Auleciems 1995).

Trigger points are a commonly misdiagnosed condition in medical practice as they have varying symptoms, a diffuse and confusing pain pattern and their response to treatment is often unpredictable (Sola et al. 1955). Frustration in practice comes about as there is a misunderstanding about the condition and when undiagnosed, treatment of the patient's pain is often prolonged and unsuccessful (Rosen 1993). With correct diagnosis and treatment, prognosis of myofasciitis is excellent (Sandman 1981).

Myofascial pain is a regional muscle pain disorder characterised by local tenderness and pain (Fricton 1986:857). It is this pain which causes the patient to seek medical attention (Auleciems 1995). Myofascial trigger points are the most common cause of persistent back pain, shoulder pain, tension-type headaches and facial pain (Fricton 1986:857).

Myofascial trigger points are foci of hyperirritability in taut bands of skeletal muscle or muscle fascia that when compressed, give rise to characteristic referred pain patterns and various autonomic phenomena (Hong et al. 1993). Pain caused from trigger points may vary from being a mild discomfort to severely incapacitating (Auleciems 1995). This varies from person to person, making a diagnosis of the condition difficult.

Other symptoms associated with myofascial trigger points include reduced ranges of motion of the involved joints, stiffness of the muscles and associated joints, a feeling of weakness in the muscles and varying autonomic phenomena (Graff-Radford et al. 1987).

A variety of perpetuating factors are associated with the development of trigger points. The most common perpetuating factors can be classified as primarily structural, systemic or behavioural (Rubin 1981; Mance et al. 1986). Structural factors include orthopaedic anomalies that alter body biomechanics and these include leg length inequalities, a small hemipelvis and Morton's foot (Auleciems 1995).

Nutritional deficiencies and recurrent bacterial and viral infections contribute to systemic development of trigger points while acute or chronic mechanical stresses and fatigue, prolonged

muscle spasm and direct or indirect trauma are all common causes of behavioural trigger point development (Rubin 1981; Mance et al.1986).

Low back pain is one of the most frequent complaints seen in private practice (De Franca and Levine 1991) and according to Deyo (1983), eighty percent of the population will suffer from low back pain at some stage in their lives. A common source of low back pain is myofasciitis (Deyo 1983), commonly involving the quadratus lumborum muscles (De Franca and Levine 1991). Problems with these muscles are so common that they are involved in low back pain regardless of the cause, and are a definite source of pain in most low back pain, where organic causes have been ruled out (Sola and Kuitert 1954).

As the quadratus lumborum muscle plays such a significant role in low back pain, it is important that the most effective treatment protocol be sought.

1.2. STATEMENT OF THE PROBLEM.

In a review of related literature, authors including Travell and Simons (1983:32-37), Friction (1986:867) and Gatterman (1990:291) all agree on the myofascial pain dysfunction syndrome in regard to development of trigger points, clinical signs and symptoms and diagnosis of the condition, but there tends to be an inconsistency with regard to treatment protocols.

The purpose of this clinical trial is to evaluate the relative effectiveness of intermittent percussion versus dry needling in patients with low back pain- of quadratus lumborum and gluteus medius myofascial origin- in terms of objective and subjective clinical findings.

Subproblem one:

To evaluate the effectiveness of intermittent percussion versus dry needling in patients with low back pain- of quadratus lumborum and gluteus medius myofascial origin- in terms of objective clinical findings.

Subproblem two:

To evaluate the effectiveness of intermittent percussion versus dry needling in patients with low back pain- of quadratus lumborum and gluteus medius myofascial origin- in terms of subjective clinical findings.

Subproblem three:

To integrate the subjective and objective clinical findings in order to establish whether dry needling or intermittent percussion is more effective in the treatment of low back pain of quadratus lumborum and gluteus medius myofascial origin.

1.3. NEED FOR A SOLUTION TO THE PROBLEM.

The main principle of myofasciitis therapy is to inactivate active trigger points by releasing the taut bands with a variety of techniques (Hong et al. 1993). Various treatment protocols are

recommended for the purpose of eliminating trigger points and according to Mance et al. (1986) they are all effective, but to date there has been little research to assess the effectiveness of the variety of treatment modalities in the management of myofascial pain syndrome. All treatment types have proven to be effective and treatment of choice seems to be based on what the practitioner is familiar and comfortable with (Friction 1986:868-869)

Treatment of these muscles include spray and stretch techniques, which are effective, but could take as many as 15-20 treatments before pain is eliminated (Mance et al. 1986). Other treatments include post-isometric relaxation and ischaemic compression, but the patient needs to be seen every two to three days depending on the chronicity of the condition (Gatterman 1990:296). Murphy (1989) suggests the use of electrotherapies such as ultra-sound and transelectrical nerve stimulation. Frampton (1985) suggests electro-acupuncture as a therapy for trigger points but it has been found that this therapy is ineffective for low back pain. Other less common forms of treatment include rest, massage and moist heat packs (Mance et al. 1986).

Dry needling is an efficient and cost-effective treatment for all myofascial trigger point syndromes and is a recognised treatment in trigger point therapy (Sola 1981). Mance et al. (1986) state that injection therapy is the most commonly used technique in the treatment of trigger points. However, some patients show contra-indications to needling such as hypersensitivity, a history of phobia and syncope associated with needling, and high anxiety and stress levels (Sola 1984:679).

Trigger points in the quadratus lumborum muscle are difficult to eliminate due to its complicated attachments and different fibre directions. Quadratus lumborum trigger points aggravate those of the gluteus medius muscles as they lie in the pain referral area. The opposite is also true whereby trigger points in the gluteus medius muscles aggravate those of the quadratus lumborum muscles. When treating low back pain, it is important that both areas be treated. (Travell and Simons 1992:68-69;153).

Travell and Simons (1992:73) briefly describe a non-invasive technique for the treatment of quadratus lumborum trigger points. For the purpose of this research, this technique has been named "intermittent percussion". The methodology is described in Chapter Three. According to Travell and Simons (1992:73), this technique provides excellent results for eliminating pain associated with quadratus lumborum trigger points.

1.4. BENEFITS OF THE RESEARCH.

A treatment therapy needs to be of benefit to the patient both for a rapid recovery and long term relief from pain; and benefit to the practitioner in that it will be simple to learn and perform. Research will enable the practitioner to choose a therapy that has been proven to be effective.

If intermittent percussion does prove to be effective for the treatment of myofascial trigger points of the quadratus lumborum and gluteus medius muscles as Travell and Simons (1992:73) profess, then the technique could be a solution for treatment of a difficult muscle that does not

respond positively to other therapies. It could prove to be an effective non-invasive therapy in the management of mechanical low back pain.

The technique of intermittent percussion is quick to learn, easy to perform and only requires the use of a reflex hammer. Therefore, no expensive equipment is necessary. It is a safe technique to use and will eliminate the side effects associated with needling.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

CHAPTER 2.

REVIEW OF THE RELATED LITERATURE.

2.1. INTRODUCTION.

One of the most common, disabling conditions affecting man to date is low back pain, a close second to respiratory diseases (Kelsey and White 1980). Despite the high prevalence of this non-fatal condition, it presents as a stigma in modern medicine as it is poorly understood. There is no consensus as to the diagnosis, and most treatment programmes for low back pain tend to be ineffective (Bernard and Kirkaldy-Willis 1987).

The lumbar spine acts as a support for the upper body and it transmits weight from the upper body to the pelvis and lower limbs (Magee 1992:247). The lumbar spine is especially prone to low back pain as it is susceptible to static loading, gravity and numerous biomechanical anomalies (Gatterman 1990:129).

Management of low back pain is successful when treatment is aimed at the pain-producing structures. This requires a detailed investigation including a thorough case history and correlation between signs, symptoms and a radiographic study. However, many common causes of low back pain are poorly understood and not always represented on x-rays, making diagnosis of the condition unreliable. (Bernard and Kirkaldy-Willis 1987).

2.2. EPIDEMIOLOGY AND INCIDENCE OF LOW BACK PAIN.

Many researchers have studied the epidemiology of low back pain, yet, it is still in its early stages when compared to other diseases. This is possibly due to the fact that it is not a life-threatening disease. (Andersson et al. 1991:95).

Most studies have found that 60-80% of individuals will suffer from low back pain at some time in their lives (Burton and Cassidy 1992:2; Kelsey et al. 1992:537). This is an estimated two billion people in the next decade (Deyo 1983).

Many studies have tried to show the degree to which low back pain causes disability to the patient. According to Borenstein et al. (1995:23), back and spinal pain caused the highest degree of limited activity in patients under 45 years of age, the second most common reason for visits to a physician (13 million physician visits for low back pain per annum), the fifth highest hospitalization rate and the third ranking reason for surgery. In a Swedish study of males in the work place, it showed that there was a 60% prevalence of low back pain with 11% of the sample population having incapacitating disability for between 3 to 12 months (Kelsey and White 1980). This is supported by Long et al. (1996) who go on to state that in their study, the average patient had experienced intermittent low back pain for about 10 years. Low back pain has a large impact on the medical system as patients have tried a multitude of health care providers with inadequate results (Travell and Simons 1992:29).

Back pain is the second leading cause of absenteeism in the work place (Borenstein et al. 1995:22) and this has a major socio-economic impact on industry, as there is more loss of productivity due to low back pain than any other medical condition. A study in an industrial population showed that four hours per person per year are lost due to low back pain (Rowe 1969). Another significant finding is that patients that are absent from work for longer than 6 months due to low back pain never return to the level of productivity that they achieved prior to the illness (Kelsey and White 1987) and according to Long et al. (1996), it was found that nearly 20.1% of the patients never returned to the work place. This results in the loss of billions of dollars in industry due to morbidity, disability and limited activity.

In 1990, workmen's compensation in the United States amounted to approximately \$50 billion, of which back care alone accounted for \$30 billion (Burton and Cassidy 1992:2). Andersson et al. (1991:105) estimate that back injuries make up 33% of total compensation costs while Leboeuf (1991) has found it to be as great as three-quarters of these total costs. Disc herniations rank third in workmen's compensation payouts (Kelsey et al. 1992:539). Long et al. (1996) report in their study that one in six patients were involved in litigation because of back pain.

Due to the widespread prevalence of this condition, the socio-economic, and medical impact, it is important that a consensus be reached as to the most effective treatment methods for low back pain.

2.3. RISKS OF LOW BACK PAIN.

Although clinical studies show that in 50% of cases, the precise cause of lower back pain is unclear, it is important to identify those who are at a higher risk of developing lower back pain (Frymoyer et al. 1983).

The most affected group ranges between the ages of 20-45 years of age (White and Punjabi 1990:386; Leboeuf 1991; Borenstein et al. 1995:22). The prevalence of low back pain seems to decrease after 65 years, especially in males (Kelsey et al. 1992:538).

There is no significant difference in gender although multiparous women tend to have a higher risk of low back pain (White and Punjabi 1990:386; Burton and Cassidy 1992:4). Pregnancy predisposes women to low back pain due to the mechanical stresses involved in carrying and delivering the child, as well as the ligament laxity involved in the birth process due to the release of the hormone Relaxin (Gatterman 1990:124). Older women are predisposed to low back pain because of osteoporosis (Andersson 1992).

Evidence suggests that an individual's height (the taller a person, the greater the prevalence of low back pain), as well as a heavy frame, are associated with increased risk of low back pain and sciatica (Kelsey and White 1980). However, many other authors, including Burton and Cassidy (1992:4) and Borenstein et al. (1995:24), dispute this.

Certain occupations are more at risk for low back pain. People in sedentary occupations are at greater risk as their occupation involves constant sitting, which puts most of the pressure on the intervertebral discs. Therefore, there is a greater chance of prolapse of the disc. This is especially significant in females. (Leboeuf 1991).

More physical occupations cause more muscular strain and ligamentous damage as they require periods of lifting, pushing, pulling and carrying (Frymoyer et al. 1983). There is still little research to show how twisting actions can predispose to low back pain, although it is probable that this may cause pathological changes such as shear loading in the discs, damage to the ligaments and to the osteocartilaginous components of the facet joints (White and Punjabi 1990:384).

Occupations involving driving put people at risk of developing low back pain, but the exact aetiologies are unknown. It is thought that the spinal column is under constant vibration and often the seat of the motor vehicle provides little lumbar support. Pain is also thought to be aggravated by the forces associated with acceleration and deceleration in driving. (Kelsey and White 1980; White and Punjabi 1990:386).

People prone to episodes of stress, depression and anxiety, or people with especially stressful occupations, run a risk of increased low back pain (Kelsey et al. 1992:545). It is proposed that these patients contract their back muscles, putting pressure on the discs and reducing the ability of the discs to absorb fluids (Kelsey and White 1980).

Certain sports predispose patients to low back pain. However, Frymoyer et al. (1983), report that those patients that continue activity into later life suffer only moderate pain when compared to those who stop participating earlier in life, who suffer a more severe pain. It has been suggested that exercise aids in reducing low back pain risks and that it could be utilised as a form of treatment (Rosen 1986:898). It has been suggested that short, frequent periods of exercise scattered throughout the day are more beneficial than strenuous, lengthy, sustained exercise over any one period of time (Rosen 1986:898).

Cigarette smokers are especially prone to lower back pain. Studies show that nicotine may reduce vertebral arterial supply and in turn affect the disc and facet joints (Frymoyer et al. 1980). Other proposed theories include increased pressure on the low back through coughing. Furthermore, nicotine causes a reduced mineral content in the bone (Burton and Cassidy 1992:4; Kelsey et al. 1992:543).

2.4. CHIROPRACTIC IN THE TREATMENT OF LOW BACK PAIN.

There is still much controversy surrounding the role of alternative health care practitioners, such as chiropractors, and their effectiveness in the treatment of back pain (Deyo 1983).

Chiropractic, according to the definition given by Gatterman (1990:406) is: "A discipline of the scientific healing arts concerned with the pathogenesis, diagnostics, therapeutics, and prophylaxis of functional disturbances, pathomechanical states, pain syndromes and

neurophysiological effects related to the statics and dynamics of the locomotor system, especially of the spine and pelvis".

Spinal manipulation is one of the oldest forms of treatment for low back pain as used by chiropractors, and since 1952 there have been over 50 clinical studies of this therapy. Spinal manipulation has been shown to reduce the episodes of pain in patients suffering from lumbar pain. (Gatterman 1990:172).

Studies of spinal manipulation have been very controversial but according to Deyo (1983), the suspected benefits have been suggested as: a reduction in a disc bulge, tightening of the posterior longitudinal ligaments, freeing of adhesions around the disc and mechanical stimulation of some large nerve fibres which inhibit small diameter nerve fibres associated with nociceptive impulses.

Chiropractic is an occupation that has challenged Medicine as an alternative healing system and has grown in numbers over the last 90 years. There are currently 23,000 chiropractors in the United States seeing an estimated 130 million patients. The consumer demand for Chiropractic is strong. (Cox 1990:3). Stano (1993) compared health care costs of Chiropractic to Medical care and found that Chiropractic represents the most rapidly growing sector of all health care professionals.

While Chiropractic care is very intensive in the beginning of treatment, it produces immediate therapeutic results (Gatterman 1990:400). In studies performed by Stano (1993), it was found

that Chiropractic care of patients with lower back pain was at least as effective as other Medical treatments, patients were satisfied with their care, and returned to work quicker at lower treatment costs. Lower costs were due to the fact that Chiropractic patients did not need added costs of specialist services, hospitalizations and pharmaceuticals.

2.5. MYOFASCIAL TRIGGER POINTS.

Possibly one of the most commonly overlooked sources of back pain originate in the surrounding musculature (De Franca and Levine 1991).

One of the most common and most poorly understood causes of muscular pain and dysfunction are myofascial trigger points (Hong et al. 1993; Bruce 1995). These are commonly misdiagnosed due to the fact that relatively little is known about the condition. Diagnosis is further hindered by the fact that trigger points have varying symptoms, they demonstrate diffuse pain patterns referred into non-dermatomal segments, exhibit few physical findings and their response to treatment is very unpredictable (McClaflin 1994).

A myofascial trigger point is a firm hyperirritable spot found in a taut muscle band or its related structures (tendons, ligaments and fascia) that, when compressed, produces characteristic pain patterns and autonomic phenomena (Travell and Simons 1983:1). Trigger points vary from 2-5 mm in diameter (Fricton 1994:860) and can be considered as weak spots in the muscle that are sensitive to stress- induced changes (Sola 1984:676).

A trigger point may occur in two states:

1. Active trigger points cause local, severe, unrelenting pain. The muscle containing the trigger point is shortened and there is reduced range of motion of the associated joint(s). There are also areas of secondary referred pain not necessarily at the site of muscle dysfunction. (Murphy 1989; Han et al. 1997).
2. Latent trigger points, which occur more commonly, are similar to active trigger points but are not associated with spontaneous pain (Han et al. 1997). There is less tenderness and less vigorous local twitch response, if any. Latent trigger points cause less dysfunction and the patient is often unaware of the trigger point being present (Simons 1991).

Trigger points, as summarised by Travell and Simons (1983:3-4), also exist as:

1. Primary trigger points: This is a spot of hyperirritability within the taut muscle band that is not activated as a result of trigger point activity in another muscle of the body.
2. Secondary trigger points: This is a trigger point that is activated by the involved muscle being overloaded as a synergist substituting for, or as an antagonist countering the tautness of, the muscle that contains the primary trigger point.
3. Satellite trigger points: These develop in a muscle that is located within the reference zone of another active trigger point.

These trigger points form one after another in the above given order. Therefore, trigger points appear to "spread" from one muscle to another (Rosen 1993).

According to Rosen (1986:888), there are key muscles in the body that should always be checked for dysfunction and tightness, even in the absence of pain, before the other muscles associated with the main complaint are examined. These are known as "gateway muscles" and are usually the major stabilisers of the body, or the antagonists of the affected painful muscles. The "gateway muscles" in the low back include quadratus lumborum, multifidus and iliopsoas. (Rosen 1986:888).

Myofasciitis is often confused with diagnoses of bursitis, tendonitis, arthritis and even nerve entrapments (Bernard and Kirkaldy-Willis 1987). To further hinder diagnosis of myofasciitis, trigger points in the lower back often mimic common causes of low back pain such as posterior facet joint and sacro-iliac joint problems, lateral stenosis and herniated discs (Bernard and Kirkaldy-Willis 1987). Treatment programmes used are often unsuccessful or prolonged due to the failure to recognise or understand myofasciitis (Rosen 1993).

2.6. PREVALENCE.

According to Bruce (1995), myofascial pain syndrome presents as the largest group of unrecognised, undertreated, acute and chronic medical problem faced. The socio-economic influence of this syndrome accounts for one in six visits to providers of health care (Bruce 1995).

Although data relating to the prevalence of myofasciitis is unavailable, myofasciitis affects everyone at some time in their lives (Han et al. 1997). The prevalence of trigger points is illustrated in the fact that patients admitted into emergency rooms who present with headaches, torticollis and low back pain, commonly have active myofascial trigger points. It is also found that in chronic pain patients, trigger points are more common than previously thought (Sola 1984:674; Simons and Simons 1989:509).

In a comprehensive pain clinic, trigger points were the primary cause of pain in 85% of the patients admitted to the clinic (Fishbain et al. 1986). This finding is supported by Han et al. (1997). Sola and Kuitert (1954) studied a group of 200 unselected, asymptomatic young adults and found tenderness representing latent trigger points in 54% of the female and 45% of the male subjects. Women are especially prone to trigger point development, and especially between the ages 20-40 years. Furthermore, pain has been shown to increase during the second week of the menstrual cycle, thus suggesting a possibility of a hormonal influence (Han et al. 1997).

Multiple trigger points were present in nearly half of the subjects researched by Sola and Kuitert (1954). According to Bruce (1995), trigger points have a tendency to reoccur in the same areas as previously situated. This possibly agrees with the theory of Sola (1984:676) who states that trigger points develop in weak spots.

Studies of the prevalence of trigger points and those individuals, at risk, show that the most commonly affected age group ranges from between 31-50 years of age (Travell and Simons 1983:5). Han et al. (1997) agree with this age range and further state that prevalence is reduced with age. Those patients most prone to trigger point formation include sedentary, middle-aged females (Yunnus et al. 1988; Bruce 1995). Han et al. (1997) have shown that there is less tendency for trigger points to develop in labourers than in sedentary workers, suggesting that activity acts as a protection against myofasciitis. It has also been found that those individuals that exercise regularly show less of a tendency to develop trigger points (Sola 1984:678). Exercise must not only include stretching but strengthening and reconditioning on a daily basis. Rosen (1986:899) suggests the use of mild analgesics prior to engaging in exercise, so as to assist in increasing the exercise and pain tolerance.

Authors such as Travell and Simons (1983:13), Sola (1984:675), Gatterman (1990:285) and De Franca and Levine (1991) all agree that the most commonly involved muscles of the lower back include those of the tensor fascia lata, gluteus medius and quadratus lumborum, with the latter muscle being the most predominantly involved of the three. Bernard and Kirkaldy-Willis (1987) have also found gluteus maximus to be a frequently involved muscle. In a review of 1293 cases studied by Bernard and Kirkaldy-Willis (1987), it was found that referred pain syndromes (as those produced by the myofascial trigger point syndromes) were twice as common as radicular syndromes.

2.7 PERPETUATING FACTORS.

Myofasciitis shows a common prevalence due to the many activating and precipitating factors that affect or stress the muscles. Unless these factors are corrected or eliminated, the treatments will have to be repeated on a regular basis. (Sandman 1981; Rosen 1993). If the myofascial condition has remained static for months, the perpetuating factors may not have been serious. However, if the myofasciitis is progressive in time and the response to treatment is temporary, then the perpetuating factors must be resolved (Simons and Simons 1989:510).

All authors tend to agree on predisposing factors. These include:

Trauma:

Korr et al. as cited in Melzack et al. (1977), believe that trigger points develop throughout the course of growth due to musculoskeletal stresses and strains. This is especially true for the muscles of the back (Melzack et al. 1977). Discrete trauma (including periods of chronic or acute overload); repetitive microtrauma and injuries resulting from deconditioning of the muscle, are all a common cause of trigger point formation (McClaflin 1994). Friction (1986:875) states that a muscle tends to be predisposed to trigger point formation if it is held in sustained contraction in a normal or abnormally shortened position for prolonged periods of time. Trauma to the muscle tends to disrupt the integrity of the muscle and predisposes it to inflammation and muscle spasm (Murphy 1989).

Orthopaedic anomalies:

The commonest orthopaedic anomalies are leg length inequalities, a small hemipelvis and Morton's foot (Murphy 1989; Fricton 1986:875). These contribute to prolonged abnormal tension on the muscles, contributing to pelvic tilting and thus functional scoliosis when standing and sitting on flat surfaces (Auleciems 1995). An estimated 10% of the population suffers from leg length inequalities of at least 1cm and this perpetuates trigger points in the lower back (Sola 1984:683).

Mechanical stresses:

Mechanical stresses include misfitting furniture, poor posture, constricting pressure on muscles, and prolonged immobility (Fricton 1986:865). Prolonged television viewing may be associated with low back pain (Graff-Radford et al. 1987).

Systemic sources:

Trigger point development shows a higher prevalence when a person suffers any chronic infections, visceral disease, disc disease or arthritis and joint dysfunction (Rubin 1981). During recurrent bacterial and viral illness, it has been found that trigger points increase in prevalence (Auleciems 1995). Chronic infections may contribute to deep pain input, causing central excitatory effects and secondary muscle spasm (Jaeger 1985).

Nutritional inadequacies:

Reduced levels of vitamin B1, B6 and B12, vitamin C, folic acid, calcium, potassium and iron all contribute to perpetuation of myofasciitis (Auleciems 1995). A deficiency of any of the B vitamin groups is nearly always a serious perpetuating factor in myofascial development (Simons and Simons 1989:510). Vitamin deficiency to date is still a relatively unexplored area of medicine (Auleciems 1995).

Metabolic and endocrine abnormalities:

Whatever impairs muscle metabolism will enhance trigger point formation (Graff-Radford et al. 1987). Metabolic and endocrine abnormalities include hypothyroidism, hypouricemia and hypoglycaemia (Auleciems 1995). Gout will certainly aggravate trigger point formation as the urate crystals tend to deposit in areas of local damage and metabolic distress (Simons and Simons 1989:512).

Psychological factors:

Depression, tension, anxiety and some behavioural types such as type-A behavioural patterns, irrational beliefs and learned helplessness (Sandman and Backstrom 1984) all contribute to trigger point development. The proposed aetiology is explained by Sandman and Backstrom (1984) later in this chapter. According to Pellegrino et al. (1989), some patients may have an autosomal dominant hereditary disposition to developing trigger points.

Other Perpetuating Factors.

Another common predisposing factor in trigger point formation is the chilling of the muscle, which can also be considered as a trauma (Graff-Radford et al. 1987). A change in the weather from warm, dry weather to cold and damp especially aggravates myofasciitis (Bruce 1995). Inactivity and immobility can affect trigger point formation and it has been found that patients who follow continuing programmes of fitness and exercise have fewer myofascial problems than those who are more sedentary (McClaflin 1994).

Often, initiating factors can become perpetuating factors if they are unresolved and continue to aggravate the active trigger points. Unless initiating factors are resolved, prognosis is poor. (Murphy 1989).

If there are multiple perpetuating and aggravating factors, the patient can develop multiple trigger points throughout the body, leading to a chronic pain syndrome (Simons 1991). According to Simons (1974:19), one factor will cause trigger points, another will aggravate the condition, and a third will be needed to intervene.

2.8. DEVELOPMENT OF MYOFASCIAL TRIGGER POINTS.

To date, there is no specific explanation for the development of myofascial trigger points. The most accepted theory is that of Travell and Simons (1983:32-37):

1. There is a traumatically induced tear within the sarcoplasmic reticulum, especially with acute strain.
2. This results in a calcium release from storage areas, as well as an accumulation of calcium in the injured site.
3. This accumulated calcium binds to adenosine triphosphate (ATP) in the myofibrils and stimulates local muscle contraction.
4. This causes shortening and tensing of the muscle fibre bundles and fatigue of the sarcoplasmic reticulum.
5. Metabolic processes within the muscle are altered and a hyperproduction of histamine results.
6. This can deplete the ATP reserves.
7. Noxious metabolic wastes sensitise sensory nerves. Local tenderness and referred pain result.
8. Circulation to the muscle is often interrupted due to the initial damage within the muscle.
9. This results in the release of platelets and serotonin which then sensitise sensory and pain nerve endings.
10. Connective tissue damage causes break down of mast cells, which release histamine and further sensitise nerve endings.
11. Restriction in the amount of muscle ATP is caused by vasoconstriction, resulting in an energy-deficient muscle contraction. The calcium pump is the most sensitive mechanism affected by depleted energy levels and will then maintain the muscle in a state of contraction.

These processes cause a self-generating muscle contraction which results in limited mobility, reduced range of motion, and makes the muscle resistant to stretching (Travell and Simons 1983:32-37).

To restore muscle functioning to normal, it is important to stretch the actin and myosin filaments apart so as to eliminate contraction. The ATP will then restore itself and begin to accumulate. This will restore normal sarcoplasmic reticulum functioning and allow circulation to normalise, thus removing metabolic build-up. (Sandman 1981).

This theory is supported by Friction (1986:867) and Gatterman (1990:291).

The length of the contracture time will affect the degree of pathological changes within the muscle. Two phases of trigger point development have been proposed. Firstly, trigger points begin as a neuromuscular dysfunction but in the absence of treatment, histological changes occur (Gatterman 1990:294).

Trigger points are especially prone to stress-induced changes. In the absence of stress, these trigger points remain latent only to be activated by positive feedback mechanisms involving sensory motor reflexes, autonomic responses and vascular changes. (Sola 1984:674).

According to Sandman and Backstrom (1984), stresses that can activate trigger point development need not necessarily be due to trauma. They propose that emotional stresses can also activate trigger points in the following manner:

1. Stress evokes chemical changes in the brain to release epinephrine, norepinephrine, serotonin and dopamine. These are nerve stimulants. Endorphins are also released and these increase metabolic processes.
2. All these factors can cause a person to tense in posture and thus cause muscle contraction.
3. Muscle contraction will then cause a decrease in blood flow and so follow along the same theory as that proposed by Travell and Simons (1983:32-37) as mentioned above.

The role of psychosocial factors should always be considered in myofascial trigger point development, as these factors clearly affect muscle tension and pain.

2.9. CLINICAL PRESENTATION.

2.9.1. SYMPTOMS.

A detailed case history is important in diagnosing myofascial trigger points and through this, the onset of pain and causative factors such as acute or chronic overload, direct trauma and chilling can often be identified (Travell and Simons 1983:14; 1989:264).

According to Simons (1974:26) and Mance et al. (1986), patients suffering from acute cases of myofasciitis complain of lancing, knife-like or stabbing pain often in the local area of the trigger point, while chronic recurrent pain is described as dull, aching or burning in the area of referred pain. Chronic pain is often described as being deep seated and varies in intensity from being a low grade discomfort to a severe incapacitating pain (Han et al. 1997).

Pain can be continuous or intermittent, but it usually presents as long-lasting, debilitating and restrictive (Auleciems 1995). Pain referral is in a non-segmental but predictable, characteristic pattern unique to each muscle group (Rubin 1981; Travell and Simons 1983:13). Trigger point pain varies in intensity over time, depending on the variable aggravating factors that affect the patient; and, clinical features of myofascial pain often outlast the precipitating event (Travell and Simons 1983:15).

Pain is present on motion or at rest and is often emphasised by sharp, sudden movements (Gatterman 1990:295). Other complaints include muscular stiffness after periods of prolonged rest or after sitting in one position for lengthened periods (Travell and Simons 1983:15).

Painful restriction of movement, fine tremors and weakness are also reported, although true weakness has not been found (Sola 1981; Jaeger 1985). In a study of 164 patients with a primary diagnosis of myofascial pain dysfunction syndrome, the following was reported by Han et al. (1997):

- 39.6% suffered an increased fatigue

- 12.2% showed signs of swelling

- 17.7% had weakness of the muscles

Weakness is thought to be due to painful inhibition (Gatterman 1990:295). The patient reports no neurological symptoms unless the muscle is taut and compresses a nerve (Travell and Simons 1989:264)

Various associated autonomic symptoms are present, with reactive hyperaemia and erythema being the most common presentations (Graff- Radford et al. 1987). Other less common autonomic phenomena include lacrimation, sweating, pilomotor erection or proprioceptor disturbances (Auleciems 1995).

With chronic myofascial trigger point sufferers, it has been found that many patients suffer from anxiety and depression because the patients tend to focus on their pain, they have varying degrees of pain and there is uncertainty regarding their condition (Sandman and Backstrom 1984; Han et al. 1997). If untreated, the myofascial dysfunction syndrome may lead to a sense of loss of well-being and ageing in the patient (Sola 1981).

A thorough case history is important in patients with psychological stresses causing trigger point development so it is always important to enquire about changes in lifestyle. If the patient has gone through a divorce or moving home for example, they may have difficulty in coping with the change. (Sandman and Backstrom 1984).

2.9.2. SIGNS.

Travell and Simons (1983:16-17) and Gatterman (1990:296) agree on physical findings in patients with myofascial trigger points. These are as follows:

1. With the presence of trigger points, there is pain on active or passive stretching of the muscle involved.
2. The stretch range of motion is reduced.

3. Resisted isometric contraction of the muscle elicits pain.
4. The muscle displays a weakened maximal contraction force.
5. Deep tenderness and dysaesthesia are referred by active trigger points to the referred pain zone. Cutaneous hyperalgesia and an increased motor unit activity has also been noted in the referred zone.
6. Autonomic phenomena occur in the referred pain area. These include sweating, pilomotor reaction and hypoaesthesia (Sola 1981)
7. Surrounding musculature can be tense on palpation, showing "protective spasm".
8. The trigger point is palpated in a taut muscle band and produces pain on compression. Sola (1984:678) and Mance et al. (1986) describe three types of hardenings: nodular, spindle-shaped and ropy, depending on which muscle is palpated. The muscle must be palpated in both relaxed and stretched positions. Pain referral may be enhanced by placing a gentle stretch on the muscle and holding a deep pressure over the point for 6- 20 seconds (Jaeger 1985)
9. A "jump sign" is often present on palpation of the active trigger point. This is a pain response whereby the patient winces, cries out or "jumps" (Travell and Simons 1989:265).
10. Snapping palpation produces a local twitch response which is a transient contraction of part of the muscle.
11. Pressure on the active trigger point will intensify pain in the referral zone. The more sensitive trigger points cause a wider radiation of pain (Han et al. 1997).
12. The skin in some patients exhibit demographia or panniculosis (especially over the back or torso) in the area overlying the trigger point.

2.10. DIAGNOSIS.

One of the most important subjective considerations in establishing a diagnosis of myofascial trigger points is the presence of pain and the area to which the pain refers (Sandman and Backstrom 1984). Diagnosis is made on the basis of the patient's symptoms rather than on physical or laboratory findings as these are unpredictable (McClaflin 1994).

- i. According to Simons (1991), there are two sets of criteria needed for the diagnosis of trigger points. The first set of criteria diagnose trigger points in a clinical situation. To make a clinical diagnosis of myofasciitis the findings must include 5 major criteria and at least 1 of the minor criteria:

Major Criteria:

- i. -local pain around/ at the trigger point.
- ii. -pain or altered sensation in the referred pain zone.
- iii. -a taut palpable band in the affected muscle.
- iv. -exquisite focal tenderness of the trigger point in the muscle.
- v. -restricted range of motion or weakness of the muscle involved.

Minor Criteria:

- i. -reproduction of the patients complaint on compression or needling.
- ii. -eliciting a local twitch response by snapping palpation or insertion of a needle.
- iii. -pain relieved by appropriate trigger point therapies.

Sandman (1981) states that pain is the major diagnosing factor as this is the symptom that causes a patient to seek medical attention.

Secondly, six criteria, according to Simons (1991) must be fulfilled before a diagnosis can be made in a research situation. These are as follows:

- i. -palpation of a taut band in the affected muscle.
- ii. -exquisite focal tenderness.
- iii. -referred pain following compression of the trigger point of at least 2cm from the focal spot.
- iv. -restricted range of motion of the muscle.
- v. -reproduction of the pain by compression or needling of the trigger point.
- vi. -a local twitch response must be present on needling.

Objective tenderness of trigger points can be measured using the algometer for pressure threshold measurements. This has been researched by Fischer (1987) and shown to be useful and reliable for measurement of myofascial trigger point sensitivity. A goniometer can be used to measure ranges of motion and according to Breum et al. (1995), it is valid and reliable as a tool for research purposes.

Laboratory tests, diagnostic procedures and x-rays provide no clinically significant information where trigger points are concerned. There are no measurable metabolic changes. This was confirmed by Yunnus et al. (1988). Biopsies of trigger points have revealed no significant histological changes that could correlate with clinical signs and symptoms (Han et al. 1997). However, results of other biopsies have revealed an increase of fine fat droplets and abnormal

mitochondria as evidence of metabolic involvement in the area (Gatterman 1990:294; Jaeger 1995). Mance et al. (1986) found an increase in mast cells, water content, chloride and acid polysaccharides in the area of the trigger points. There are to date no laboratory tests, diagnostic procedures or x-rays that can help to confirm the presence of trigger points (Sandman 1981; Yunnus et al. 1988). Blood and urine tests have not revealed anything either, unless another disease is present in conjunction with myofasciitis (Fricton 1986:857).

Other less commonly used measurement tools include EMG studies to show altered electromyographic activity within taut muscles (Sandman and Backstrom 1984). Other instruments include a dynamometer to measure weakness of muscles and thermography to measure disturbances in vasomotor activity in the region of the trigger point (Fischer 1987). These instruments can not be used accurately as there have been conflicting results and lack of controls in previous research (Han et al. 1997). Magnetic resonance imaging has also not revealed any abnormalities (Fricton 1986:857).

2.11. TREATMENT.

In some instances, trigger points can disappear spontaneously if the muscle is given a few days to a few weeks rest, but more often than not, they may self-perpetuate and produce more severe symptoms (Travell and Simons 1989).

There are many trigger point treatments available to eliminate and desensitize active trigger points. Treatment of trigger points not only involves the elimination of pain but should also

include restoration of full range of motion to the joints, normal strength to muscles involved and return of the patient to normal functional activities. (Rosen 1986:897-900).

When effectively managed, myofascial trigger point syndrome has an excellent prognosis (Auleciems 1995).

Below is a summary of the most commonly used therapies:

2.11.1. SPRAY AND STRETCH TECHNIQUE.

One of the most common treatments include the spray and stretch technique developed by Travell and Simons (1983:63-74). This is often used as the first choice treatment especially if there are multiple muscles involved in a complex myofascial problem (Mance *et al.* 1986). It is the quickest, most simple and the least painful technique (Simons and Simons 1989:517).

The muscle is first warmed with moist heat and then cooled with a vapocoolant spray applied in parallel sweeps in the direction of the muscle fibres, from a distance of 50 cm above the skin. The number of sweeps is determined by the size of the muscle and is usually maintained for a few seconds with a few seconds break, then repeated. The muscle is then stretched to its normal length using a variety of techniques. (Sola and Williams 1956; Rubin 1981; Travell and Simons 1989:273).

The theorised mechanism behind spray and stretch is that the sudden drop in skin temperature is thought to produce temporary anaesthesia by blocking the spinal stretch reflex and the sensation

of pain at higher centres. The reduction in pain allows stretching of the muscle towards its normal length which then helps to inactivate trigger points (Han et al. 1997)

At times, a few treatments will be sufficient but usually 15 to 20 treatments are necessary (Mance et al. 1986).

2.11.2. NEEDLING.

Invasive techniques include needling of the trigger points. Needling is the most commonly used technique (Mance et al. 1986; Gatterman 1990:296) and often produces dramatic relief of pain (Sola 1984:679). Several mechanisms have been postulated as to how invasive needling works (Han et al. 1997):

1. Mechanical disruption of the muscle fibres and nerve endings.
2. The disruption of the muscle fibres causes increased extracellular potassium to be released, thus depolarizing nerve fibres.
3. Interruption of positive feedback mechanisms that aggravate pain.
4. Injection of local anaesthetics reduce nociceptive senses and increase vasodilation to remove metabolites.

Injecting of 10 to 15ml of procaine or lidocaine have been used successfully in the treatment of trigger points (Mance et al. 1986). Injecting with local anaesthetics have histologically shown to produce hyaline degeneration and necrosis of muscle fibres (Jaeger 1985). Mild hypersensitivity has been noted in some patients (Wreje and Brorsson 1995). Injecting saline eliminates the

possibility of hypersensitivity with only pain as a side effect (Wreje and Brorsson 1995). The injecting of substances is thought to exert pressure at the site of the trigger point, thus activating pressure receptors which alter the vasomotor activity in the area (Sola and Williams 1956). Dry needling has proven to be effective, but the accuracy of locating the trigger point is essential (Han et al. 1997).

The primary objective of needling is to locate and disrupt the trigger point as well as produce hyperstimulation analgesia to interrupt the abnormal neural pattern (Travell and Simons 1983:79-80). The needle provides a mechanical disruption and relieves pain through a process known as hyperstimulation analgesia (Melzack 1981).

With needling, the active trigger point is located using the appropriate palpatory methods as described by Travell and Simons (1983:59-62). Insertion of the needle is extremely important as it must enter the trigger point in the same direction as that which was palpated and produced pain (Mance et al. 1986). A fanning technique is used for most trigger points in which the needle is partially withdrawn and re-inserted in a different direction to ensure that the entire trigger point is deactivated (Travell and Simons 1983:75).

The findings associated with successful needling include: vasodilation of the skin around the needle accompanied by a feeling of warmth. Palpation of the area following needling should be less painful and some of the previously positive signs should be absent. (Macdonald et al. 1983).

In acute cases, one injection will be sufficient to reduce pain, otherwise a series of injections must be administered every second, third or fourth day appropriate to the patients complaint (Mance et al. 1986). Sola (1984:680) reported that younger patients are more responsive to needling than older patients.

Contra-indications to needling include systemic illness associated with fever, high anxiety and stress levels and a history of phobia and syncope associated with needling (Sola 1984:679).

2.11.3. ISCHAEMIC COMPRESSION.

Ischaemic compression is an effective, non-invasive technique whereby compression is applied directly onto the area of tenderness with a steady, moderately painful pressure. Pressure is increased as the pain is relieved in order to maintain the steady painful pressure. Ischaemic compression is applied for 10 to 20 seconds (Gatterman 1990:296). Upon release of the pressure, the skin blanches followed by reactive hyperaemia which improves circulation to the area and releases energy (Auleciems 1995). It is hypothesised that changes in skin perfusion aid in treatment (Mance et al. 1986).

Ischaemic treatment should be repeated every 2 to 3 days for several weeks depending on the chronicity of the condition (Gatterman 1990:296).

2.11.4. POST-ISOMETRIC RELAXATION.

Post-isometric relaxation is used to relieve tension in the muscles associated with trigger points and often eradicates trigger points. This technique is highly effective if performed correctly and is simple to perform. The treatment requires alternating voluntary contraction with passive stretching to release the tight areas. The muscle is stretched to the point of resistance and held there isometrically. The patient then resists against the examiner for 3-7 seconds, and the patient then relaxes the muscle and the muscle is further gently stretched. This must be repeated three to five times. This type of stretch is also known as contract-relax or rhythmic stabilisation.(Lewit and Simons 1984).

It has an advantage in that it can be taught to a patient as a home therapy. (Simons and Simons 1989:518).

2.11.5. RESEARCH TREATMENT.

Travell and Simons (1992:73) have briefly suggested a non-invasive treatment for active trigger points in the quadratus lumborum muscles. This involves striking the area with a percussion hammer. The muscle is positioned in a relaxed position and the tender area is struck with a percussion hammer eight to ten times at a frequency of one beat per second. The same force is used as that of a deep tendon reflex. No studies have been performed regarding this technique. As it was not named by the previous authors, the researcher has named it intermittent percussion

for the sake of research purposes. According to the authors, this is a "remarkably effective" treatment method.

The mechanism of this technique is presumed to be similar to that of ischaemic compression in that local stretching of involved sarcomeres occurs, emptying of capillaries and thus rebound hyperaemia follows, so flushing away metabolites and blocking sensory nerves (Mance et al. 1986).

According to Rosen (1986:905), in personal communication with Travell, this intermittent percussion can be used to facilitate better localization of the trigger points that require needling.

2.11.6. OTHER THERAPIES.

Other, less commonly used therapies include rest, moist heat packs, cryotherapy, diathermy and ultrasound at 0.5 W/cm squared (Sola 1984:674; Mance et al. 1986).

According to Frampton (1985), electro-acupuncture is effective in the treatment of myofasciitis in the upper body but is ineffective in the treatment of lower back pain of myofascial origin.

In treatments performed by Sola and Kuitert (1954), it was found that heat and massage alone provided little relief of myofasciitis of quadratus lumborum trigger points.

Non-steroidal anti-inflammatory drugs have proven to be ineffective as there is no evidence to suggest that trigger points exist in an inflammatory state (McClaflin 1994).

In patients suffering from psychological stress-induced trigger points, management will involve relaxation techniques to reduce physiologic tension. Furthermore, hypnosis and breathing techniques are sometimes used in treatment of chronic pain. (Sandman and Backstrom 1984).

All relevant authors recommend that all treatment modalities be accompanied by an active home stretching programme. Stretching decreases muscle tension, allowing the sarcomeres to return to their normal length and the return of metabolic equilibrium (Auleciems 1995). It is recommended that small, frequent periods of exercise throughout the day is more beneficial than less frequent, longer periods of sustained exercise (Rosen 1986:899-900).

If treatment is proving unresponsive, serum vitamin levels, blood chemistry panels, full blood counts, erythrocyte sedimentation rates and thyroid function tests may be needed to determine perpetuating factors (Auleciems 1995). However, it is not cost-effective and thus should not be performed as a screening procedure on all patients.

Patients are often asked to limit caffeine intake to two beverages a day, as well as avoid smoking and minimise alcohol intake, as these tend to aggravate trigger points (Auleciems 1995).

2.11.7. HOME THERAPIES AND SELF-HELP.

Home therapies can be seen as self-efficacy programmes whereby the patients can be taught a variety of physical and psychological principles to help themselves in eradicating trigger points. The goal of home treatment is to give the patient back control of his/her life (Rosen 1986:899).

Physical skills involve stretch and spray, ischaemic compression and Lewit post-isometric relaxation technique (Travell and Simons 1983:86-87; Lewit and Simons 1984). Lewit post-isometric relaxation technique can be taught as a home therapy, although precision is needed (Lewit and Simons 1984).

Utilizing correct lifting procedures and better utilization of work-station space are all encouraged to prevent the re-occurrence of trigger points (Auleciems 1995).

Psychological principles include stress management and relaxation skills that can be taught to the patient. (Graff-Radford et al. 1987).

Patient co-operation as far as home routine exercises are concerned, enhance the long-term effects of trigger point therapy (Murphy 1989).

A home programme for stretching should include active and passive muscle stretching exercises to reduce the activity of the trigger points while postural exercises prevent the reoccurrence of

the trigger points. Strengthening exercises will improve circulation to the muscles and increase strength and durability of the muscles. (Fricton 1986:870).

Melzack (1981) proved the effectiveness of trans-electrical nerve stimulation as a powerful controller of severe forms of pain; it is convenient as it can be self-administered as a home therapy. Pain relief often lasts several days or weeks (Melzack 1981). This is supported by Han et al. (1997).

The role of the doctor in patient care of myofascial pain needs to be reorganised in that the patient needs to take more responsibility for their condition; they need to make daily changes in order to improve the condition (Fricton 1986:870).

2.11.8. PAST RESEARCH OF MYOFASCIAL TRIGGER POINT THERAPIES.

One of the first therapies used in the treatment of trigger points was massage, but it was found to be of little benefit when used alone (Rubin 1981). However, according to Williams and Elkins (1942), as quoted by Hong et al. (1993), deep massage is the most effective treatment in fibromyalgia of the hand. Deep massage helps to mechanically break down fibrous bands of trigger points and improves point tenderness (Auleciems 1995). Vigorous massage of hyperirritable points can actually exacerbate the pain and should be reserved for latent trigger points, as it is painful to perform (Mance et al. 1986). According to Rubin (1981), cold packs

used before deep massage are often beneficial. If massage is used in conjunction with exercise and stretching, the benefits are increased (Auleciems 1995).

Stretching and strengthening exercises help maintain healthy musculature. However, these need to be repeated at least three times a day with 10 to 20 repetitions of each (Auleciems 1995). This type of therapy needs patient compliance and is thus combined with other therapies. (Mance et al. 1986). Furthermore, it has been found that when other modalities have been used in the absence of stretches or exercise they have helped, but the condition commonly reoccurs (McClaflin 1994).

Typically trigger points are treated using spray and stretch techniques or needling (Graff-Radford et al. 1987). Spray and stretch is an easy, convenient therapy and is one of the most commonly used techniques and often gives immediate reduction of pain (Fricton 1986:873; Hong et al. 1993). Spray and stretch is useful in treating multiple muscle groups together and thus saves time (Auleciems 1995). However, an intensive management programme is often required (Fricton 1986:873), which usually requires 10-20 treatments (Mance et al. 1986). A precaution as regards the spray is necessary, as it is a freezing agent and frosting of the skin or excessive sweeps can aggravate the trigger points (Fricton 1986:873). Use of this method in patients that suffer from vasospastic or peripheral vascular diseases is contra-indicated (Mance et al. 1986). Vapocoolant sprays tend to be harmful to the environment and can therefore be replaced by ice (Auleciems 1995). According to Murphy (1989), spray and stretch programmes work most effectively when combined with an electrotherapy such as ultrasound.

Needling of the trigger points is another common form of therapy used in treatment of myofascial trigger points and is usually used if the spray and stretch is ineffective (Fricton 1986:872). The main purpose of needling is to mechanically disrupt the trigger point (Melzack 1981).

Needling of trigger points has been successful in 70-80% of cases of myofasciitis and should be used in trigger points that are not responding to less invasive therapies (Auleciems 1995). Dry needling was shown to be as effective as injecting a solution into the trigger point, according to Garvey et al. (1989) and is a more simple form of treatment. However Rosen (1986:905) found that dry needling does not give rapid pain relief and in his opinion, has not been as successful as injecting a substance into the trigger point. In a study comparing dry needling to the injecting of lidocaine, dry needling resulted in a 63% success rate as compared to lidocaine with only a 42% improvement rate in terms of pain (Han et al. 1997). Travell and Simons (1983:75) suggest the use of procaine injections for the treatment of trigger points, because being a local anaesthetic, it reduces the soreness of the injection. Murphy (1989) found that injection of an anaesthetic produced more consistent results than dry needling alone. According to McClafflin (1994), procaine is usually used, but saline or dry needling appear to be just as effective. In a study performed by Broome (1995:91), it was found that both dry needling and saline were beneficial but neither was statistically more significantly effective than the other.

Steroid injections are contra-indicated in the treatment of trigger points as they damage muscle fibres and irritate the nerves (Bruce 1995), although Auleciems (1995) states that it can help to reduce inflammation.

As can be seen in the search of relevant literature, there is much debate as to the injecting of substances, or the use of dry needling. According to Garvey et al (1989), it was found that it was not the substance injected, but rather the mechanical stimulus of the trigger point that provided the pain relief.

Electro-acupuncture has been found to be effective in the treatment of trigger points involved in neck pain, but not those involved in low back pain (Frampton 1985).

A comparison study between TENS and acupuncture for the treatment of active trigger points revealed that neither was statistically more effective than the other (Melzack 1981). The advantage however is that acupuncture is a therapy of short duration. Nevertheless, it is invasive and requires specialised practitioners (Melzack 1981). TENS is non-invasive and can be self-administered, provided the correct location of the trigger point is found (Han et al. 1997). Yet, treatments are as long as 30 minutes (Mance et al. 1986).

The study above consists of two methods that increase sensory input. However, another study performed by Melzack (1981) showed that injecting an anaesthetic substance (thus blocking sensory input) proved effective.

Post-isometric relaxation was found to be "remarkably effective" in the treatment of trigger points and often aided in more effective manipulation procedures. The technique is harmless and non-invasive. However, although the technique is simple, it is highly specific and precision is important. (Lewit and Simons 1984).

According to Friction (1986:868), many of the traditionally used methods of treatment are failing. He suggests that an interdisciplinary pain clinic setting would be beneficial in treating patients with pain, especially those with pain of a chronic nature.

2.12.MUSCLE OVERVIEW.

2.12.1. QUADRATUS LUMBORUM.

This commonly overlooked muscle is the most frequent source of lower back pain (Schneider 1994:167). The quadratus lumborum muscle is known as " the joker" of the low back as it mimics many low back pain-producing syndromes (Sola 1984:682). According to Sola and Kuitert (1954), the quadratus lumborum is involved in lower back pain regardless of the cause and is a definite source of most low back pain of mechanical origin.

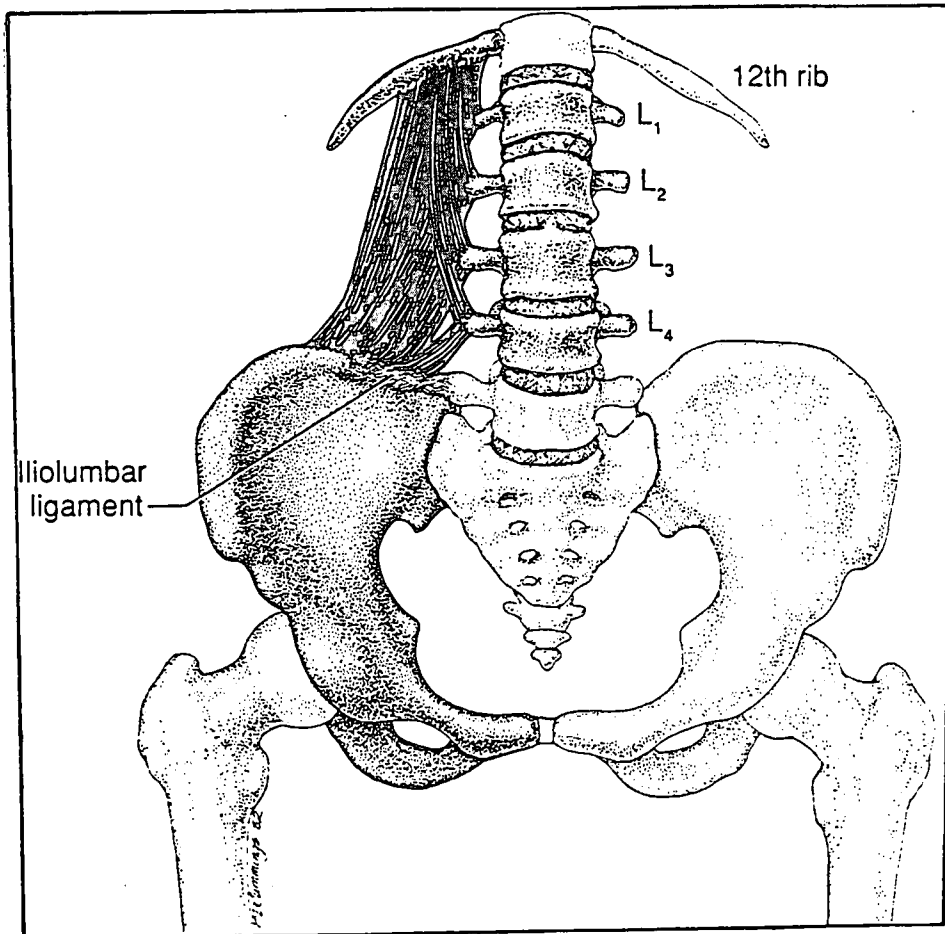
The muscle is orientated in three directions and can anatomically and functionally be regarded as three different muscles. Vertical iliocostal fibres insert laterally from the 12th rib to the posterior crest of the ilium, diagonal iliolumbar fibres originate at the ends of the first three or four lumbar transverse processes and insert into the crest of the ilium and iliolumbar ligament. The diagonal lumbocostal fibres run from the 12th rib to all the lumbar transverse processes. (Moore 1985:276; Gatterman 1990:301; De Franca and Levine 1991).

The colon, kidney, psoas muscles and the diaphragm lie anteriorly to this muscle (De Franca and Levine 1991).

DIAGRAM ONE

ATTACHMENTS OF QUADRATUS LUMBORUM.

Travell and Simons (1992:31)



The quadratus lumborum muscle is a flexor-rotator muscle of the low back. Unilaterally it is involved in ipsilateral lateral flexion and restricting contralateral lateral flexion and it elevates the ipsilateral hip. Bilaterally, the muscle is involved in extension of the lumbar spine, it aids in

respiration as it attaches to the twelfth rib and it stabilises the diaphragm at its attachment to the upper lumbar vertebrae. (Gatterman 1990:301; Travell and Simons 1992:35).

Trigger points in this muscle are easily activated as it is under constant tension during sitting, walking and lying. According to Han et al. (1997), the quadratus lumborum trigger points are activated during sustained contraction rather than intermittent activity. The muscle is especially prone to trigger point formation during sudden trauma usually associated with bending, twisting and diagonal lifting. Repetitive and prolonged micro-trauma aggravates trigger points and is usually due to chronic fatigue or overuse syndromes. (Sola and Kuitert 1954; Travell and Simons 1992:40-41).

Trigger points in the antagonistic muscle can activate myofasciitis (Travell and Simons 1989:270). Sola and Kuitert (1954) report immunizations and upper respiratory tract infections precipitating trigger points in the quadratus lumborum muscles.

Perpetuating factors include: leg-length inequality, a small hemipelvis, short upper limbs and unconditioned abdominal muscles. Pelvic tilt with compensatory scoliosis is a major perpetuating factor as it causes a variation in leg length on standing and a pelvic asymmetry on sitting. Often the trigger points in the muscles are aggravated by the contralateral muscle. Hypersensitivity on the muscles of the upper trunk can aggravate those in the gluteal and lumbar regions so a thorough investigation is often necessary. (Travell 1976; Sola 1984:676; Travell and Simons 1992:40-41).

Unilateral deep, aching pain is commonly associated with quadratus lumborum trigger points. However, pain can vary from low-grade burning to severe knife-like pain (Sola and Kuitert 1954; De Franca and Levine 1991). When the trigger points are involved bilaterally, the patient describes the pain as extending across the low back and a deep tenderness is often involved in the referred pain zone (Travell and Simons 1989:270). Because the quadratus lumborum muscle attaches to the twelfth rib, it often presents as rib pain on deep inspiration (Sola 1984:682).

Symptoms include lancing pain on certain movements including walking, when bending or twisting, rising from a chair, climbing stairs or turning in bed (Sola and Kuitert 1954). Pain is severe at rest and aggravated especially at night (Gatterman 1990:301). Pain is also felt on sneezing or coughing due to the contraction of the twelfth rib (De Franca and Levine 1991). This often mimics a positive Dejerines triad (Schneider 1994:167). Trigger points in the quadratus lumborum muscle are a frequent cause of anterior abdominal pain and pain in the anterior aspect of the thigh due to their referred pain pattern (Travell and Simons 1992:29).

Other less common symptoms associated with trigger points in the muscle are heaviness of the hips, local fatigue of the area, burning sensations into the legs and feet and calf cramping (Sola and Kuitert 1954).

Examination of the patient reveals a loss of lumbar lordosis, a pelvic list and pain on extension of the lumbar spine (Travell 1976). A short leg or an elevated iliac crest can also be seen on examination due to muscle spasm (Schneider 1994:167). In an acute unilateral spasm of the muscle, the patient will present in a laterally flexed position to the side of involvement,

mimicking a disc involvement (Sola and Kuitert 1954). There is a common association between quadratus lumborum trigger points and related thoraco-lumbar joint dysfunction, according to De Franca and Levine (1991) and Schneider (1994:167). Usually however, the only signs include tenderness over the muscle with reproduction of the pain on palpation (Sola and Kuitert 1954). Trigger points in this muscle show an interesting characteristic in that they have very predictable referred pain patterns and this makes diagnosis easier (De Franca and Levine 1991).

Quadratus lumborum trigger points masquerade as sacro-iliac and hip joint problems, trochanteric and ischial bursitis and disc disorders (De Franca and Levine 1991).

Three regions in the muscle are examined for trigger points. The first region is deep in the angle where the iliac crest meets the paraspinal muscles, the second region is along the inner region of the ilium where the iliocostal fibres attach, while the third region is where the paraspinal mass meets the 12th rib. (Travell and Simons 1992:29).

Two trigger points are superficial: one caudal and one cephalad. The refer pain laterally and more anteriorly while two deep, medial trigger points (caudal and cephalad) refer pain distally (Travell and Simons 1992:29).

Travell and Simons (1992:29) summarise the referred pain patterns as follows:

Cephalad, superficial trigger point: Pain is referred along the outer crest of the ilium towards the lower quadrant of the abdomen ipsilaterally. Pain can be referred to the outer upper aspect of the groin.

Caudal, superficial trigger point: pain is referred to the greater trochanter and outer aspect of the upper thigh.

Cephalad, deep trigger point: Referred pain occurs along the sacro-iliac joint bilaterally.

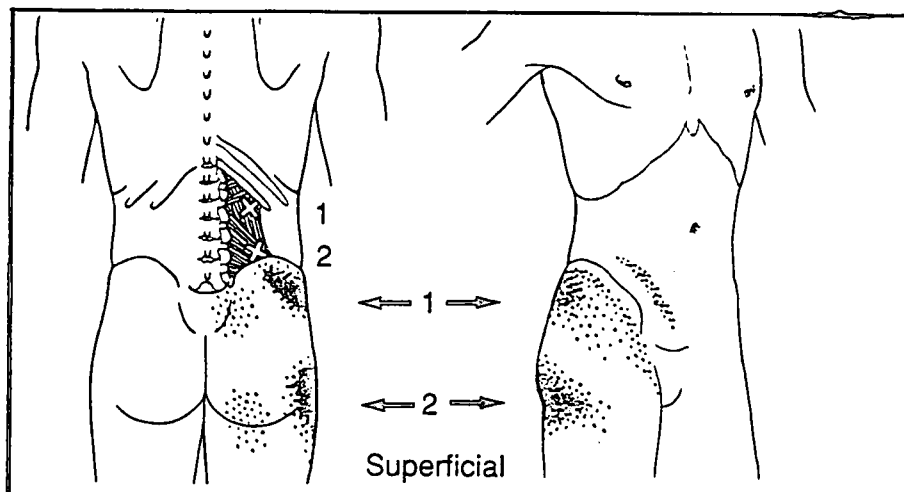
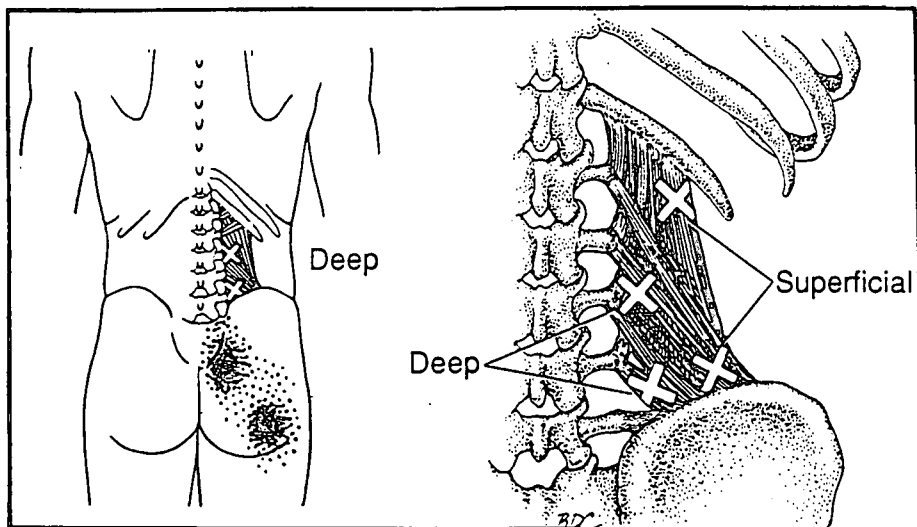
Caudal, deep trigger point: Pain is referred to the lower buttock.

This is supported by Schneider (1994:167).

DIAGRAM TWO.

REFERRED PAIN PATTERNS OF QUADRATUS LUMBORUM.

Travell and Simons (1992:30)



Myofascial trigger point therapies include all the procedures as described earlier in this chapter. However, release of trigger points in the quadratus lumborum muscle are complicated by the varying directions of the fibres and attachments of the muscle. Because the muscle functions bilaterally in extending the lumbar spine, it is often advised to inactivate trigger points routinely on both sides as the pain may shift from one side to the other at a later stage. (Travell and Simons 1992:69-73).

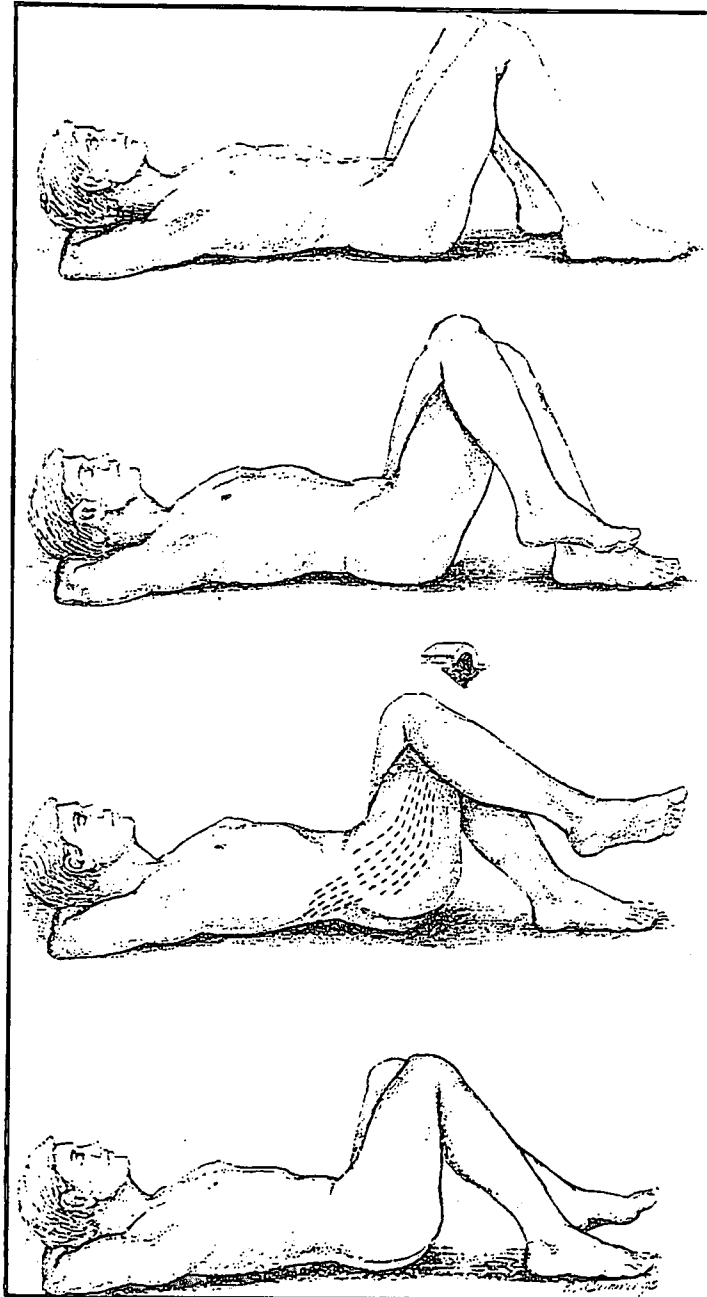
Spray and stretch is a successful therapy. However, pain can occur in the muscle with stretching (Travell and Simons 1992:69-73). Heat and massage have been found to be unsuccessful (Sola and Kuitert 1954). Massage of the trigger points may need to continue for as long as six weeks (Travell and Simons 1992:73). Needling of the trigger points is often successful, with relief of symptoms after one to two injections. However, four to five treatments may be needed in acute situations (Sola and Kuitert 1954). Needling of these trigger points is often painful, can cause a strong jump sign and produces post-needle soreness (Travell and Simons 1992:74-76). Unilateral pain is often responsive to trigger point injection (Sola 1984:681) or in females with bilateral low back pain (Sola and Kuitert 1954). Due to the high incidence of thoraco-lumbar joint dysfunction associated with trigger points in this muscle, spinal manipulation often helps to release trigger points (De Franca and Levine 1991). According to Travell and Simons (1992:73), post- isometric relaxation is effective but must not cause pain when stretching the muscle. The method of intermittent percussion (the treatment method to be researched) is described by Travell and Simons (1992:73) as being "remarkably effective" in the treatment of trigger points in this muscle.

Stretching this muscle involves lying supine with both the hips and knees flexed. The hands are placed behind the head to elevate the rib cage. The thigh on the involved side is adducted to the point of taking up all the slack in the muscle and the other leg is crossed over the affected thigh to provide resistance. The patient relaxes and allows the involved leg to be pulled medially and downward by the uninvolved leg. This causes the pelvis on the involved side to drop caudally. During inspiration, the patient abducts the thigh against resistance of the other thigh. On expiration, the patient relaxes the thigh (Travell and Simons 1992:82). This is the " Quadratus Lumborum Supine Self Stretch" and is the most effective stretch for this muscle. Other stretches are also available.

DIAGRAM THREE.

QUADRATUS LUMBORUM SUPINE SELF STRETCH.

Travell and Simons (1992:83)



2.12.2. GLUTEUS MEDIUS MUSCLE.

This fan-like muscle is commonly involved when quadratus lumborum trigger points are active, as it lies in the referred pain zone. The reverse is also true whereby quadratus lumborum trigger points become activated by active gluteus medius trigger points.(Sola 1984:683; Travell and Simons 1992:68).

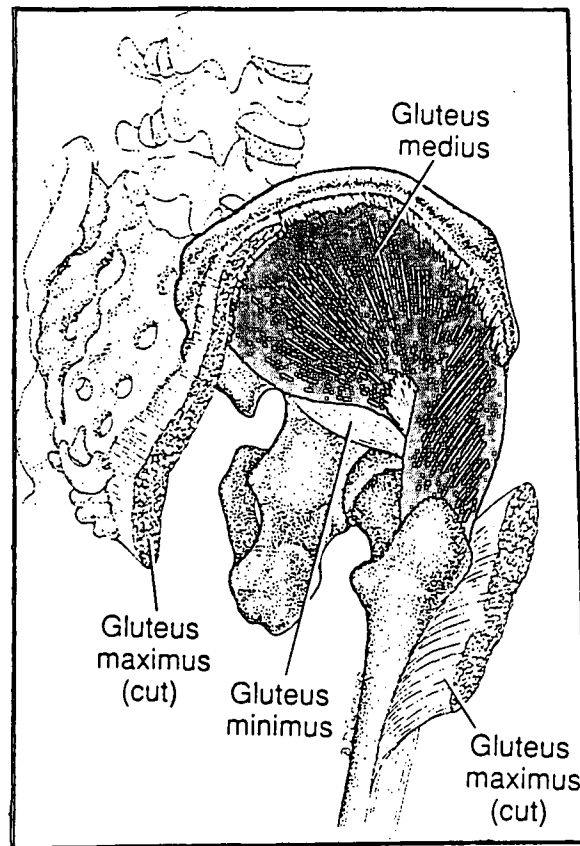
According to Sola (1984:683), the gluteus medius muscle is also a commonly overlooked source of widespread low back pain and sciatica but is seldom involved as a single entity. Han et al. (1997) state that the trigger points in the gluteus medius muscle are often confused with diseases of the sacroiliac joint.

The gluteus medius muscle originates from the upper portion of the ilium, deep to the gluteus maximus muscle, attaching to the lateral surface of the greater trochanter. Gluteus medius muscle is innervated by the superior gluteal nerve (L5,S1). (Gatterman 1990:299).

DIAGRAM FOUR.

ATTACHMENTS OF GLUTEUS MEDIUS.

Travell and Simons (1992:152)



The primary function of this muscle is to stabilize the contralateral pelvis during gait or on one limb weight bearing (Schneider 1994:170). Failure of the muscle to perform this function results in a positive Trendelenberg's sign whereby the pelvis tilts on the unsupported side (Gatterman 1990:299). Gluteus medius provides powerful abduction and medial rotation of the thigh (Travell and Simons 1992:153). A positive Ober's sign can occur as taut gluteus medius fibres limit abduction of the thigh (Schneider 1994:170).

Three trigger points are found in this muscle and are summarised by Travell and Simons (1992:150-151) as the following:

Trigger point one is close to the iliac crest near the sacro-iliac joint and refers pain over the posterior crest of the ilium, the sacro-iliac joint, the sacrum on the same side and pain may extend over the entire buttock.

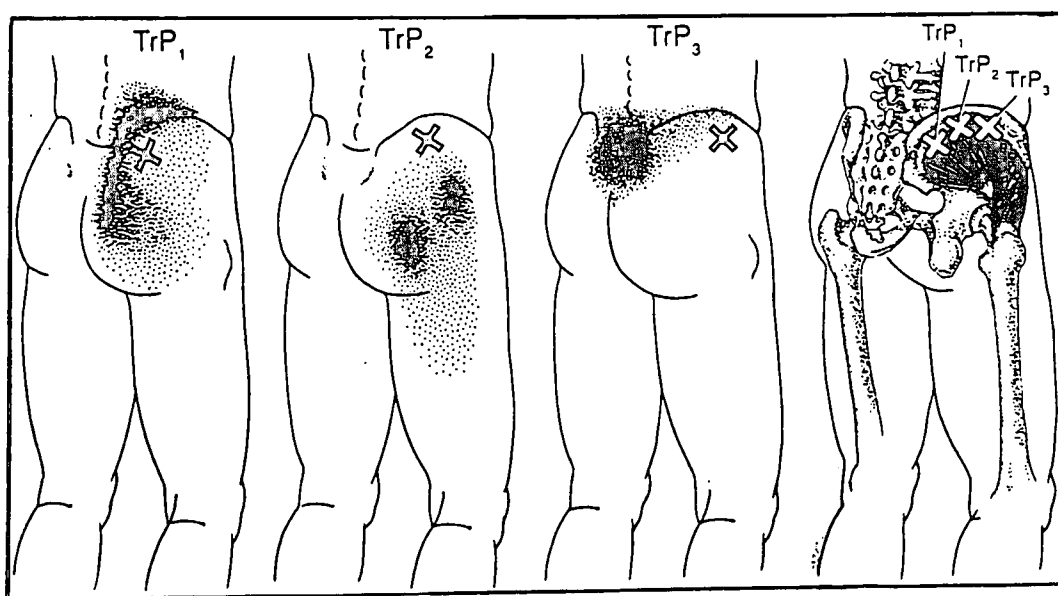
Trigger point two is in the mid-belly of the muscle below the iliac crest and refers pain laterally, to the mid-gluteal region and upper thigh posteriorly and laterally.

Trigger point three is rare, near the anterior superior iliac spine. Pain referral is along the iliac crest, lumbosacral area and the sacrum bilaterally.

DIAGRAM FIVE.

REFERRED PAIN PATTERNS OF GLUTEUS MEDIUS.

Travell and Simons (1992:151)



Trigger points in this muscle are commonly activated by sudden falls, running, long walks on soft sand and weight bearing on one limb for extended periods. The muscle can be activated by injecting into the muscle and latent trigger points can be activated by the irritating substances injected. Similarly to the quadratus lumborum, this muscle is perpetuated by leg length inequality, a small hemipelvis, as well as sitting on a full wallet. Morton's foot and hyperpronation contribute to trigger points in the gluteus medius muscle as the muscle attempts to restrict medial rotation and abduction. (Travell and Simons 1992:155-156; Schneider 1994:170-171).

Patients with trigger points in the gluteus medius musculature often complain of pain on walking, pain on sleeping on the affected side and discomfort in slumped sitting positions, as this compresses the trigger points (Travell and Simons 1992:154). This muscle can mimic sciatica and is often the cause of hip pain in the later stages of pregnancy (Sola 1984:683). The gluteus medius muscle has been related to muscles of the cervical spine and is involved in cervical pain and headaches although the precise mechanism is unknown (Sola 1984:683).

On examination, the patients gait must be analyzed for a positive Trendelenberg's sign (Gatterman 1990:299). Patients tend to favour one side on standing, in order to relieve tension or discomfort (Travell and Simons 1992:157).

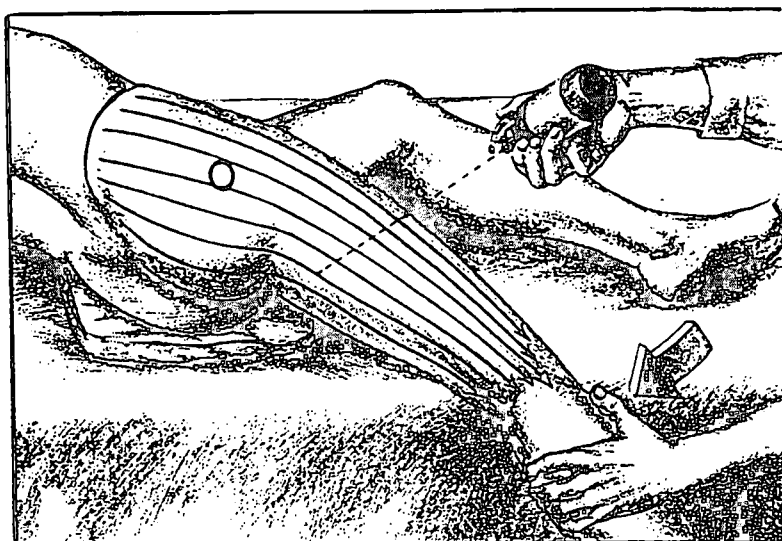
Trigger points in this muscle respond well to most therapies including spray and stretch,

Stretching this muscle passively involves the patient lying on their opposite side with the involved leg flexed 90 degrees at the hip and the knee of that leg resting on the table. The thigh is then passively further abducted by pulling the pelvis backward. Anterior fibres are stretched by lying in the same position but the thigh is extended and adducted over the table. (Gatterman 1990:299-300).

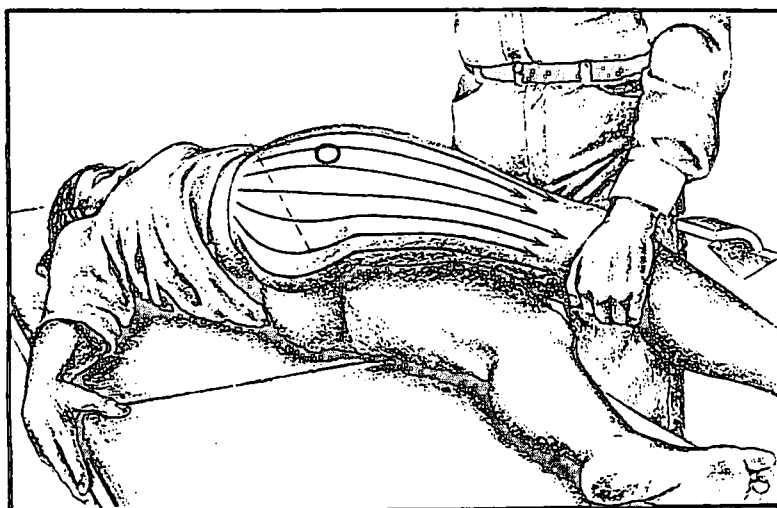
DIAGRAM SIX.

STRETCHES FOR GLUTEUS MEDIUS.

Travell and Simons (1992:160)



ANTERIOR FIBRE STRETCH



POSTERIOR FIBRE STRETCH

2.13. SUMMARY.

From the literature reviewed, it can be seen that low back pain is a common entity in medicine and remains an enigma as it is difficult to diagnose; furthermore, many treatment protocols often prove futile. A large, yet relatively misunderstood causative factor of low back pain is myofascial trigger points. The most commonly involved muscles in most mechanical low back pain syndromes include the quadratus lumborum and gluteus medius muscles, as they constantly aggravate one another.

Few research studies have assessed the effectiveness of therapeutic modalities in the management of myofascial pain syndromes, especially myofasciitis of the low back (Hong et al 1993). Some treatment methods are effective in myofasciitis of quadratus lumborum muscles, but these trigger points are difficult to eradicate quickly due to their unusual attachments and varying fibre directions.

Travell and Simons' (1992:74) method of intermittent percussion has never been researched. The aim of this research is to determine the effects of intermittent percussion and to determine if it is as effective as the two authors state. The research will also determine the effectiveness of dry needling. As dry needling is a recognised therapy in the treatment of myofasciitis (Sola 1981) and is used in the relief of both quadratus lumborum and gluteus medius trigger points (Travell and Simons 1992:74-76; 161-162), dry needling will also be used as a comparative technique to intermittent percussion.

Research is necessary in order to determine a more effective treatment approach in the elimination of trigger points causing low back pain.

CHAPTER THREE

METHODS AND METHODOLOGY

CHAPTER 3 . METHODS AND METHODOLOGY.

3.1 INTRODUCTION AND STUDY DESIGN.

This study was designed as a randomised comparative clinical trial to evaluate the relative effectiveness of intermittent percussion versus dry needling, in patients with low back pain of quadratus lumborum and gluteus medius myofascial origin, in terms of objective and subjective clinical findings.

The data collected from the two treatment groups was statistically analysed to determine whether dry needling or intermittent percussion was the more effective treatment.

3.2. PATIENT SELECTION.

Patients were obtained by the appropriate advertising methods (eg: newspaper, radio) and accepted into the study by means of consecutive sampling, whereby any patient presenting to the Technikon Natal Chiropractic Day Clinic complaining of low back pain, was briefly assessed to determine if he/she would be considered for the study. The patients were asked to describe the location, character of the pain, the duration and probable causes.

Travell and Simons (1983:13) describe the pain as dull, aching or burning in chronic cases while acute cases are a sharp and lancing pain. The trigger points of the quadratus lumborum and gluteus medius muscles were then palpated to determine any characteristic referred pain

patterns. If, according to the researcher, the patient was eligible to enter the study, the patient would undergo a more detailed examination as described further in this chapter.

3.3. INCLUSION AND EXCLUSION CRITERIA FOR TREATMENT.

Strict criteria were given to ensure the integrity of the study. These criteria were described in chapter two of this research under diagnosis of myofascial trigger points. The six main criteria used in the diagnosis of myofascial pain and dysfunction syndrome in a research situation, according to Simons (1991) were as follows:

1. Referred pain following the compression of the active trigger point of at least 2cm from the focal spot.
2. Restriction in the stretched range of motion of the affected muscle.
3. A taut, palpable band in the affected muscle.
4. Digital pressure of the taut band produces exquisite focal tenderness.
5. Needling or snapping palpation of the trigger point produces a local twitch response.
6. Reproduction of the pain by needling or palpation of the trigger point.

According to Simons (1991), all six criteria must be met in order for the patient to be accepted into a research situation. Only once the subjects had met these criteria were they accepted into the research.

Other entrance criteria were as follows:

1. The subjects had to be diagnosed by the researcher as having active myofascial trigger points, as associated with myofascial pain and dysfunction syndrome, of the quadratus lumborum and/or gluteus medius muscles.
2. Active trigger points could be unilateral or bilateral.
3. Subjects had to be between the ages of 17 to 70 years of age.
4. Patients diagnosed as having any pathology or exhibiting any contra-indications as set out by Gatterman (1990:67,322), would be excluded from the study. X-rays would be taken if necessary to exclude possible pathology.
5. Any patients that fell ill during the study were excluded as this could alter the results of the treatment.
6. Any patient accepted into the study was to refrain from any analgesic medication two weeks prior to the study commencing, as this could influence results. The use of analgesic medication would mask the symptoms and alter the initial readings.

On acceptance into the study, the subjects signed an informed patient consent form (APPENDIX A) and agreed to abstain from the use of any analgesics or medication as well as undergoing any other manual treatment for the condition while undergoing the research treatment.

The sample size was set at thirty subjects who were then randomly divided into two groups of fifteen by random assignment. The one group (Group A) would receive dry needling and the other group (Group B) would receive intermittent percussion. Random assignment of patients

was performed by placing fifteen labels marked with an A representing dry needling and fifteen labels marked with a B representing intermittent percussion. These were folded, placed into a box and agitated so as to mix them. On a separate page, the numbers 1 to 30 were drawn up. As each label was drawn from the box, it corresponded to the numbers in sequence (APPENDIX B). Labels were discarded after being recorded to prevent any complications in recording. This random sampling method was used by Broome (1995:48).

There was no blinding of patients in the study, and the patients were informed as to which treatment they would be receiving.

3.4. TREATMENT PROTOCOL.

Methodology used in this study was based on that used by Jones (1994:39). Each patient that passed the initial screening procedure was then booked for a consultation where a detailed case history (APPENDIX C), a physical examination (APPENDIX D) and a lumbar spine regional (APPENDIX E) were performed. Once this was completed and myofascial pain and dysfunction syndrome diagnosed, they were scheduled for a maximum of five treatments within a four week period, the frequency of treatments depended on the level of disability that the patient was experiencing. That is to say, in an acute case, the five treatments would be performed over a period shorter than a month This was followed by a one-month follow-up assessment consultation.

Should the patients have recovered before the specified number of treatments were completed, they would still be required to continue evaluation. If the patient again became symptomatic, he/she would continue treatment until the end of the specified treatment period.

The active myofascial trigger points were recorded onto a pain drawing (APPENDIX F) so as to ensure easy, exact relocation of the active trigger points in quadratus lumborum and/or gluteus medius muscles. Before each treatment proceeded, the active trigger points were marked on the patient with a skin pencil to ensure easy location when treating.

Before the first, final and follow-up treatments, the patients were required to complete a Numerical Rating Scale 101 (APPENDIX G), a Short Form McGill Pain Questionnaire (APPENDIX H) and an Oswestry Low Back Pain Disability Questionnaire (APPENDIX I) under the supervision of the researcher. Algometer readings were taken on all the active trigger points to determine the pain thresholds, and goniometer readings were taken of lumbar spinal ranges of motion. These objective readings were taken at the first, final and follow-up treatments to monitor the patient's progress.

Group A received dry needling using sterile 0.32mm acupuncture needles (Macdonald et al. 1983) of varying lengths. Patient positioning for quadratus lumborum musculature is essential for accurate location and needling of the trigger points as indicated by Travell and Simons (1992:64). The patients were placed on the uninvolved side with the involved arm raised above the patient's head to elevate the rib cage. The uninvolved knee was dropped behind the other knee to pull the pelvis distally and lower the iliac crest. (Travell and Simons 1992:64). At all

times, the area to be needled was swabbed with alcohol to disinfect the region. Needling of this muscle usually produces a strong jump sign (Travell and Simons 1992:74). Post needle soreness is often associated with this muscle and the patient must be warned of this (Travell and Simons 1992:74).

Two different techniques were required to needle varying portions of the muscle. Superficial trigger points were needled using a fanning technique, whereby the needle was inserted into the trigger point under palpatory control. Then the needle was partially withdrawn and re-inserted in a different direction to ensure the entire trigger point was deactivated. Deeper trigger points were located by deep palpation and spanned on either side by two fingers of the examining hand. The needle was directed perpendicularly towards the transverse processes of the underlying lumbar vertebrae. A fanning technique was also applied to this muscle with caution . (Travell and Simons 1992:74-75).

With needling of the gluteus medius trigger points, the patient lay on the uninvolved side. The taut band was located and needled in the direction of deep tenderness, towards the ridge of the iliac crest. Fanning could be used in needling these trigger points. A local twitch response was likely to be felt with needling but due to the extreme depth of the trigger points, the patient would be unaware of the response (Travell and Simons 1992:161). A new needle was used at every treatment.

In group B, intermittent percussion was used. The intermittent percussion is a technique that was described by Travell and Simons (1992:73) and is, according to the authors, remarkably

successful. The patient was positioned so that the quadratus lumborum muscle was relaxed but not slack. The patient was seated, leaning sideways away from the side to be treated, while the body weight was supported on the arm rest of the chair to reduce the gravity force on the muscle. The area was located and using approximately the same force as in a deep tendon reflex, the area was struck, with a reflex hammer, eight to ten times at a frequency of one beat per second (Travell and Simons 1992:73).

Positioning of the gluteus medius muscle for intermittent percussion was the same as described for dry needling.

3.5. OBSERVATIONS AND DATA COLLECTION.

3.5.1. OBJECTIVE DATA COLLECTION.

Objective primary data was collected in the form of algometer and goniometric readings to measure pain thresholds and lumbar spinal ranges of motion, respectively.

The **algometer** is a device used to quantify pain sensitivity through pressure and has been shown to be suitable for clinical evaluation of trigger points by Fischer (1986, 1987). The algometer used in this study was a Wagner force dial FDK 20 (P.O. Box 1217, Greenwich, CT 06836 U.S.A.) (APPENDIX J). It is a force gauge fitted with a rubber disc measuring one square centimetre. The calibrations were in kilograms per square centimetre. The method of taking an algometer pressure reading was as follows:

1. The procedure was explained to the patient and they were instructed to indicate to the examiner, the moment they felt discomfort.
2. The muscle to be tested was placed in a relaxed position. This was essential for accurate measurements.
3. The gauge was calibrated to zero. The algometer was held perpendicularly to the trigger point and pressure was applied at a steady even rate.
4. The moment the patient had indicated discomfort, the pressure gauge was stopped and the reading taken.
5. Readings of all the active trigger points in the respective muscles were averaged to provide a single reading for that patient for that treatment period.

This provided an indicator of effectiveness of the treatments for, the higher the readings, the less tender the trigger points, and this would correlate with a reduction in the prevalence of the signs and symptoms. The readings were recorded on a table (APPENDIX K).

The **Goniometer** used for the purpose of this study was a Performance Attainment Associates Back Range of Motion II (BROM) (3600 LaBore Road, Suite 6, St Paul, MN 55110-4144) (APPENDIX L). This has been shown to be valid and reliable by Breum et al. (1995) as a measuring tool for research purposes. Ranges of motion of the lumbar spine to be measured included right and left lateral flexion and rotation, flexion and extension (APPENDIX M). The procedure for recording the ranges of motion were as follows:

1. The one apparatus was placed at the level of S1, and T12 was the point of reference.

2. A neutral reading was taken off the compass face.
3. The patient was instructed to forward flex and a reading was taken.
4. The following reading was taken in extension.
5. A second apparatus was placed at L3 after which lateral flexion and rotation was measured off the compass face.

3.5.2. SUBJECTIVE DATA COLLECTION.

Primary, subjective data was collected from the Numerical Rating Scale 101, the Short-form McGill Pain Questionnaire and the Oswestry Low Back Pain Disability Questionnaire.

The **Numerical Rating Scale 101** used in this study was chosen because of its ease in application , scoring and it's established validity and reliability (Jensen et al. 1986). The Numerical Rating Scale 101 consists of asking the patient to record their perceived pain intensity on a numerical scale of 0 to 10 where 0 represents no pain and 10 represents the worst pain possible. This number recorded is the basic data for statistical evaluation (Jensen et al. 1986).

The **Short-Form McGill Pain Questionnaire** was developed specifically for research studies where time is limited, yet more information than merely pain intensity is required. It has been proven reliable, valid and consistent by Melzack and Katz (1992:157-159). Fifteen adjectives are listed, describing pain. The first eleven questions provide information on the sensory dimension of pain, while the last three describe the affective dimension of pain. Each question is

rated on a scale of 0 to 3 where 0= no pain, 1=mild pain, 2=moderate pain and 3= severe pain. Each question can score a maximum of three for the most severe symptoms and a minimum of zero in that specific category. The sum of all the categories are counted and given as a percentage of the highest score possible.

The **Oswestry Low Back Pain Disability Questionnaire** provides a level of functioning of the patient when compared to a fit person. Its validity and reliability has been shown by Fairbanks et al. (1980). The questionnaire is divided into ten sections with six statements in each. Each statement describes a greater degree of disability in that activity than the statement before. The patient marks one statement from each section and this is rated on a score of 0 to 5, where 5 represents the greatest difficulty. The scores for all the sections are added together, doubled and converted into a percentage disability (Fairbank et al. 1980).

3.6. DATA ASSESSMENT AND STATISTICAL ANALYSIS.

3.6.1 SOLVING FOR THE SUBPROBLEMS AND HYPOTHESES.

3.6.1.1. HYPOTHESIS ONE FOR SUBPROBLEM ONE.

The Ho: within each group, there would be no improvement of the patient's condition with regard to objective clinical findings.

The Ha: within each group there would be a significant improvement in terms of objective clinical findings.

The objective data was collected from the goniometer and algometer readings.

3.6.1.2. HYPOTHESIS TWO FOR SUBPROBLEM TWO.

Similarly, the Ho: there would be no improvement within the two groups with regard to subjective clinical findings.

The Ha: there would be a significant improvement in the two groups in terms of subjective clinical findings.

The subjective data would be collected from the Numerical Rating Scale 101, the Short Form McGill Pain Questionnaire and the Oswestry Low Back Pain Disability Questionnaire.

3.6.1.3. HYPOTHESIS THREE FOR SUBPROBLEM THREE.

Once the intra-group analyses of the objective and subjective clinical findings were processed, the results of subproblem three, namely, which of the two treatments was the more effective, could be established. This was obtained by using the Mann-Whitney test at a 95% ($\alpha=0.05$) confidence level. This test is recommended by Daniel (1978:82).

The H_0 : there would be no significant improvement when dry needling was compared to intermittent percussion.

The H_a : the intermittent percussion would be shown to be more effective in the treatment of quadratus lumborum and gluteus medius trigger points than dry needling treatments.

3.7.STATISTICAL ANALYSIS.

3.7.1 TREATMENT OF THE DATA.

3.7.1.1. OBJECTIVE DATA TREATMENT.

- The goniometer measurements were recorded in degrees, for the following low back ranges of motion: flexion, extension, left and right lateral flexion and left and right rotation. This was performed on both treatment groups respectively.
- Algometer readings were recorded separately for each of the groups.
- A statistical analysis of the data was performed for the objective data.

3.7.1.2. SUBJECTIVE DATA TREATMENT.

- The Oswestry Low Back Pain Disability Questionnaire, the Short-Form McGill Pain Questionnaire and the Numerical Rating Scale 101 were all collected and screened to ensure they were correctly completed.
- All the questionnaires were added up and converted to a percentage for each of the treatment groups.
- A statistical analysis was performed for the subjective data.

3.7.2 SPECIFIC STATISTICAL ANALYSIS OF DATA.

The non-parametric tests were conducted using Wilcoxon Signed-Rank Test and Mann-Whitney U Test, using a two-tailed test where:

Reject H_0 if $p \leq \alpha/2 = 0.025$.

Accept H_0 if $p > \alpha/2 = 0.025$

3.7.2.1. NON- PARAMETRIC PAIRED HYPOTHESIS TESTS.

The Wilcoxon Signed-Rank Test was used for analysing the data. This test is performed for the intra-group analysis as it is a powerful test, less restrictive and nearly equal in sensitivity to the T test, and it is ideal in the situation whereby the sample size is less than 25 (Daniel 1978:31).

Accept H_0 if $p > \alpha/2 = 0.025$.

3.7.2.1.(a). Objective Data.

Each of the goniometric measurements recorded from the BROM, in degrees, was analyzed for both treatment groups. The measurements were recorded from the following :

- a) The initial consultation (IC) and the final consultation (5C)
- b) The initial consultation (IC) and the follow-up consultation (FC)
- c) The final consultation (5C) and the follow-up consultation (FC)

<u>GROUP A</u>	<u>GROUP B</u>
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IC \leftrightarrow 5C	IC \leftrightarrow 5C
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IC \leftrightarrow FC	IC \leftrightarrow FC
-------------------------	-------------------------

5C \leftrightarrow FC	5C \leftrightarrow FC
-------------------------	-------------------------

The figures were analyzed to determine the level of significance.

The data was taken at:

- a) The initial consultation (IC) and the final consultation (5C) to establish if the treatment was effective.
- b) The initial consultation (IC) and the follow-up consultation (FC) to investigate the long term effects of the treatment.
- c) The final consultation (5C) and the follow-up consultation (FC) to determine if the treatment results were maintained.

The algometer readings, in kilograms per centimeter squared, were recorded for each group.

They were analysed from the following:

- a) The initial consultation (IC) and the final consultation (5C)
- b) The initial consultation (IC) and the follow-up consultation (FC)
- c) The final consultation (5C) and the follow-up consultation (FC)

<u>GROUP A</u>	<u>GROUP B</u>
----------------	----------------

IC \leftrightarrow 5C	IC \leftrightarrow 5C
-------------------------	-------------------------

IC \leftrightarrow FC	IC \leftrightarrow FC
-------------------------	-------------------------

5C \leftrightarrow FC	5C \leftrightarrow FC
-------------------------	-------------------------

The figures were analysed to determine the level of significance.

The data was taken at:

- The initial consultation (IC) and the final consultation (5C) to establish if the treatment was effective.
- The initial consultation (IC) and the follow-up consultation (FC) to investigate the long term effects of the treatment.
- The final consultation (5C) and the follow-up consultation (FC) to determine if the treatment results were maintained.

3.7.2.2.(b). Subjective Data.

The subjective results collected from the Numerical Rating Scale 101, the Oswestry Low Back Pain Disability Questionnaire and the Short-Form McGill Pain Questionnaire, all recorded in percentages, were taken from both groups respectively and analyzed at the following treatments:

- The initial consultation (IC) and the final consultation (5C)
- The initial consultation (IC) and the follow-up consultation (FC)
- The final consultation (5C) and the follow-up consultation (FC)

<u>GROUP A</u>	<u>GROUP B</u>
IC \leftrightarrow 5C	IC \leftrightarrow 5C
IC \leftrightarrow FC	IC \leftrightarrow FC
5C \leftrightarrow FC	5C \leftrightarrow FC

These figures were compared to determine the level of significance.

The data was taken at:

- The initial consultation (IC) and the final consultation (5C) to establish if the treatment was effective.
- The initial consultation (IC) and the follow-up consultation (FC) to investigate the long term effects of the treatment.
- The final consultation (5C) and the follow-up consultation (FC) to determine if the treatment results were maintained.

3.7.2.2. NON- PARAMETRIC UNPAIRED HYPOTHESIS TESTS.

The Mann-Whitney test was used at a 95% ($\alpha = 0.05$) confidence level to analyze both the objective and subjective data. This test is recommended by Daniel (1978:82) for groups with sample sizes of less than 25.

3.7.2.2.(a). Objective Data.

Goniometer measurements (in degrees) using the BROM, were used to analyse the mean units for both the groups and were compared according to the following:

- a) The initial consultation (IC) for Group A and Group B.
- b) The final consultation (5C) for Group A and Group B.
- c) The follow-up consultation (FC) for Group A and Group B.

GROUP A + GROUP B

IC \leftrightarrow IC

5C \leftrightarrow 5C

FC \leftrightarrow FC

These figures were compared to determine the level of significance.

The mean units (kilograms per centimeter squared) for the algometer recordings were analysed for both treatment groups for the following:

- a) The initial consultation (IC) for Group A and Group B.
- b) The final consultation (5C) for Group A and Group B.
- c) The follow-up consultation (FC) for Group A and Group B.

GROUP A + GROUP B

IC \leftrightarrow IC

5C \leftrightarrow 5C

FC \leftrightarrow FC

These figures were compared to determine the level of significance.

3.7.2.2.(b). Subjective Data.

Each questionnaire (Numerical Rating Scale 101, Oswestry Low Back Pain Disability Questionnaire and Short-Form McGill Pain Questionnaire) that the patient was asked to complete was analysed from both groups. The mean units, in percentages, were compared as follows:

- a) The initial consultation (IC) for Group A and Group B.
- b) The final consultation (5C) for Group A and Group B.
- c) The follow-up consultation (FC) for Group A and Group B.

GROUP A + GROUP B

IC \leftrightarrow IC

5C \leftrightarrow 5C

FC \leftrightarrow FC

These figures were compared to determine the level of significance.

All statistical analyses were performed using the computer software programme STATGRAPHICS VERSION 6 PLUS supplied by MANUGRAPHICS INC at the Technikon Natal.

In order to further strengthen the statistical results, the standard deviation and standard error was used. This is measuring the variability of a set of data in terms of deviation from the mean. The less spread out a group of data is around the mean, the closer the estimated population was to the mean and conversely, the greater the spread of the group around the mean, the less the estimated population conforms to the mean. A widely dispersed population gives a larger standard deviation.

Other variables within the sample groups were statistically analysed and a subjective comparative analysis was performed on the data. Variables such as age, gender distribution, the trigger point distribution in patients, and the level of disability that myofasciitis caused, were all analysed against findings of other authors as follows:

1. AGE.

All the ages within the sample size were recorded and an analysis was performed comparing the research of Travell and Simons (1983:5) , who state that the most commonly affected age group ranges from between 31-50 years of age. According to Han et al. (1997), the average age ranges between 30-49 years and decreases with age. The results were tabulated according to age range and mean age.

2. GENDER.

In a study performed by Sola (1954), the sample size of 200 patients showed a gender distribution of 54% of females and 45% of males affected by myofasciitis. Middle aged, sedentary females tend to be the most affected group according to Yunnus et al. (1988). All the members of the sample size were recorded according to gender and this figure converted into a percentage.

3. TRIGGER POINT DISTRIBUTION.

Sola (1954) found that approximately 62.5% of the sample group had multiple trigger points and the tendency was for the trigger points to occur bilaterally. In this research, an attempt was made to determine how many subjects had trigger points unilaterally and how many had trigger points bilaterally. This was recorded separately for each muscle.

4. LEVEL OF DISABILITY.

Myofascial pain can vary from being a recurrent, dull ache or burn to a severe lancing knife-like or stabbing pain (Gatterman 1990:295). A very subjective analysis based on a scale of 0 to 3 whereby, 0= no disability, 1= mild disability, 2= moderate disability and 3= severe disability was used. The researcher based his score on the case history and physical findings as well as the overall appearance and behaviour of the patient.

All processed data was tabulated. Most data was also presented as bar graphs and/or pie charts for easy visual interpretation.

CHAPTER FOUR

RESULTS

CHAPTER 4. RESULTS.

4.1. INTRODUCTION.

This chapter will represent the results of the data collected from the clinical trial.

The first section consisted of demographic data collected from the sample size of 30 patients. This included ages, gender and data regarding the prevalence and distribution of the trigger points within the quadratus lumborum and gluteus medius muscles.

The second section was a statistical analysis of the data in order to solve the subproblems. Using a sample size of thirty patients, non-parametric hypothesis testing was used. Wilcoxon Signed Rank Test was used for intra-group analysis and the Mann-Whitney Test was used for inter-group analysis.

Subjective data was collected from the Numerical Rating Scale 101, the Oswestry Low Back Pain Disability Questionnaire and the Short-form McGill Pain Questionnaire. Objective data was collected from the algometer and goniometer readings.

4.2. DEMOGRAPHIC DATA.

4.2.1.AGE DISTRIBUTION.

Table 1. Age distribution and mean age within the two sample groups.

AGE DISTRIBUTION	DRY NEEDLING	INTERMITTENT PERCUSSION	TOTAL
AGE RANGE (YEARS)	18-62	19-63	18-63
MEAN (YEARS)	35.07	38.4	36.73
10 - 19 YEARS	1	1	2
20 - 29 YEARS	7	5	12
30 - 39 YEARS	2	2	4
40 - 49 YEARS	1	3	4
50 - 59 YEARS	3	1	4
60 - 69 YEARS	1	3	4

4.2.2. GENDER DISTRIBUTION.

Table 2. Gender distribution within the two sample groups.

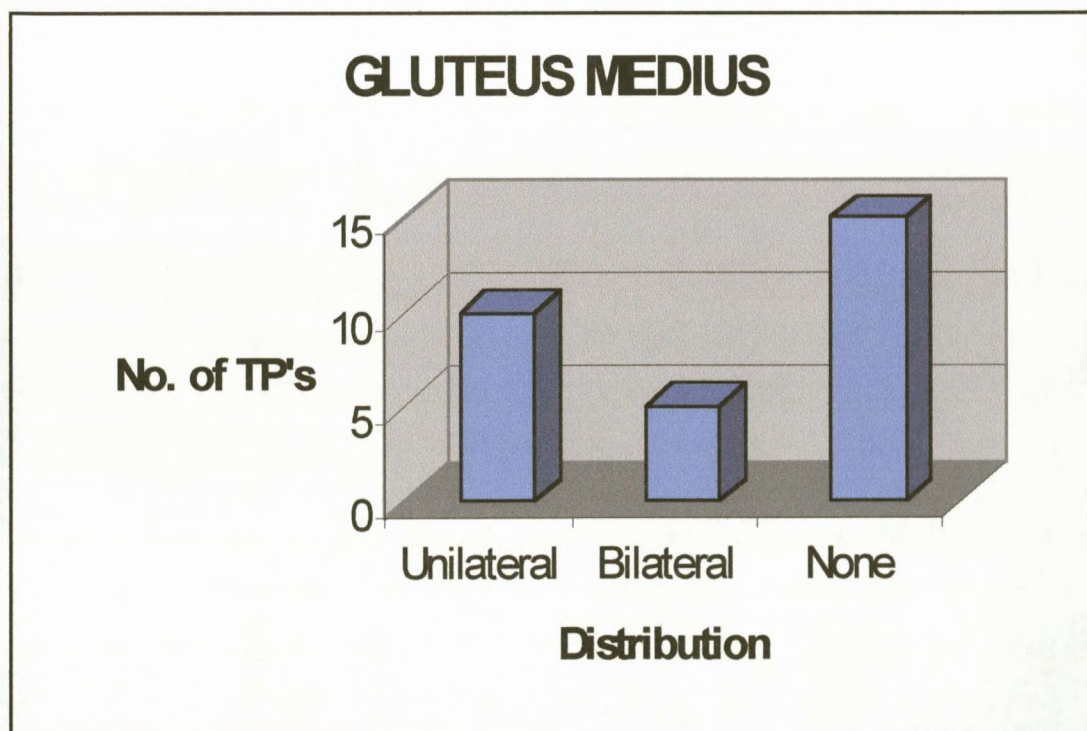
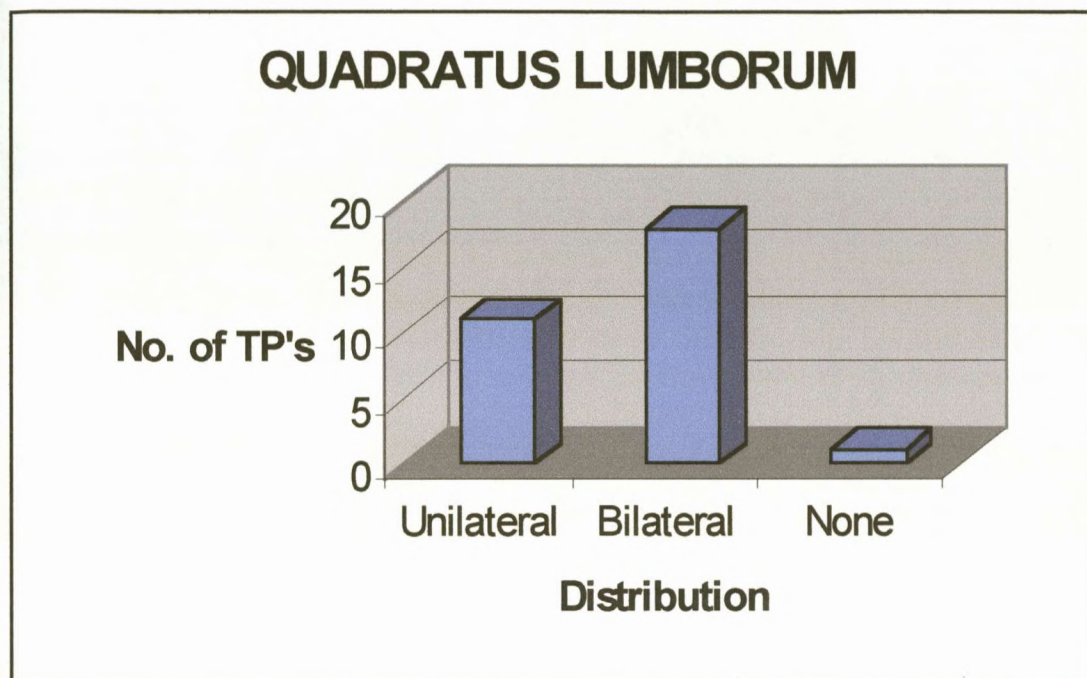
GENDER DISTRIBUTION	DRY NEEDLING	INTERMITTENT PERCUSSION	TOTAL
FEMALES	9	7	16
MALES	6	8	14

4.2.3. TRIGGER POINT DISTRIBUTION.

Table 3. The specific number of trigger points in the quadratus lumborum compared to the gluteus medius muscles.

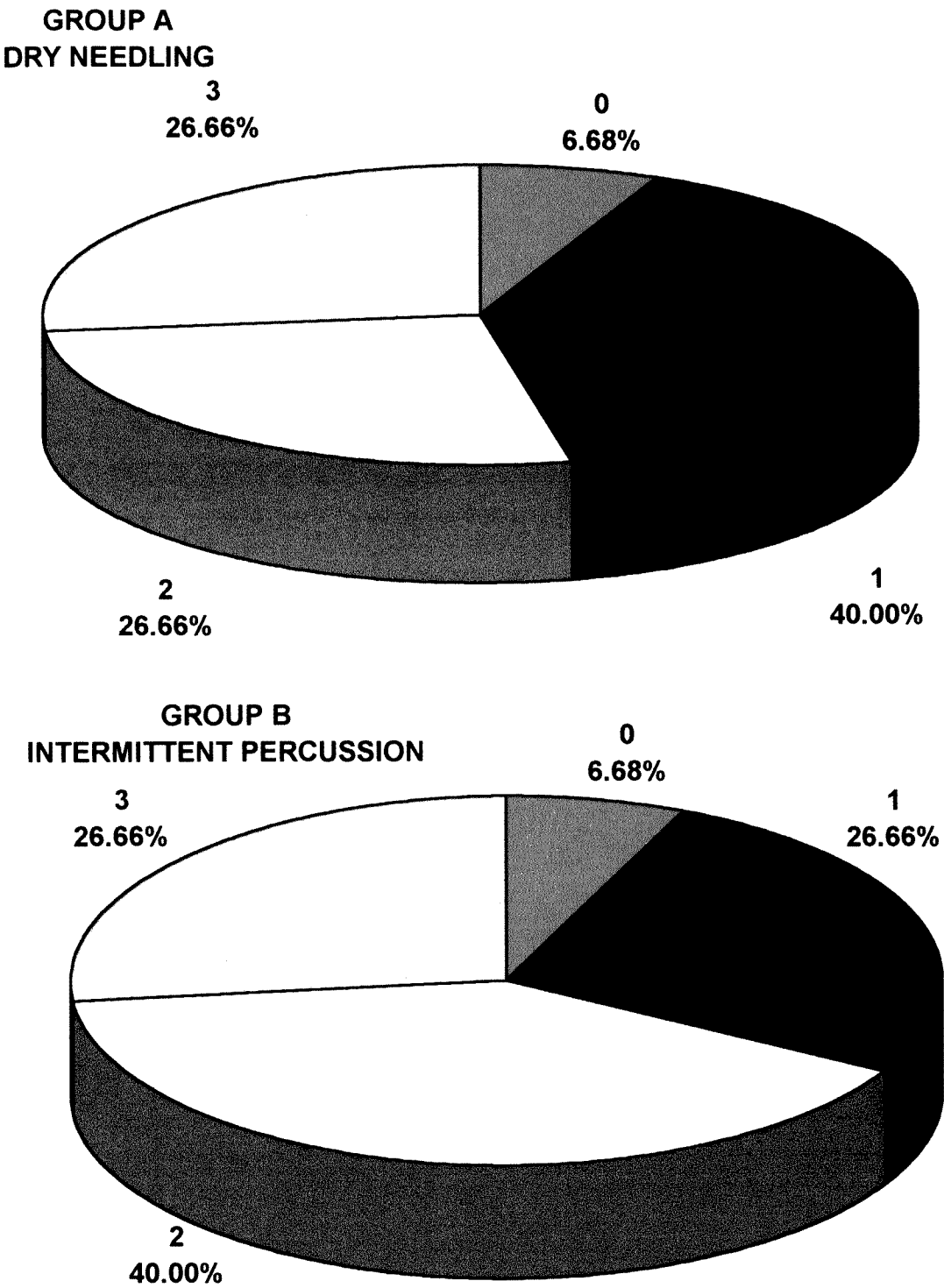
	QUADRATUS LUMBORUM	GLUTEUS MEDIUS	TOTAL
DRY NEEDLING	30	7	37
INTERMITTENT PERCUSSION	39	16	55
TOTAL	69	23	92

Figure 1. The specific distribution of trigger points within the quadratus lumborum and gluteus medius muscles.

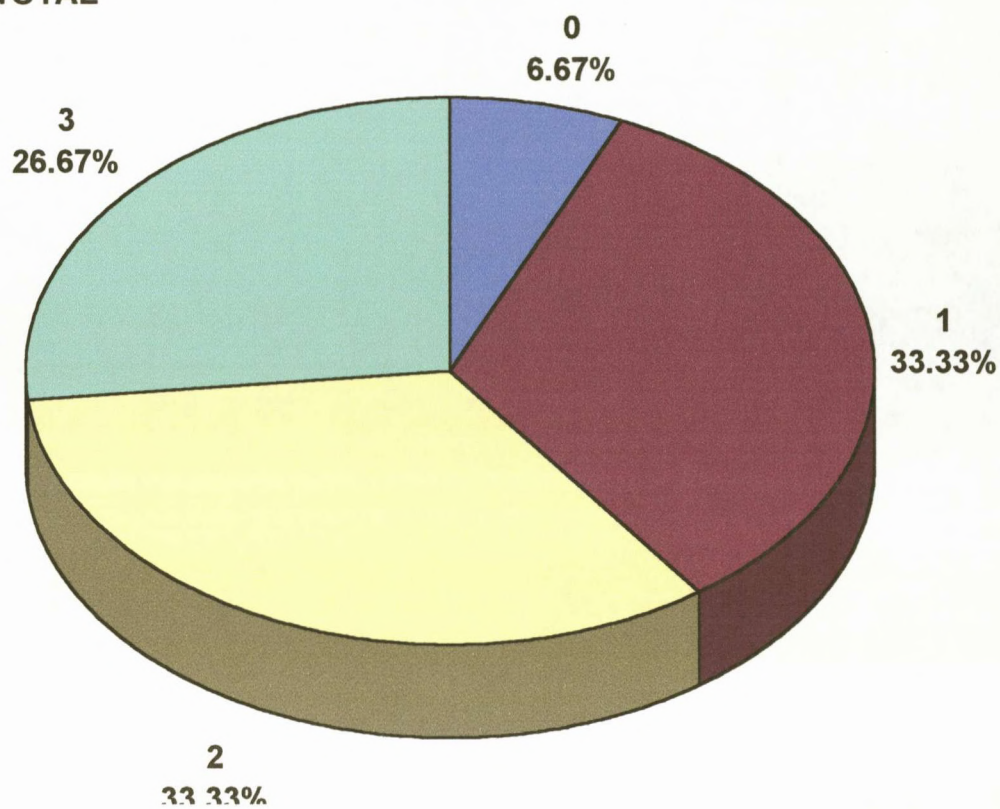


4.2.4. LEVEL OF DISABILITY.

Figure 2. The level of disability of patients in the sample size.



TOTAL



4.3. THE STATISTICAL ANALYSIS OF THE DATA.

4.3.1. ABBREVIATIONS.

S.D.= Standard Deviation

S.E.= Standard Error

P-Value= Observed level of significance for the test

Ho= Null Hypotheses

H1= Alternate Hypothesis

α = The level of Significance

IC= Initial Consultation

5C= Final Consultation

FC= Follow-up Consultation

NRS 101= Numerical Rating Scale 101

Oswestry= Oswestry Low Back Pain Disability Questionnaire

SFMPQ= Short-Form McGill Pain Questionnaire

4.3.2. NON-PARAMETRIC HYPOTHESIS TESTING.

4.3.2.1. SUBPROBLEM ONE.

Subproblem one is analysing the objective data (Algometer and Goniometer readings) for both the dry needling and intermittent percussion of trigger points in the quadratus lumborum and gluteus medius muscles.

Table 4. The results of the Wilcoxon Signed Rank Test comparing algometer and goniometer readings for Group A (Dry needling) for the period between the initial consultation (IC) and the final consultation (5C).

GROUP A

GONIOMETER	IC				5C		
	MEAN	SD	SE	P-VALUE	MEAN	SD	SE
Flexion	22.22	6.84	1.77	0.7518	21.62	6.07	1.57
Extension	6.73	4.10	1.06	0.7728	8.26	2.77	0.71
Right rotation	33.27	13.77	3.56	0.0055	41.20	17.18	4.44
Left rotation	29.10	17.61	4.55	0.0265	41.07	15.39	3.97
Right lat flexion	12.86	6.64	1.72	0.5050	13.48	4.28	1.11
Left lat flexion	10.52	4.60	1.19	0.2278	12.03	4.12	1.06
ALGOMETER	2.32	0.76	0.20	0.0098	2.91	1.42	0.37

For the goniometer readings for flexion, extension, left rotation, right lateral flexion and left lateral flexion, the null hypothesis was accepted. For the goniometer reading for right rotation and the algometer readings, the null hypothesis was rejected.

Table 5. The results of the Wilcoxon Signed Rank Test comparing algometer and goniometer readings for Group B (Intermittent percussion) for the period between the initial consultation (IC) and the final consultation (5C).

GROUP B							
	IC				5C		
GONIOMETER	MEAN	SD	SE	P-VALUE	MEAN	SD	SE
Flexion	19.06	6.57	1.70	1.0	19.64	5.50	1.42
Extension	6.51	5.43	1.40	0.0265	8.49	4.17	1.08
Right rotation	39.60	15.96	4.12	0.1814	43.57	15.69	4.05
Left rotation	38.30	16.07	4.50	0.0614	45.32	16.89	4.36
Right lat flexion	11.62	3.89	1.01	0.0455	13.37	4.02	1.04
Left lat flexion	12.08	4.24	1.09	1.0	12.27	4.01	1.03
ALGOMETER	2.56	0.94	0.24	0.0098	3.04	0.99	0.25

For all the goniometer readings: flexion, extension, right rotation, left rotation, right lateral flexion and left lateral flexion, the null hypothesis was accepted. For the algometer readings, the null hypothesis was rejected.

Table 6. The results of the Wilcoxon Signed Rank Test comparing algometer and goniometer readings for Group A (Dry needling) for the period between the initial consultation (IC) and the follow-up consultation (FC).

GROUP A							
GONIOMETER	IC				FC		
	MEAN	SD	SE	P-VALUE	MEAN	SD	SE
Flexion	22.22	6.84	1.77	0.2888	22.82	7.15	1.85
Extension	6.73	4.10	1.06	0.0269	9.52	3.33	0.86
Right rotation	33.27	13.77	3.56	0.1814	39.75	17.46	4.51
Left rotation	29.10	17.61	4.55	0.0961	41.47	14.79	3.82
Right lat flexion	12.86	6.64	1.72	0.1306	13.10	5.46	1.41
Left lat flexion	10.52	4.60	1.19	0.3428	11.96	3.33	0.86
ALGOMETER	2.32	0.76	0.20	0.0055	3.11	1.32	0.34

For all the goniometer readings: flexion, extension, right rotation, left rotation, right lateral flexion and left lateral flexion, the null hypothesis was accepted. For the algometer readings, the null hypothesis was rejected.

Table 7. The results of the Wilcoxon Signed Rank Test comparing algometer and goniometer readings for Group B (Intermittent percussion) for the period between the initial consultation (IC) and the follow-up Consultation (FC).

GROUP B							
	IC				FC		
GONIOMETER	MEAN	SD	SE	P-VALUE	MEAN	SD	SE
Flexion	19.06	6.57	1.70	0.7728	16.92	8.19	2.12
Extension	6.51	5.43	1.40	0.0614	8.46	5.15	1.33
Right rotation	39.60	15.96	4.12	0.1489	46.93	13.57	3.50
Left rotation	38.30	16.07	4.50	0.0162	47.48	13.02	3.36
Right lat flexion	11.62	3.89	1.01	0.0077	14.01	4.31	1.11
Left lat flexion	12.08	4.24	1.09	0.2278	12.42	4.74	1.22
ALGOMETER	2.56	0.94	0.24	0.0961	3.11	1.43	0.30

For the goniometer readings for flexion, extension, right rotation and left lateral flexion, the null hypothesis was accepted. For the goniometer readings for left rotation and right lateral flexion and the algometer readings, the null hypothesis was rejected.

Table 8. The results of the Wilcoxon Signed Rank Test comparing algometer and goniometer readings for Group A (Dry needling) for the period between the final consultation (5C) and the follow-up consultation (FC).

GROUP A

	5C				FC		
GONIOMETER	MEAN	SD	SE	P-VALUE	MEAN	SD	SE
Flexion	21.62	6.07	1.57	0.2888	22.82	7.15	1.85
Extension	8.26	2.77	0.71	0.3428	9.52	3.33	0.86
Right rotation	41.20	17.18	4.44	1.0	39.75	17.46	4.51
Left rotation	41.07	15.39	3.97	1.0	41.47	14.79	3.82
Right lat flexion	13.48	4.28	1.11	1.0	13.10	5.46	1.41
Left lat flexion	12.03	4.12	1.06	1.0	11.96	3.33	0.86
ALGOMETER	2.91	1.42	0.37	0.3017	3.11	1.32	0.34

For all the goniometer readings: flexion, extension, right rotation, left rotation, right lateral flexion, left lateral flexion and the algometer readings, the null hypothesis was accepted.

Table 9. The results of the Wilcoxon Signed Rank Test comparing algometer and goniometer readings from Group B (Intermittent percussion) for the period between the final consultation (5C) and the follow-up consultation (FC).

GROUP B

	5C				FC		
GONIOMETER	MEAN	SD	SE	P-VALUE	MEAN	SD	SE
Flexion	19.64	5.50	1.42	0.7728	16.92	8.19	2.12
Extension	8.49	4.17	1.08	0.7518	8.46	5.15	1.33
Right rotation	43.57	15.69	4.05	0.5050	46.93	13.57	3.50
Left rotation	45.32	16.89	4.36	0.7728	47.48	13.02	3.36
Right lat flexion	13.37	4.02	1.04	0.7518	14.01	4.31	1.11
Left lat flexion	12.27	4.01	1.03	0.7518	12.42	4.74	1.22
ALGOMETER	3.04	0.99	0.25	0.5791	3.11	1.43	0.30

For all the goniometer readings: flexion, extension, right rotation, left rotation, right lateral flexion and left lateral flexion as well as the algometer readings, the null hypothesis was accepted.

4.3.2.2. SUBPROBLEM TWO.

Subproblem two is analysing the subjective data (Oswestry Low Back Pain Disability Questionnaire, Numerical Rating Scale 101 and Short-form McGill Pain Questionnaire) for both dry needling and intermittent percussion of the quadratus lumborum and gluteus medius muscles.

Table 10. The results of the Wilcoxon Signed Rank Test comparing the Numerical Rating Scale (NRS 101), the Oswestry Low Back Pain Disability Questionnaire (Oswestry) and Short-form McGill Pain Questionnaire (SFMPQ) from group A (Dry needling), for the period between the initial consultation (IC) and the final consultation (5C).

GROUP A

	IC				5C		
	MEAN	SD	SE	P-VALUE	MEAN	SD	SE
NRS 101	42.83	16.80	4.34	0.0961	31.69	17.75	4.58
Oswestry	15.57	6.68	1.73	0.3865	14.13	9.43	2.43
SFMPQ	21.48	12.49	3.22	0.0003	10.09	7.68	1.98

For the Numerical Rating Scale 101 and the Oswestry Low Back Pain Disability Questionnaire, the null hypothesis was accepted. For the Short-Form McGill Pain Questionnaire, the null hypothesis was rejected.

Table 11. The results of the Wilcoxon Signed Rank Test comparing the Numerical Rating Scale (NRS 101), the Oswestry Low Back Pain Disability Questionnaire (Oswestry) and Short-form McGill Pain Questionnaire (SFMPQ) From Group B (Intermittent percussion) for the period between the initial consultation (IC) and the final consultation (5C).

GROUP B

	IC				5C		
	MEAN	SD	SE	P-VALUE	MEAN	SD	SE
NRS 101	36.94	21.22	5.48	0.0019	24.40	13.13	3.39
Oswestry	14.17	13.53	3.49	0.0033	6.84	8.80	2.27
SFMPQ	21.13	18.33	4.73	0.0005	12.41	12.84	3.31

For the Numerical Rating Scale 101, the Oswestry Low Back Pain Disability Questionnaire and the Short-Form McGill Pain Questionnaire, the null hypothesis was rejected.

Table 12. The results of the Wilcoxon Signed Rank Test comparing the Numerical Rating Scale (NRS 101), the Oswestry Low Back Pain Disability Questionnaire (Oswestry) and Short-form McGill Pain Questionnaire (SFMPQ) From Group A (Dry needling) for the period between the initial consultation (IC) and the follow-up consultation (FC).

GROUP A

	IC				FC		
	MEAN	SD	SE	P-VALUE	MEAN	SD	SE
NRS 101	42.83	16.80	4.34	0.0009	31.13	18.21	4.70
Oswestry	15.57	6.68	1.73	0.0389	10.20	6.59	1.70
SFMPQ	21.48	12.49	3.22	0.0003	9.53	7.81	2.02

For the Oswestry Low Back Pain Disability Questionnaire, the null hypothesis was accepted.

For the Numerical Rating Scale 101 and the Short-Form McGill Pain Questionnaire, the null hypothesis was rejected.

Table 13. The results of the Wilcoxon Signed Rank Test comparing the Numerical Rating Scale (NRS 101), the Oswestry Low Back Pain Disability Questionnaire (Oswestry) and Short-form McGill Pain Questionnaire (SFMPQ) From Group B (Intermittent percussion) for the period between the initial consultation (IC) and the follow-up consultation (FC).

GROUP B

	IC				FC		
	MEAN	SD	SE	P-VALUE	MEAN	SD	SE
NRS 101	36.94	21.22	5.48	0.0019	19.51	19.50	5.04
Oswestry	14.17	13.53	3.49	0.0162	9.47	10.41	2.69
SFMPQ	21.13	18.33	4.73	0.0005	11.83	15.43	3.99

For the Numerical Rating Scale 101, the Oswestry Low Back Pain Disability Questionnaire and the Short-Form McGill Pain Questionnaire, the null hypothesis was rejected.

Table 14. The results of the Wilcoxon Signed Rank Test comparing the Numerical Rating Scale (NRS 101), the Oswestry Low Back Pain Disability Questionnaire (Oswestry) and Short-form McGill Pain Questionnaire (SFMPQ) From Group A (Dry needling) for the period between the final consultation (5C) and the follow-up consultation (FC).

GROUP A

	5C				FC		
	MEAN	SD	SE	P-VALUE	MEAN	SD	SE
NRS 101	31.69	17.75	4.58	0.2278	31.13	18.21	4.70
Oswestry	14.13	9.43	2.43	0.3865	10.20	6.59	1.70
SFMPQ	10.09	7.68	1.98	0.0433	9.53	7.81	2.02

For the Numerical Rating Scale 101, the Oswestry Low Back Pain Disability Questionnaire and the Short-Form McGill Pain Questionnaire, the null hypothesis was accepted.

Table 15. The results of the Wilcoxon Signed Rank Test comparing the Numerical Rating Scale (NRS 101), the Oswestry Low Back Pain Disability Questionnaire (Oswestry) and Short-form McGill Pain Questionnaire (SFMPQ) From Group B (Intermittent percussion) for the period between the final consultation (5C) and the follow-up consultation (FC).

GROUP B

	5C				FC		
	MEAN	SD	SE	P-VALUE	MEAN	SD	SE
NRS 101	24.40	13.13	3.39	0.3865	19.51	19.50	5.04
Oswestry	6.84	8.80	2.27	0.7728	9.47	10.41	2.69
SFMPQ	12.41	12.84	3.31	0.4227	11.83	15.43	3.99

For the Numerical Rating Scale 101, the Oswestry Low Back Pain Disability Questionnaire and the Short-Form McGill Pain Questionnaire, the null hypothesis was accepted.

4.3.2.3. SUBPROBLEM THREE.

In order to determine the more effective of the two treatments namely, dry needling or intermittent percussion, the results of the two previous subproblems were combined and an intergroup analysis was performed using the Mann-Whitney U Test.

Table 16. The results of the Mann-Whitney U test comparing the algometer and goniometer readings of Group A and Group B at the initial consultation (IC) .

	GROUP A				GROUP B		
	IC				IC		
GONIOMETER	MEAN	SD	SE	P-VALUE	MEAN	SD	SE
Flexion	22.22	6.84	1.77	0.2171	19.06	6.57	1.70
Extension	6.73	4.10	1.06	0.5401	6.51	5.43	1.40
Right rotation	33.27	13.77	3.56	0.5169	39.60	15.96	4.12
Left rotation	29.10	17.61	4.55	0.1559	38.30	16.07	4.50
Right lat flexion	12.86	6.64	1.72	0.2828	11.62	3.89	1.01
Left lat flexion	10.52	4.60	1.19	0.7667	12.08	4.24	1.09
ALGOMETER	2.32	0.76	0.20	0.6328	2.56	0.94	0.24

For all the goniometer readings: flexion, extension, right rotation, left rotation, right lateral flexion and left lateral flexion as well as the algometer readings, the null hypothesis was accepted.

Table 17. The results of the Mann-Whitney U test comparing the algometer and goniometer readings of Group A and Group B at the final consultation (5C).

	GROUP A				GROUP B		
	5C				5C		
GONIOMETER	MEAN	SD	SE	P-VALUE	MEAN	SD	SE
Flexion	21.62	6.07	1.57	0.4563	19.64	5.50	1.42
Extension	8.26	2.77	0.71	0.9491	8.49	4.17	1.08
Right rotation	41.20	17.18	4.44	0.7543	43.57	15.69	4.05
Left rotation	41.07	15.39	3.97	0.5164	45.32	16.89	4.36
Right lat flexion	13.48	4.28	1.11	0.8826	13.37	4.02	1.04
Left lat flexion	12.03	4.12	1.06	1.0	12.27	4.01	1.03
ALGOMETER	2.91	1.42	0.37	0.7396	3.04	0.99	0.25

For all the goniometer readings: flexion, extension, right rotation, left rotation, right lateral flexion and left lateral flexion as well as the algometer readings, the null hypothesis was accepted.

Table 18. The results of the Mann-Whitney U test comparing the algometer and goniometer readings of Group A and Group B at the follow-up consultation (FC).

	GROUP A				GROUP B		
	FC				FC		
GONIOMETER	MEAN	SD	SE	P-VALUE	MEAN	SD	SE
Flexion	22.82	7.15	1.85	0.2388	16.92	8.19	2.12
Extension	9.52	3.33	0.86	0.4194	8.46	5.15	1.33
Right rotation	39.75	17.46	4.51	0.5713	46.93	13.57	3.50
Left rotation	41.47	14.79	3.82	0.3751	47.48	13.02	3.36
Right lat flexion	13.10	5.46	1.41	0.5732	14.01	4.31	1.11
Left lat flexion	11.96	3.33	0.86	0.5880	12.42	4.74	1.22
ALGOMETER	3.11	1.32	0.34	0.8681	3.11	1.43	0.30

For all the goniometer readings: flexion, extension, right rotation, left rotation, right lateral flexion and left lateral flexion as well as the algometer readings, the null hypothesis was accepted.

Table 19. The results of the Mann-Whitney U Test comparing the Numerical Rating Scale 101 (NRS), the Oswestry Low Back Pain Disability Questionnaire (Oswestry) and the Short-Form McGill Pain Questionnaire (SFMPQ) results of Group A and Group B at the initial Consultation (IC).

	GROUP A				GROUP B		
	IC				IC		
	MEAN	SD	SE	P-VALUE	MEAN	SD	SE
NRS 101	42.83	16.80	4.34	0.4292	36.94	21.22	5.48
Oswestry	15.57	6.68	1.73	0.3809	14.17	13.53	3.49
SFMPQ	21.48	12.49	3.22	0.9010	21.13	18.33	4.73

For the Numerical Rating Scale 101, the Oswestry Low Back Pain Disability Questionnaire and the Short-Form McGill Pain Questionnaire, the null hypothesis was accepted.

Table 20. The results of the Mann-Whitney U Test comparing the Numerical Rating Scale 101 (NRS), the Oswestry Low Back Pain Disability Questionnaire (Oswestry) and the Short-Form McGill Pain Questionnaire (SFMPQ) results of Group A and Group B at the final consultation (5C).

	GROUP A				GROUP B		
	5C				5C		
	MEAN	SD	SE	P-VALUE	MEAN	SD	SE
NRS 101	31.69	17.75	4.58	0.0698	24.40	13.13	3.39
Oswestry	14.13	9.43	2.43	0.1087	6.84	8.80	2.27
SFMPQ	10.09	7.68	1.98	0.4305	12.41	12.84	3.31

For the Numerical Rating Scale 101, the Oswestry Low Back Pain Disability Questionnaire and the Short-Form McGill Pain Questionnaire, the null hypothesis was accepted.

Table 21. The results of the Mann-Whitney U Test comparing the Numerical Rating Scale 101 (NRS), the Oswestry Low Back Pain Disability Questionnaire (Oswestry) and the Short-Form McGill Pain Questionnaire (SFMPQ) results of Group A and Group B at the follow-up consultation (FC).

	GROUP A				GROUP B		
	FC				FC		
	MEAN	SD	SE	P-VALUE	MEAN	SD	SE
NRS 101	31.13	18.21	4.70	0.0534	19.51	19.50	5.04
Oswestry	10.20	6.59	1.70	0.3591	9.47	10.41	2.69
SFMPQ	9.53	7.81	2.02	0.7554	11.83	15.43	3.99

For the Numerical Rating Scale 101, the Oswestry Low Back Pain Disability Questionnaire and the Short-Form McGill Pain Questionnaire, the null hypothesis was accepted.

CHAPTER FIVE

DISCUSSION

CHAPTER 5. DISCUSSION.

5.1. INTRODUCTION.

This chapter is a discussion regarding the results reported on in Chapter 4. Group A in the discussion received dry needling and the Group B received intermittent percussion. Objective results were obtained using the algometer and goniometer. Subjective results were obtained using the Numerical Rating Scale 101, the Oswestry Low Back Pain Disability Questionnaire and the Short-Form McGill Pain Questionnaire. The intragroup analysis for both the objective results and the subjective results were performed using the Wilcoxon Signed Rank Test. The intergroup analysis for both the objective and subjective results were performed using the Mann-Whitney U Test.

5.2. INTRAGROUP ANALYSIS.

5.2.1. OBJECTIVE DATA ANALYSIS.

All the objective results were recorded at the beginning of the initial, final and the follow-up consultations. A comparative analysis was performed between the initial and final consultation to evaluate the effectiveness of the treatment, between the initial and follow-up consultation to evaluate the long term efficacy of the treatment and between the final and the follow-up consultation to determine if the treatment results were maintained.

Table 4 represented objective results collected from the Group A between the initial consultation and the final consultation. At a 5% level of significance, the null hypotheses were accepted for all the ranges of motion except right rotation. Therefore, one could conclude that there was no significant statistical improvement using dry needling. However, a general clinical trend may be suggested from the results in the table, in that all ranges of motion showed slight improvement except for flexion.

The null hypothesis for the algometer readings was rejected, indicating that there was a statistically significant objective difference in trigger point sensitivity from the initial consultation to the final consultation. Dry needling was effective in reducing pain in the active trigger points of the quadratus lumborum and gluteus medius muscles as the algometer readings increased from the initial consultation to the final consultation. Right rotation showed a statistically significant improvement which was also subjectively reported by most patients. However, if one considers the SD and the SE for rotation, they were too greatly spread around the mean. When considering that rotation was being measured in degrees, an SE range of between 3.56° and 4.55° seems to show very little variation. However, the physical mobility or restriction of mobility would be clinically remarkable. In the researcher's opinion, this variation could have been due to the difficulties encountered when measuring rotation using the goniometer.

The SD and SE for the algometer readings and for most ranges of motion were closely concentrated around the mean, indicating that the data was reliable and that the mean was an accurate representation of the sample population.

Table 5 illustrates the objective results collected from Group B between the initial consultation and the final consultation. The null hypotheses for all the ranges of motion were accepted at the 5% level of significance. Therefore, one could possibly conclude that intermittent percussion had little effect on the range of motion of the lumbar spine. Interpreting the results from a clinical perspective however, shows that there was a minor improvement in all ranges of motion. Algometer readings showed a statistically significant improvement in the sensitivity of the patient's trigger points, as the null hypothesis was rejected. In the author's opinion, intermittent percussion was effective in reducing pain in active trigger points of the quadratus lumborum and gluteus medius muscles when comparing the mean values between the first and the final consultations. As can be seen in the table, the algometer readings increased from 2.56 to 3.04 kg/cm squared. An increase in algometer readings represents an improvement in the sensitivity of trigger points.

As with table 4, the SD and SE were closely concentrated around the mean, rendering the data reliable and the mean an accurate representation of the sample population. However, the SD and the SE for rotation were too greatly spread around the mean, with the SE varying from 4.05° to 4.50°. An example would be left rotation at the initial consultation (38.30°). Adding or subtracting 4.5° would give 42.8° and 33.8° respectively. In a clinical situation, this would show as a vast difference in the patient's lumbar spine mobility.

Table 6 represented the objective results obtained from Group A between the initial consultation and the follow-up consultation. Although the null hypothesis (at the 5% level of significance) was accepted, there were a few degrees improvement in all ranges of motion maintained at the one month follow-up, when clinically interpreted. Rotation showed the greatest improvement and this again, was reported subjectively by some of the patients. The algometer readings showed that the improvement was maintained at the one month follow-up.

The SD and SE were closely concentrated around the mean for the ranges of motion and the algometer readings. However, there was a discrepancy with rotation as the SD and SE were too greatly spread around the mean. As previously indicated, this would significantly affect the patient's lumbar spine mobility. Variations of between 3.56° and 4.55° would be detected in a clinical situation.

Table 7 represented objective data collected from Group B between the initial consultation and the follow-up consultation. Statistically, there was an improvement in left rotation and right lateral flexion. All the remaining ranges of motion showed no statistically significant improvement. Interpreting the table from a clinical perspective, all ranges of motion showed a few degrees of improvement except for flexion, which showed a decrease in movement from 19.06° to 16.92° . Clinically, the algometer readings showed a reduction in the sensitivity of the trigger points from 2.56 to 3.11 kg/cm squared. This however, was not regarded as statistically significant.

The SD and SE showed the same trends as previously mentioned, with all the values being closely concentrated around the mean, except for those of rotation which showed an SE varying between 3.36° and 4.50°.

Table 8 and Table 9 were objective results for Group A and Group B respectively, between the final consultation and the follow-up consultation. Both tables showed similar results in that there was no statistically significant improvement in both the ranges of motion and the algometer readings. Any improvement obtained from dry needling and intermittent percussion was not maintained. When interpreting the results from a clinical perspective, some results showed further improvement, even in the absence of treatment, while others showed a deterioration. This deterioration could be attributed to patients returning to their daily activities and lifestyles and the muscles being subjected to wear and tear without continued treatment.

Once again, the SD and SE for most of the data were concentrated around the mean. Therefore, the data is shown to be reliable and the mean to be an accurate representation of the sample population. Rotation for both groups showed SD and SE to be too greatly spread around the mean, thus rendering the data less accurate and less reliable.

Figure 3. Mean goniometer values for rotation in Group A.

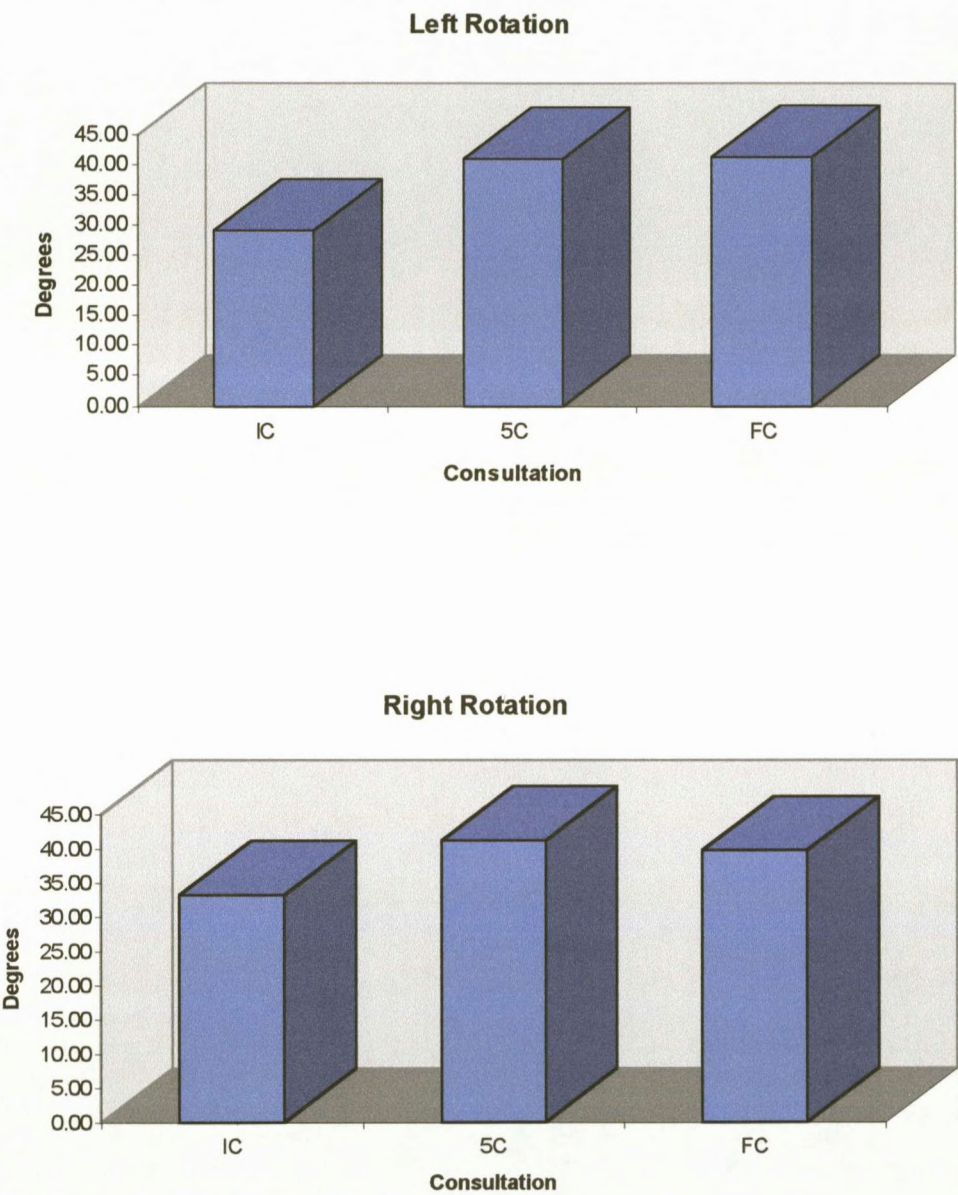


Figure 4. Mean goniometer values for rotation in group B.

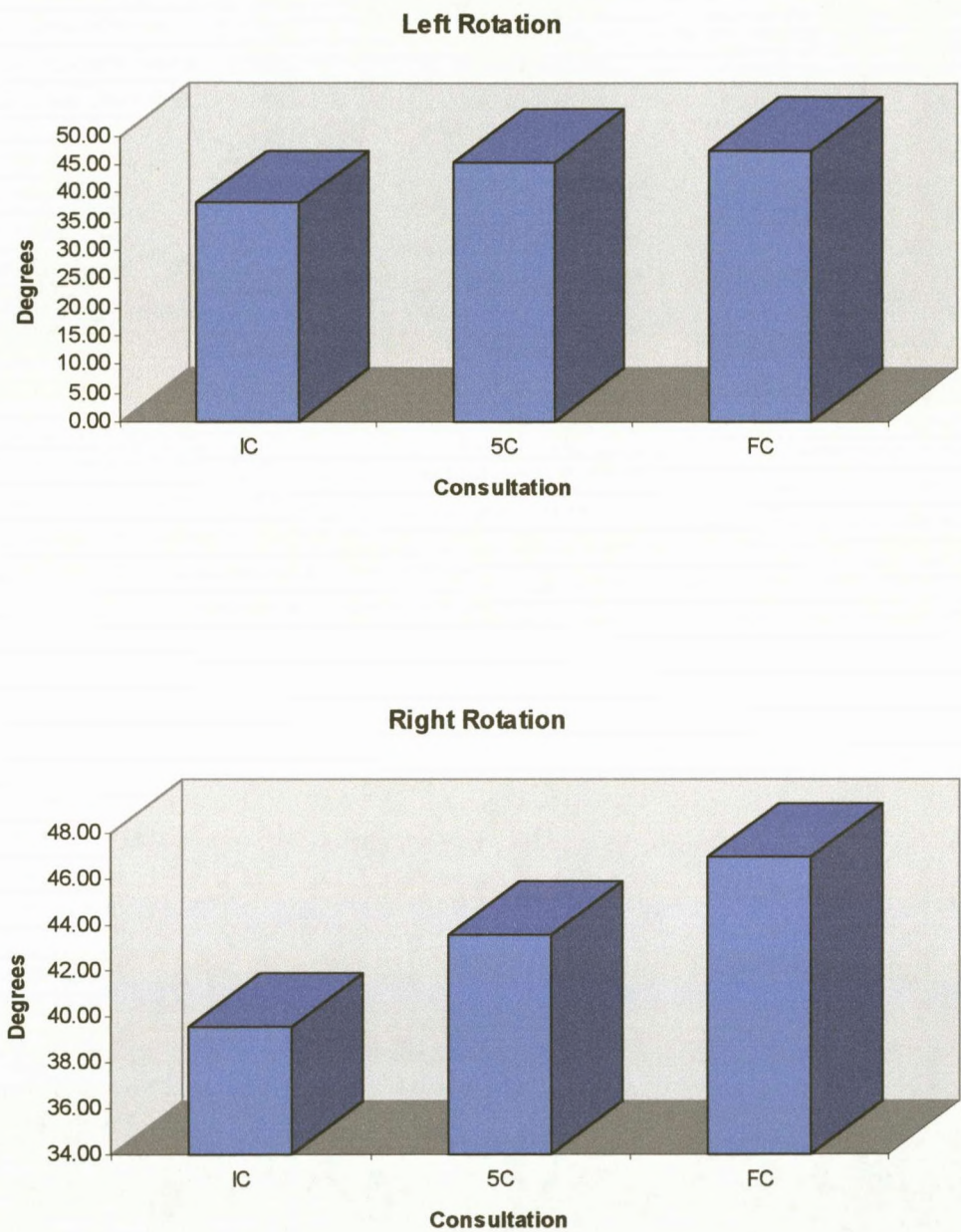
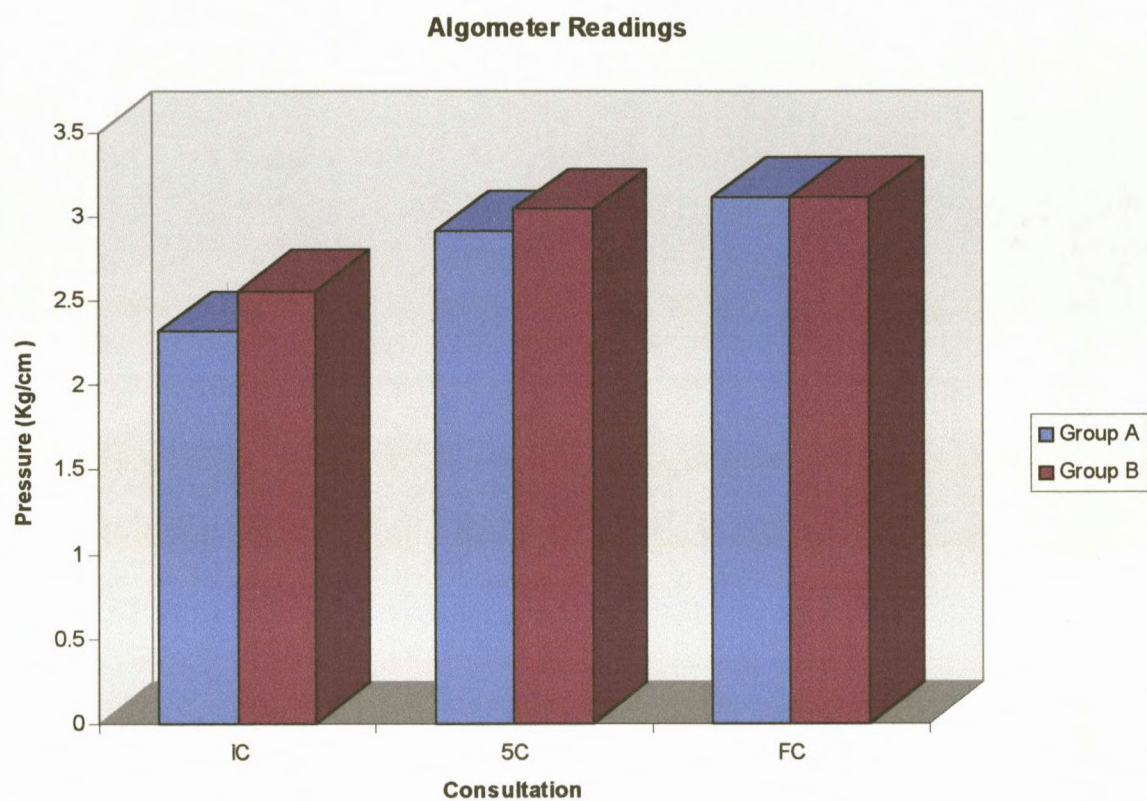


Figure 5. Graph showing the mean algometer readings comparing dry needling (Group A) and intermittent percussion (Group B) at the initial consultation (IC), the final consultation (5C) and the follow-up consultation (FC).



5.2.2. SUBJECTIVE DATA ANALYSIS.

All subjective results were recorded at the beginning of the initial, final and follow-up consultations. A comparative analysis was performed between the first and final consultations to evaluate if the treatment was effective, between the first and follow-up consultation to determine the long-term efficacy of the treatment and between the final and follow-up consultations to determine if the treatment results were maintained.

Table 10 represents the subjective results from Group A between the initial consultation and the final consultation. Only the Short-Form McGill Pain Questionnaire showed a statistically significant difference. On comparing the mean values, it would seem that there was a reduction in the intensity of the pain experienced by the patients (ie: the intensity of the pain diminished between the first and final consultations for Group A). When the questionnaires were clinically interpreted, all showed minimal improvement.

The SD and SE were measured in percentages. The SD for all the questionnaires appeared to be high. However, the SE (which is a more accurate assessment), was closely concentrated around the mean, rendering the data reliable and the mean an accurate representation of the sample population. In the researcher's opinion, if the SE were greater than 10%, then it would be too greatly spread around the mean and this would have affected the overall results of the subjective data.

Table 11 represented the subjective data collected from Group B at the initial consultation and the final consultation. All three questionnaires showed a statistically significant improvement, as all the null hypotheses were rejected at the 5% level of significance. This indicates that intermittent percussion reduced the amount of pain, the pain intensity and the level of disability that the patients encountered.

All the SD and SE analyses showed the mean to be an accurate representation of the sample population and the data was accepted as reliable.

Table 12 represented the subjective data collected from Group B at the initial consultation and the final consultation. At the 5% level of significance, there was a statistically significant improvement of the data from the Numerical Rating Scale 101 and the Short-Form McGill Pain Questionnaire. This suggests that there was a reduction in the amount of pain that the patients were experiencing. The null hypothesis for the Oswestry Low Back Pain Disability Questionnaire was accepted, illustrating no statistically significant improvement with this questionnaire. However, clinically interpreted, there was an improvement of approximately 5.37%. An improvement of this percentage in disability may be of significance to a patient suffering from low back pain.

The SD and SE for these questionnaires (measured in percentage), were closely concentrated around the mean. Therefore, the data is reliable and the mean is an accurate representation of the sample population.

Table 13 was the subjective data collected from Group B between the initial consultation and the follow-up consultation. All questionnaires showed the treatment to be successful as all the questionnaires showed a statistically significant difference between the first and follow-up consultations. The results of these questionnaires showed that the effects of the treatment were maintained throughout the month-long follow-up. The SD was greatly spread around the mean. However, when the SE was evaluated, it was closely concentrated around the mean and therefore rendered the data reliable.

Table 14 and 15 represented subjective data collected between the final consultation and the follow-up consultation from Groups A and B respectively. During the one month follow-up period, when no treatment was being administered, the patients were possibly subjected to daily muscular wear and tear. This may account for why no further improvements were detected in the patient's conditions. The null hypotheses for both groups were accepted, which indicates that no significant difference occurred over the one month follow-up for either group. Clinically, both groups showed a small percentage of improvement for all the questionnaires. However, this was not statistically significant and was probably not even significant to the patients.

The SD was high especially for the NRS 101. The SE (which as mentioned earlier, is a more accurate indicator of the spread of data around the mean) was evaluated and shown to be closely concentrated around the mean. This rendered the data reliable and the mean, according to the SE, was therefore a true representation of the sample population.

Figure 6. Graph showing the mean Numerical Rating Scale 101 values comparing dry needling and intermittent percussion at the initial consultation (IC), the final consultation (5C) and the follow-up consultation (FC).

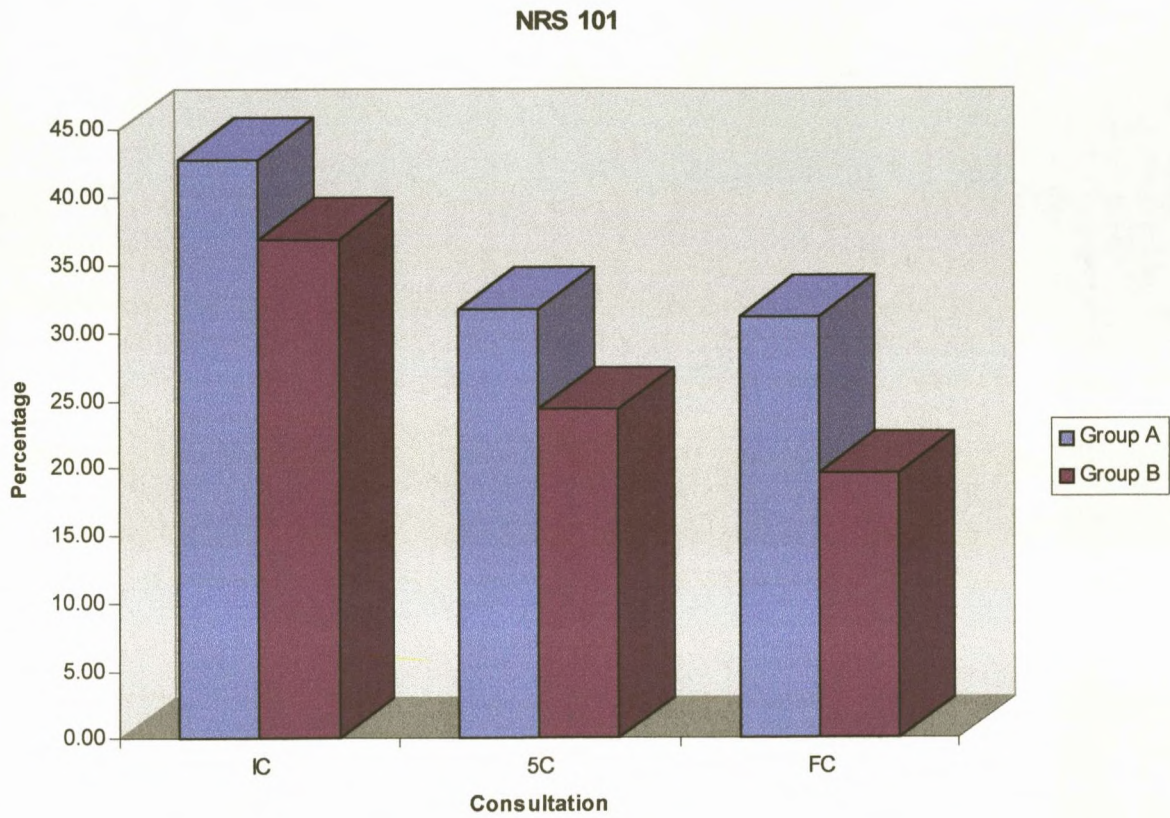


Figure 7. Graph showing the mean Oswestry Low Back Pain Disability Questionnaire values comparing dry needling and intermittent percussion at the initial consultation (IC), the final consultation (5C) and the follow-up consultation (FC).

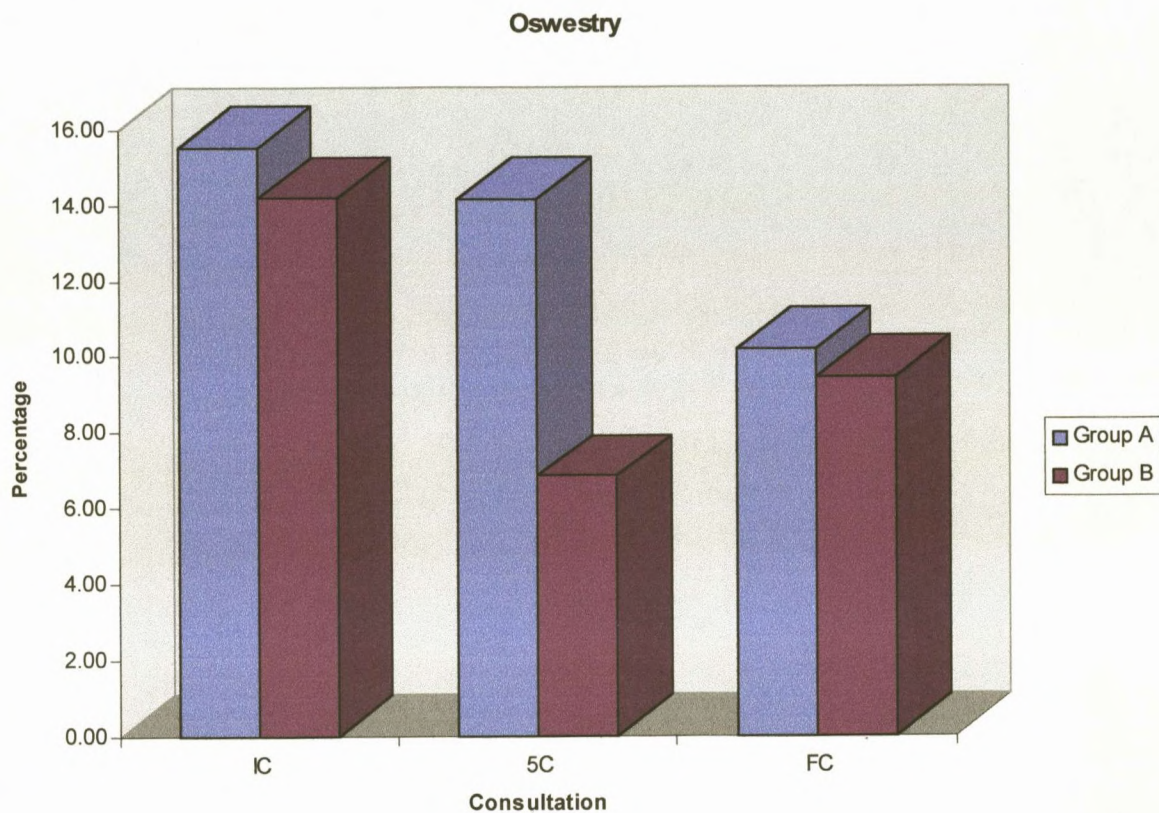
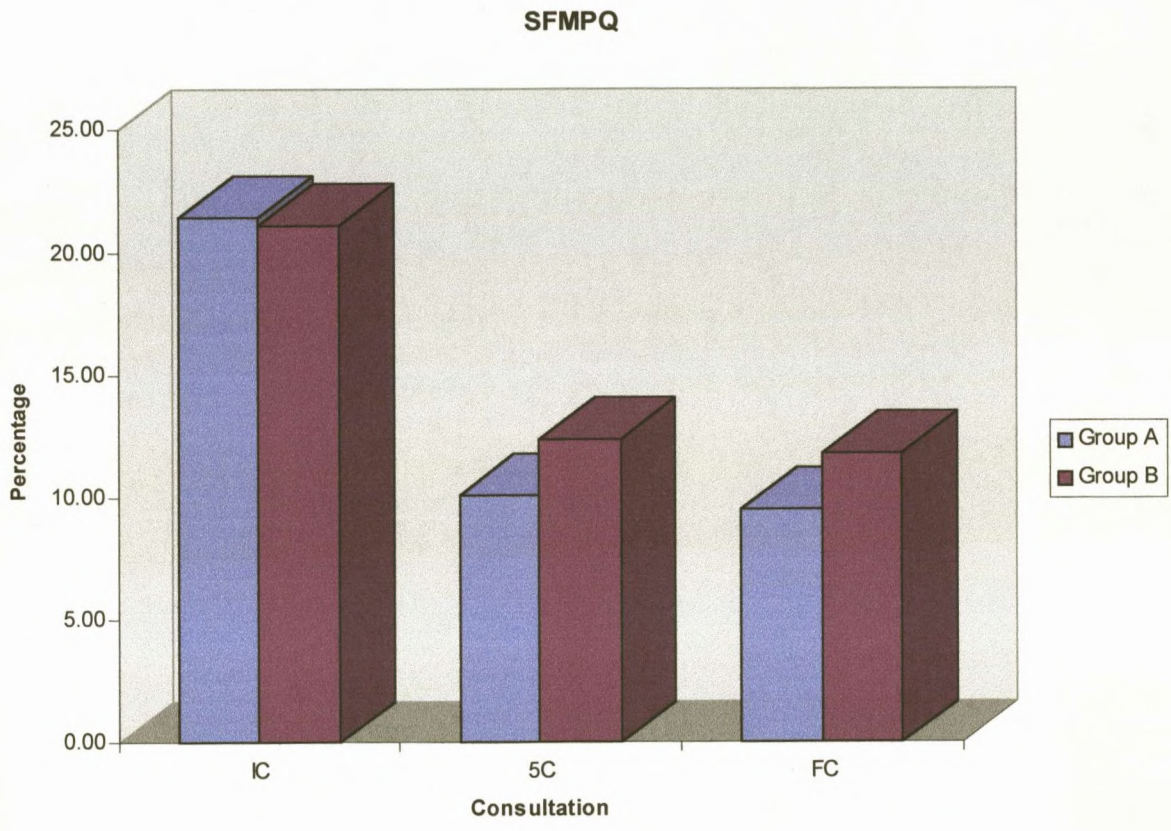


Figure 8. Graph showing the mean Short-Form McGill Pain Questionnaire values comparing dry needling and intermittent percussion at the initial consultation (IC), the final consultation (5C) and the follow-up consultation (FC).



5.3. INTERGROUP ANALYSIS.

5.3.1. OBJECTIVE DATA ANALYSIS.

Table 16 represented statistical comparisons of the objective data performed between Group A and Group B at the initial consultation. The null hypotheses were accepted- for all the data. When the two groups of data were compared (in degrees of movement and kg/cm squared of pressure), their recordings were very similar and so the data is analogous.

The SD and SE were closely concentrated around the mean for most readings, rendering the data reliable and the mean an accurate representation of the sample population. The SD and SE for rotation were greatly spread around the mean. In a clinical situation, this would manifest as a great variability in the patient's capability of movement. Hence, this was not an accurate representation of the sample population and the data is less reliable.

Table 17 compared algometer and goniometer readings of Group A and Group B at the final consultation. The null hypothesis for all the readings was accepted. Therefore, at the 5% level of significance, no statistically significant objective differences were detected at the final consultations of Group A and Group B. Comparing the final consultations, neither treatment was more effective than the other in terms of objective results. When examining the degrees of movement between the two groups, they were shown to be approximately the same. The algometer readings showed similar findings.

The SD and SE findings were similar to Table 16 where all the values, except rotation bilaterally, were closely concentrated around the mean. This again illustrates that most of the ranges of motion measurements were reliable and an accurate representation of the sample population.

Table 18 compared the objective results of both Group A and Group B at the one month follow-up consultation. For both groups of data, the null hypotheses were accepted. Clinically, the ranges of motion (in degrees) between the two groups showed great variability. The Group A maintained the improvement gained from dry needling between the initial and final consultation, while the group that received intermittent percussion not only maintained the improvement, but also showed further improvement in rotation bilaterally, even in the absence of treatment.

The SD and SE were closely concentrated around the mean for most readings. Therefore, the data is reliable and an accurate representation of the sample population. The SD and SE for rotation however, were too greatly spread around the mean and is thus not a true representation of the sample population and the data is less reliable.

5.3.2. SUBJECTIVE DATA ANALYSIS.

Table 19 represented statistical comparisons of the subjective data performed between Group A and Group B at the initial consultation. For all the data, the null hypotheses were accepted and one may see that both sets of data closely resemble one another. When the comparisons

of the percentages of all three questionnaires were made between the two groups, they closely resembled one another. Therefore similar data is compared.

The SD's for the Numerical Rating Scale 101 and the Short-Form McGill Pain Questionnaire were greatly spread around the mean, especially for the intermittent group (Group B).

However, when analysing the SE for both groups, the data was fairly concentrated around the mean and rendered the mean an accurate representation of the sample population.

Table 20 was the collection of subjective data from the final consultations for both Group A and Group B. The null hypotheses were accepted. There was no statistically significant difference between the dry needling and the intermittent percussion at the final consultation. From a clinical perspective, both groups showed some improvements from the initial consultation to the final consultation. However, intermittent percussion showed a higher success rate with low percentages recorded for the Numerical Rating Scale 101 and the Oswestry Low Back Pain Disability Questionnaire. The SD and SE were all closely concentrated around the mean rendering the mean an accurate representation of the sample population and the data reliable.

Table 21 represented the data from both groups compared at the follow-up consultation. The null hypotheses were accepted for all the questionnaires. Hence, there was no difference between the group receiving dry needling and the group receiving intermittent percussion at the follow-up consultation. A clinical interpretation indicates that Group A showed a better improvement in the quality of pain (represented by the Short-Form McGill Pain

Questionnaire), while Group B was shown to be more effective in terms of reducing the quantity of pain and the level of disability (as represented by a reduction in the Numerical Rating Scale 101 and the Oswestry Low Back Pain Disability Questionnaire). The SD and SE were closely concentrated around the mean, rendering the mean an accurate representation of the sample population and rendering the data reliable.

An overall clinical perspective is as follows: Objectively, both dry needling and intermittent percussion showed very little effectiveness when considering changes in the patients' ranges of motion. However, both treatments did reduce the sensitivity of the active trigger points of the quadratus lumborum and gluteus medius muscles. These improvements however, did not seem to be maintained over the one month follow-up period.

Both treatments showed subjective improvements. Dry needling showed some improvement in reducing the quantity and intensity of pain, while intermittent percussion further aided in reducing the level of disability. Although dry needling effects did not last the one month follow-up, the effects obtained from the intermittent percussion were maintained.

Neither the dry needling nor the intermittent percussion were shown to be more effective than the other. Both treatments were unsuccessful with regard to the objective clinical findings. However, they both showed improved subjective clinical findings.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 6.

CONCLUSIONS AND RECOMMENDATIONS.

6.1. CONCLUSIONS.

The purpose of this study was to investigate whether dry needling and intermittent percussion were effective in the treatment of active trigger points of the quadratus lumborum and gluteus medius muscles.

Statistically, it was shown that dry needling was ineffective in improving a patient's range of motion. However, there was a reduction in the sensitivity of the trigger points. Despite this, the effect was not maintained over the one month follow-up period. This suggests that dry needling would not be effective in the long term. There was an improvement in the subjective findings in that there was a reduction in the patients' levels of disability. This once again, was not maintained over the one month follow-up period.

Intermittent percussion showed similar objective clinical findings in so far as there was no statistically significant changes in the ranges of motion. Similarly, intermittent percussion reduced the pain sensitivity of the trigger points but this was not maintained over the one month follow-up period, rendering it ineffective as a long term therapy. Subjectively, intermittent percussion showed a statistically significant reduction in the quantity of pain, pain intensity and in the level of disability. These effects were however only short-lived, as the improvements were not maintained into the one month follow-up re-evaluation consultation.

The intergroup analysis showed that in terms of objective clinical findings, neither treatment was more effective than the other. Both treatments were ineffective in treating myofascial trigger points of the quadratus lumborum and gluteus medius muscles. In terms of subjective clinical findings, the intergroup analysis again showed that neither treatment was more effective than the other. However, the intragroup analysis showed that intermittent percussio is effective over the short term for all three subjective findings. It is arguably slightly more effective than dry needling.

The following aspects discussed below are from the researcher's point of view and personal involvement in the study. In a clinical situation, the patient's well-being is considered. However, with any practice, time plays an essential role. While each of the treatments were easy to perform, the intermittent percussion was a simple, quick method of inactivating the trigger points. All the patient was required to do was sit leaning over to the opposite side. The entire procedure took less than 30 seconds to perform. Dry needling involved the patient lying, the area being swabbed, the fanning technique to be performed to locate the trigger point, and the needle to be disposed of. This procedure took longer than intermittent percussion to perform.

The cost of the two treatments should also be regarded. The intermittent percussion requires a reflex hammer which every practitioner should have. Dry needling requires more disposable equipment. To perform dry needling properly, the practitioner requires cotton wool or alcohol swabs, alcohol, acupuncture needles and a sharps bin to dispose of the needles once the treatment is complete.

When considering comfort to the patient, one must consider that some individuals have a phobia about being needled and needling in these circumstances is contra-indicated (Sola 1984:679). Dry needling of the quadratus lumborum trigger points are especially painful and can cause post-needle soreness (Travell and Simons 1992:75). A number of patients experienced this pain in the clinical trial. Intermittent percussion is not as painful as dry needling. However, patients reported that intermittent percussion did cause some prolonged tenderness a few hours after the treatment. The author is sure that if the patients were given a choice between the two treatments, most would probably choose the intermittent percussion as a result of their fear of the needles. However, some patients who received the intermittent percussion felt that it may have been a placebo treatment and that they felt nothing was being achieved. Therefore, the psychological aspect of healing must be taken into consideration.

Although the two methods of treatment are fairly safe to perform, the practitioner must be aware that needling some of the trigger points of the quadratus lumborum muscle in the area above the L1 transverse process must be carefully performed as the ureters lie directly underneath the trigger point. Furthermore, a pneumothorax may develop if the lung or pleura is pierced (Travell and Simons 1992:75). Practitioners performing dry needling must use new, sterilised needles due to the high risk of pyrogenic infections, Hepatitis B and HIV Virus transmission.

Based on the above discussion, the author would most probably choose intermittent percussion as the choice form of myofascial trigger point therapy. However, it is important to take the patient's preferences into consideration.

6.2. RECOMMENDATIONS ABOUT THE RESEARCH.

Within the research study, there were a number of problems encountered. Although Breum et al. (1995) recommend that the goniometer recordings are reliable, the recordings of some of the ranges of motion were found to be difficult. The researcher needs to be very careful that the goniometer is recording ranges of motion in the lumbar spine rather than the entire spine. Rotation was difficult as the patients tended to rotate their entire body. It was difficult to explain to them about rotation restricted to the lumbar spine only. Perhaps keeping the patient's shoulders against the wall and only rotating the lower trunk may prove more fruitful. This would eliminate upper body rotation. Something other than the goniometer needs to be used to measure rotation. Flexion and extension were relatively simple to measure. The researcher needs to ensure that with lateral flexion however, the patient is not flexing forward.

The sample size consisted of 30 patients. This restricted the statistical analysis to non-parametric analyses. A sample size of greater than thirty candidates ($n > 30$) is needed to validate this research. Further parametric tests can be performed, including the two-tailed unpaired t-test (Gulezian 1979:335). Although the mean, standard deviation and standard error were used, power testing could further help strengthen the results obtained in this research. With hypothesis testing, there is always a risk of type II errors (a type II error occurs when the null hypothesis fails to be rejected when it is true). This is not due to calculation errors but rather due to stochastic variation in the sampling process.

Although both treatment groups showed no effectiveness in terms of range of motion, and only some effectiveness in reducing trigger point sensitivity and improvements in the subjective clinical findings, it is recommended that further research be performed using intermittent percussion. Future studies could include not only the quadratus lumborum and gluteus medius muscles, but other muscles too (eg. Trapezius, rhomboids, infraspinatus and supraspinatus). A study of how intermittent percussion compares to ischaemic compression can also be investigated as they are presumed to have similar physiological mechanisms of treatment. Furthermore, a study done over a shorter period of time, with more frequent treatments and less time between treatments should also be considered.

Although the two treatments in this study have been shown to be less effective than previously thought, practitioners must remember that in order to aid patients suffering from myofasciitis, a multidisciplinary approach is often the best treatment approach (Fricton 1986:868).

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APPENDICES

APPENDIX A

INFORMED CONSENT FORM

(To be completed in duplicate by patient/subject*) *Delete whichever is not applicable.

TITLE OF RESEARCH PROJECT

NAME OF SUPERVISOR

NAME OF RESEARCH STUDENT

PLEASE CIRCLE THE APPROPRIATE ANSWER

1. Have you read the research information sheet? YES/NO
2. Have you had an opportunity to ask questions regarding this study? YES/NO
3. Have you received satisfactory answers to your questions? YES/NO
4. Have you had an opportunity to discuss this study? YES/NO
5. Have you received enough information about this study? YES/NO
6. 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 _____
(in block letters)

Signature _____

PARENT/GUARDIAN* Name _____
(in block letters)

Signature _____

WITNESS Name _____
(in block letters)

Signature _____

RESEARCH STUDENT Name _____
(in block letters)

Signature _____

TREATMENT GROUPS.

1. DRY NEEDLING
2. DRY NEEDLING
3. INTERMITTENT PERCUSSION
4. DRY NEEDLING
5. INTERMITTENT PERCUSSION
6. INTERMITTENT PERCUSSION
7. INTERMITTENT PERCUSSION
8. DRY NEEDLING
9. INTERMITTENT PERCUSSION
10. DRY NEEDLING
11. DRY NEEDLING
12. INTERMITTENT PERCUSSION
13. INTERMITTENT PERCUSSION
14. DRY NEEDLING
15. INTERMITTENT PERCUSSION
16. DRY NEEDLING
17. INTERMITTENT PERCUSSION
18. DRY NEEDLING
19. DRY NEEDLING
20. DRY NEEDLING
21. INTERMITTENT PERCUSSION
22. DRY NEEDLING
23. INTERMITTENT PERCUSSION
24. INTERMITTENT PERCUSSION

APPENDIX B2

- 25. DRY NEEDLING
- 26. DRY NEEDLING
- 27. INTERMITTENT PERCUSSION
- 28. INTERMITTENT PERCUSSION
- 29. DRY NEEDLING
- 30. INTERMITTENT PERCUSSION

APPENDIX C 1

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

CASE HISTORY

Patient: _____ Date # _____
File # : _____
X-ray # : _____
Age: _____ Sex: _____ Occupation: _____
Intern: _____ Signature: _____

FOR CLINICIAN'S USE ONLY

Initial visit clinician: _____ Signature: _____

Case History:

Examination:

Previous: TN
Other

Current: TN
Other

X-ray Studies:

Previous: TN
Other

Current: TN
Other

Clinical path. lab.:

Previous: TN
Other

Current: TN
Other

Case status:

PTT: Conditional: Signed off: Final sign out:

Recommendations:

APPENDIX C2

Intern's case history

1. Source of history:
2. Chief complaint: (patient's own words)

3. Present illness:

Location

Onset

Duration

Frequency

Pain (character)

Progression

Aggravating factors

Relieving factors

Associated S & S

Previous occurrences

Past treatment and outcome

APPENDIX C3:

4. Other complaints:

5. Past history:

General health status

Childhood illnesses

Adult illnesses

Psychiatric illnesses

Accidents/injuries

Surgery

Hospitalizations

APPENDIX C4

6. Current health status and life-style: Allergies

Immunizations

Screening tests

Environmental hazards
(home, school, work)

Safety measures
(seat belts, condoms)

Exercise and leisure

Sleep patterns

Diet

Current medication

Tobacco

Alcohol

Social drugs

7. Family history:

Immediate family:

Age

Health

Cause of death

DM

Heart disease

TB

HBP

Stroke

Kidney disease

CA

Arthritis

Anemia

Migraines

Thyroid disease

Epilepsy

Mental illness

Alcoholism

Drug addiction

Other

8. Psychosocial history:

Home situation

Daily life

Important experiences

Religious beliefs

9. Review of systems:

General

Skin

Head

Eyes

Ears

Nose/sinuses

Mouth/throat

Neck

Breasts

Respiratory

Cardiac

Gastro-intestinal

Urinary

APPENDIX C6

Genital

Vascular

Musculoskeletal

Neurologic

Haematologic

Endocrine

Psychiatric.

TECHNIKON NAZAL CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

Underline abnormal findings in RED and elaborate on back of relevant page, if necessary.
Mark "HAD" if normal.

Patient: _____ Pilot: _____

 Last name First name

Clinician: _____ Signature: _____

Intern: _____ Signature: _____

Date: _____

Height: _____ Weight: _____ Temp: _____

Rate: Heart: _____ Pulse: _____ Respiration: _____

Blood pressure: Arms: L / R /

 Legs: L / R /

General appearance:

STANDING EXAMINATION.

Minor's sign

Skin changes

Posture

grect

Adam's

"Ranges of motion:

T/L spine: Flexion: 90 Fingers to floor

Extension: 50

R.lat.flex.: 30 Fingers down leg

L.lat.flex.: 30 Fingers down leg

Rot.to R.: 35

Rot.to L.: 35

Flex.

L.Rot.

R.Rot.

L.lat
flex.

R.lat.
flex.

Ext.

/ = pain-free limitation; // = painful limitation.

Romberg's sign.

Pronator drift.

Trendelenburg's sign.

Gait.

rhythm

balance

pendulousness

on toes

on heels

tandem

Half squat.

Scapular winging.

Muscle tone.

Spasticity/Rigidity.

Shoulder:

skin

symmetry

ROM - glenohumeral

scapulo-thoracic

acromioclavicular

elbow

wrist

Chest measurement

inspiration

expiration

Visual acuity

Breast examination:

Inspection:

skin

size

contour

nipples

arms overhead

hands against hips

leaning forward.

Palpation:

axillary lymph nodes.

SEATED EXAMINATION.

Spinal posture

Head

scalp

skull

face

skin

Eyes

conjunctiva

sclera

eyebrows

eyelids

lacrimal gland

nasolacrimal duct

alignment

corneal reflex

ocular movement

L

III IV VI

R

III IV VI

visual fields

accommodation

iris

pupils

red reflex

optic disc

vessels
general background
macula
vitreous
lens

Ears:

auricle
ear canal
drum
auditory acuity
Weber test
Rinne test

Nose:

external
internal
septum
turbinates
olfaction

Sinuses (frontal & maxillary):

tenderness
transillumination

Mouth and pharynx:

lips
buccal mucosa
gums and tooth
roof
tongue
inspection
movement
taste
palpation
pharynx
inspection
C/X

-Neck:

posture
size
swelling
scars
discoloration
hair line

ROM:

Flexion: 45 chin to larynx
 chin to sternum
 Extension: 55 forehead parallel
 to floor
 L.lat.flox: 40
 R.lat.flox: 40
 L.rot.: 70
 R.rot.: 70

Flox.

L.Rot.

R.Rot.

L.Lat.
flox.R.lat.
flox.

Ext.

lymph nodes

trachea

thyroid

carotid arteries (thrills, bruit)

CN V

CN VII

CN VIII (nystagmus)

CN IX

CN XI

THJ --

Inspection

ROM

deviation

Palpation

crepitus

tenderness

Neurological:

Dermatomes

C5

C6

C7

C8

T1

Tendon reflexes

biceps

triceps

brachioradialis

Muscle strength

C5

C6

C7

C8

T1

Coordination:

point-to-point

dysdiadochokinesia

Thorax:

Chest:

Inspection:

skin

shape

respiratory distress

rhythm (respiratory)

depth

effort

intercostal/supraclavicular retractions

Palpation:

tenderness

masses

respiratory expansion

tactile fremitus

Percussion:

lungs (posterior)

diaphragmatic excursion

kidney punch

Auscultation:

breath sounds

vesicular

bronchial

adventitious sounds

crackles (rales)

wheezes (rhonchi)

voice sounds

broncophony

whispered pectoriloquy

egophony

Cardiovascular:

auscultation (aortic ~~murmur~~)

Allen's test

SUPINE EXAMINATION

JVP

PMI

auscultation heart (L.lat.recumbent)

respiratory excursion

percussion chest (anterior)

breast palpation

The abdomen:

Inspection:

skin

umbilicus

contour

peristalsis

pulsations

hernias (umbilical/incisional)

Auscultation:

bowel sounds

bruit

Percussion:

general

liver

spleen

Palpation:

superficial reflexes

cough

light

rebound tenderness

deep

liver

spleen

kidneys

aorta

intra-/retro-abdominal wall mass

shifting dullness

fluid wave

Acute abdomen:

where pain began and now

cough

tenderness

guarding/rigidity

rebound tenderness

Rovsing's sign

psoas sign

obturator sign

cutaneous hyperaesthesia

rectal exam

Murphy's sign.

APPENDIX D8

Male genitals and hernias.

Inspection:

- skin
- prepuce
- glans
- scrotum
- nits/lich
- scrotum
- inguinal/femoral bulges

Palpation:

- penis (tenderness/induration)
- testes
- epididymis
- inguinal canal
- femoral canal
- cremasteric reflex

Auscultation:

- scrotal mass.

Periphereal vasculature:

Inspection:

- skin
- nail beds
- pigmentation
- hair loss

Palpation:

- pulses - radial, brachial, femoral, popliteal, post.tibial, dorsalis pedis
- lymph nodes - epitrochlear, femoral (horizontal & vertical)
- temperature (foot & legs)

Manual compression test

- Retracted filling (Trendelenburg) test

- Arterial insufficiency test

Musculoskeletal:

ROM

hip

- flex. 90/120

- ext. 15

- abd. 45

- add. 30

- int rot 40

- ext rot 45

knee

- flex. 130

- ext. 0/15

ankle

- plantar flex 45

- dorsiflex 20

- inversion 30

- eversion 20

- leg length

Neurological:**dermatomes**

L1

L2

L3

L4

L5

S1

muscle strength

hip flexion

knee extension

ankle dorsiflexion

plantar flexion

tendon reflexes

patellar

Achilles

plantar reflex**Rectal examination:****Inspection**

sacrococcygeal & perianal areas

Palpation

sphincter tone

tenderness

induration

nodules

prostate

seminal vesicles

Mental status**Appearance and behaviour:**

level of consciousness

posture and motor behaviour

dress, grooming, personal hygiene

facial expression

affect

Speech and language:

quantity

rate

volume

fluency

aphasia (prn)

Mood**Thought processes (logical, relevant, organized)****Memory and attention:**

orientation (time, place, person)

remote memory

recent memory

new learning ability

Higher cognitive functions:

information and vocabulary (general & specialised knowledge)

abstract thinking.

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC.REGIONAL EXAMINATION -- LUMBAR SPINE AND PELVIS.

PATIENT: _____

FILE # : _____ DATE: _____

INTERN/RESIDENT: _____

SUPERVISING CLINICIAN : _____

STANDING :

Posture
 Minor's Sign
 Skin
 Scars
 Discoloration
 Muscle tone
 Bony and soft tissue contours

Spinous percussion
 Schober's Test (6cm)
 Treadmill
 Body Type
 Attitude

RANGE OF MOTION.

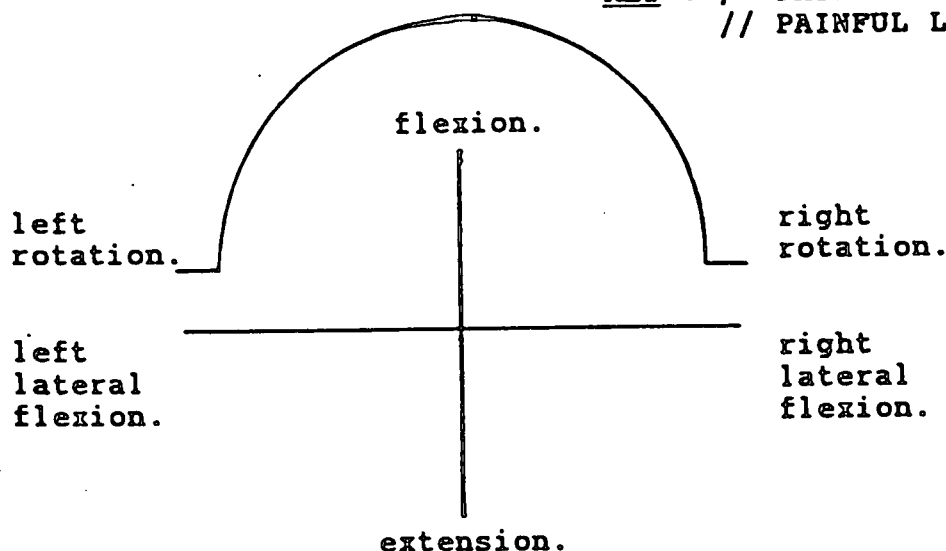
Forward Flexion = 40-60 degrees. (15cm from floor)

Extension = 20-35 degrees.

L/R Rotation = 3-18 degrees.

L/R Lateral flexion = 15-20 degrees.

KEY : / PAINLESS LIMITATION.
 // PAINFUL LIMITATION.



APPENDIX E2

SUPINE :

Skin.
Hair.
Nails.

Observe abdomen
Fasciculations
Abdominal reflexes
Auscultate abdomen/groin
Palpate abdomen/groin
Pulses (abdomen)
Pulses (extremities)

SLR
Bowstring
Plantar reflex
Circumference (thigh, calf)
Leg length :

actual
apparent

Sciatic notch
Patrick Faber
Gaenslen's Test
Gluteus Maximus Stretch
Hip medial rotation
Psoas Test
Thomas' Test :
hip joint
rectus femoris

LATERAL RECUMBENT :

S-I compression
Ober's Test
Femoral nerve stretch
Myotomes :
QL
Gluteus Medius

NON-ORGANIC SIGNS :

Pin Point Pain.
Axial Compression.
Trunk Rotation.
Burn's Bench Test.
Flip Test.
Hoover's Test.
Ankle Dorsiflexion Test.

PRONE :

Gluteal skyline
Skin rolling
Iliac crest compression
Facet joint challenge
S-I tenderness
Erichson's Test
Pheasant's Test
Myotomes :

Gluteus Maximus

Active MF Trigger Points:

QL
Glut. Med.
Glut. Max.
Glut. Min.
Piriformis
Hamstrings
TFL

APPENDIX E3

GAIT :

Rhythm

On toes (standing)

On heels (standing)

Half-squat on one leg

Remarks : _____

NEUROLOGICAL EXAMINATION :

DERMATOMES: Left; Right. MYOTOMES: Left; Right. REFLEXES: Left; Right

T12		hip flex		C5	
L1		hip int rot		C6	
L2		hip ext rot		C7	
L3		hip abd			
L4		hip add			
L5		knee flex			
S1		knee ext			
S2		dorsiflex			
S3		plantarflex			
		eversion			
		ext.hall.long			

Tripod

Kemp's Test

COMMENTS: _____

APPENDIX E4

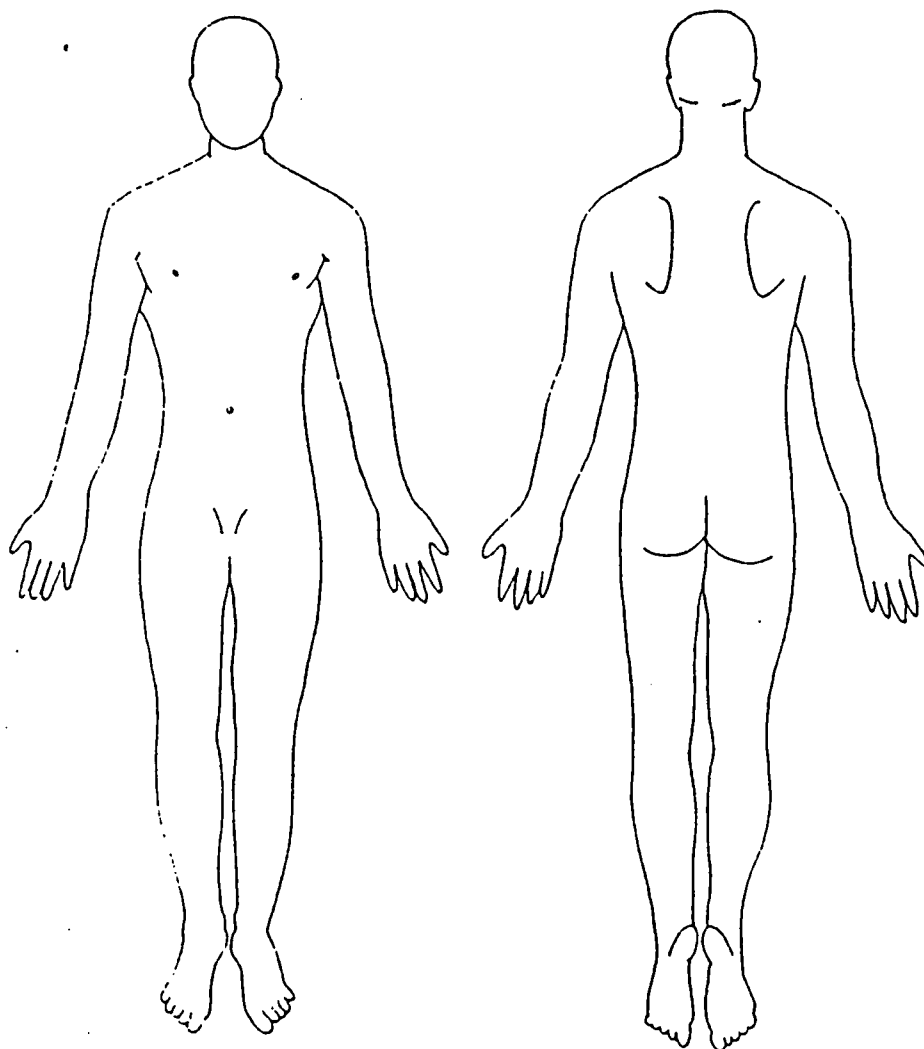
MOTION PALPATION :

Jt.play		Left						Right					Jt.pla	
P/A	Lat	Fle	Ext	LF	AR	PR		Fle	Ext	LF	AR	PR	P/A	La
							T10							
							T11							
							T12							
							L1							
							L2							
							L3							
							L4							
							L5							
					U	L	SI	U	L					

APPENDIX F ✓

PATIENT NAME : -----

FILE # : ----- DATE : -----



PAIN DRAWINGS

APPENDIX G

NUMERICAL RATING SCALE

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

0 _____ 100

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

0 _____ 100

APPENDIX H

PATIENT NAME : _____

FILE # : _____ DATE : _____

	NONE	MILD	MODERATE	SEVERE
1 THROBBING	0) _____	1) _____	2) _____	3) _____
2 SHOOTING	0) _____	1) _____	2) _____	3) _____
3 STABBING	0) _____	1) _____	2) _____	3) _____
4 SHARP	0) _____	1) _____	2) _____	3) _____
5 CRAMPING	0) _____	1) _____	2) _____	3) _____
6 GNAWING	0) _____	1) _____	2) _____	3) _____
7 HOT-BURNING	0) _____	1) _____	2) _____	3) _____
8 ACHING	0) _____	1) _____	2) _____	3) _____
9 HEAVY	0) _____	1) _____	2) _____	3) _____
10 TENDER	0) _____	1) _____	2) _____	3) _____
11 SPLITTING	0) _____	1) _____	2) _____	3) _____
12 TIRING-EXHAUSTING	0) _____	1) _____	2) _____	3) _____
13 SICKENING	0) _____	1) _____	2) _____	3) _____
14 FEARFUL	0) _____	1) _____	2) _____	3) _____
15 PUNISHING-CRUEL	0) _____	1) _____	2) _____	3) _____

McGILL PAIN QUESTIONNAIRE

OSWESTRY BACK DISABILITY INDEX

PATIENT NAME: _____ FILE #: _____ DATE: _____

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

Section 1 - Pain Intensity

- ☐ I have no pain at the moment.
☐ The pain is very mild at the moment.
☐ The pain is moderate at the moment.
☐ The pain is fairly severe at the moment.
☐ The pain is very severe at the moment.
☐ The pain is the worst imaginable at the moment.

Section 2 - Personal Care (Washing, Dressing etc.)

- ☐ I can look after myself normally without causing extra pain.
☐ I can look after myself normally but it causes extra pain.
☐ It is painful to look after myself and I am slow and careful.
☐ I need some help but manage most of my personal care.
☐ I need help every day in most aspects of self care.
☐ I do not get dressed, I wash with difficulty and stay in bed.

Section 3 - Lifting

- ☐ I can lift heavy weights without extra pain.
☐ I can lift heavy weights but it gives extra pain.
☐ Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently positioned, for example on a table.
☐ Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned.
☐ I can lift very light weights.
☐ I cannot lift or carry anything at all.

Section 4 - Walking

- ☐ Pain does not prevent me walking any distance.
☐ Pain prevents me walking more than 1 mile (2.2 km).
☐ Pain prevents me walking more than 1/2 mile (1.1 km).
☐ Pain prevents me walking more than 1/4 mile (0.5 km).
☐ I can only walk using a stick or crutches.
☐ I am in bed most of the time and have to crawl to the toilet.

Section 5 - Sitting

- ☐ I can sit in any chair as long as I like.
☐ I can only sit in my favorite chair as long as I like.
☐ Pain prevents me from sitting more than 1 hour.
☐ Pain prevents me from sitting more than 1/2 hour.
☐ Pain prevents me from sitting more than 10 minutes.
☐ Pain prevents me from sitting at all.

Section 6 - Standing

- ☐ I can stand as long as I want without extra pain.
☐ I can stand as long as I want but it gives me extra pain.
☐ Pain prevents me from standing for more than one hour.
☐ Pain prevents me from standing for more than 30 minutes.
☐ Pain prevents me from standing for more than 10 minutes.
☐ Pain prevents me from standing at all.

Section 7 - Sex Life

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

Section 8 - Social Life

- ☐ My social life is normal and gives me no extra pain.
☐ My social life is normal but increases the degree of pain.
☐ Pain has no significant effect on my social life apart from limiting my more energetic interests, for example, dancing.
☐ Pain has restricted my social life and I do not go out as often.
☐ Pain has restricted my social life to my home.
☐ I have no social life because of pain.

Section 9 - Sleeping

- ☐ I have no trouble sleeping.
☐ I can sleep well only by using pills.
☐ Even when I take pills I have less than six hours sleep.
☐ Even when I take pills I have less than four hours sleep.
☐ Even when I take pills I have less than two hours sleep.
☐ Pain prevents me from sleeping at all.

Section 10 - Travelling

- ☐ I can travel anywhere without extra pain.
☐ I can travel anywhere but it gives me extra pain.
☐ Pain is bad but I manage trips over two hours.
☐ Pain restricts me to trips of less than one hour.
☐ Pain restricts me to trips under 30 minutes.
☐ Pain prevents me from travelling, except to the doctor or hospital.

APPENDIX J

PATIENT NAME: _____

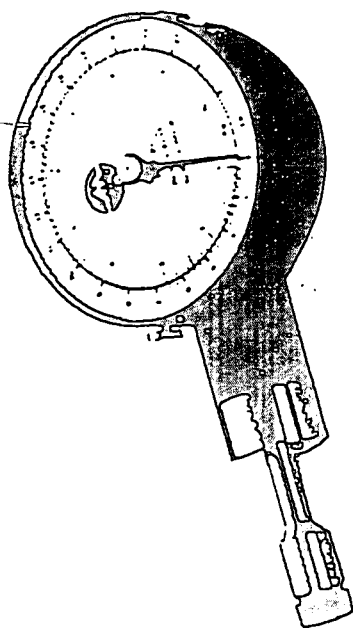
FILE NUMBER: _____

DATE: _____

ALGOMETER READINGS.

	FIRST RX	FINAL RX	FOLLOW-UP RX
QUAD LUMB TP ONE			
QUAD LUMB TP TWO			
QUAD LUMB TP THREE			
QUAD LUMB TP FOUR			
GLUT MED TP ONE			
GLUT MED TP TWO			
GLUT MED TP THREE			

APPENDIX K 1



Activator Methods, INC.

3714 E INDIAN SCHOOL RD., PHOENIX, AZ 85018
(602) 224-0220

ALGOMETER INSTRUCTIONS

Background:

Pressure pain threshold (PPT) has been used by many authors to quantify palpatory pain findings for myofascial trigger points and pain over bone using an algometer (1-7).

Description:

The pressure algometer consists of a force dial which reads in pounds or kilograms and a 1 cm diameter rubber tipped stylus. Pain threshold is determined by the amount of force/cm² required for a person to first perceive pain.

Procedure:

Prior to recording the pain threshold, discuss the procedure with the patient. Before taking a measurement, you may wish to demonstrate the process to the patient by pressing the algometer into the palm of their hand.

1. Localize any sensitive areas you wish to measure by gentle but firm palpation.
2. Hold the meter in the palm of your hand between your thumb and index finger.
3. Place the rubber tipped stylus over the pre-determined trigger point or area of palpable tenderness you wish to

measure. Make sure the force dial is perpendicular to the skin surface. Stabilize any nodular muscular regions between the middle and index finger of your indifferent hand.

4. Apply steady, gentle pressure at a rate of 1kg/cm²/sec. until the patient first feels pain and responds by saying "now."
5. Remove the stylus and record the value and locations of the tender areas in your notes or on a diagram for follow-up examination.
6. Reset the meter prior to making another reading.

References:

1. Fischer AA. Pressure algometry over normal muscles: Standard values, validity, reproducibility of pressure threshold. Pain 1986; 30:115-126.
2. Hsieh J, Hong CZ. Effect of chiropractic manipulation on the pain threshold of myofascial trigger point: a pilot study. Presented at the FCER's 2nd Annual International Conference on Spinal Manipulation, May 11-12, 1990, Washington, D.C.
3. Maloney P, Tepe R, Buerger D, et al. Evaluating the algometer as a diagnostic instrument. Presented at the FCER's 1st

GENERAL INFORMATION

The algometer is most accurate in the range which is 75% from full scale. In the range below 25% of full scale, the gauge will give consistent readings, however, with less accurate results. This inaccuracy is inherent to the design of mechanical gauges. (Note: several studies have demonstrated reliability in a clinical setting.)

The algometer requires no lubrication or other form of service.

The face of the meter has no zero setting because the zero has no significance in the calibration or accuracy of the gauge.

CALIBRATION

Activator Methods certifies that all algometers have been properly calibrated and are accurate to $\pm 1\%$ of full scale. The calibration of the algometer may be checked by attaching the pull hook and suspending test weights at $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, and full capacity in the vertical position. The weight of the plunger, flat tip, and pull hook (15 g.) should be subtracted from the test results. If it is determined that calibration is required, the instrument should be returned to the factory.

Annual International Conference on Spinal Manipulation, March 31-April 1989, Washington, D.C.

4. Osterbauer PJ, Fuhr AW, DeBoer KF, et al. Preliminary clinical and biomechanical assessment patients with chronic sacroiliac syndrome. Presented at the FCER's 2nd Annual International Conference on Spinal Manipulation, May 11-12, 1990, Washington, D.C.
5. Reeves JL, Jaeger B, Graff-Radford S. Reliability of the pressure algometer: a measure of myofascial trigger point sensitivity. Pain 1986; 24:313-21.
6. Vernon HT. Pressure pain threshold evaluation of the effect of spinal manipulation on chronic neck pain: a single case study. J Can Chiropr Assoc 1988; 32(4):191-4.
7. Vernon HT, Acker P, Burns S, et al. Pressure pain threshold evaluation of the effect of spinal manipulation in the treatment of chronic neck pain: a pilot study. J Manipulative & Physiol Ther 1990; 13(1):13-16.

**THIS INSTRUMENT CARRIES A
ONE YEAR WARRANTY
FROM DATE OF PURCHASE.**

FORCE DIAL

CERTIFICATE OF CALIBRATION

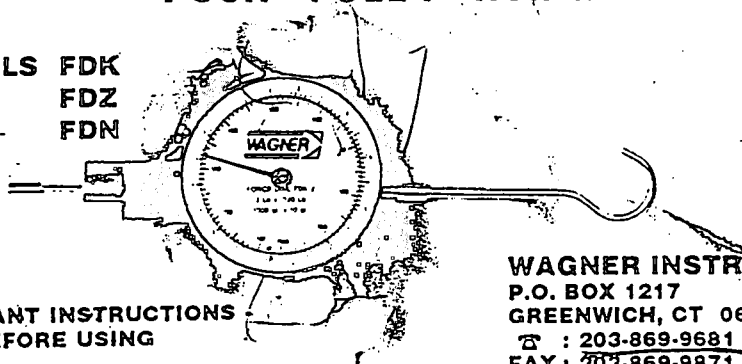
WAGNER INSTRUMENTS certifies that all **FORCE DIALS** are calibrated at the factory to meet the specified accuracy of $\pm 1\%$ of full scale, advertised in our current catalog.

QUALITY CONTROL DIRECTOR

FORCE DIAL™

PUSH - PULL FORCE GAGE

**MODELS FDK
FDZ
FDN**



**IMPORTANT INSTRUCTIONS
READ BEFORE USING**

WAGNER INSTRUMENTS
P.O. BOX 1217
GREENWICH, CT 06836 U.S.A.
☎ : 203-869-9681
FAX : 203-869-9871

Complete list of available **FORCE DIALS**

FDK

DECIMAL POUND / GRAM GRADUATIONS					OUNCE / GRAM GRADUATIONS				
Model	Capacity/Graduations				Model	Capacity/Graduation			
FDK 025	.25 LB x	.002 LB/	100 G x	1 G	FDK 4	4 OZ x	1/32 OZ/	100 G x	1 G
FDK 050	.50 LB x	.005 LB/	200 G x	2 G	FDK 8	8 OZ x	1/16 OZ/	200 G x	2 G
FDK 1	1 LB x	.010 LB/	500 G x	5 G	FDK 16	16 OZ x	1/8 OZ/	500 G x	5 G
FDK 2	2 LB x	.020 LB/	1000 G x	10 G	FDK 32	32 OZ x	1/4 OZ/	1000 G x	10 G
FDK 5	5 LB x	.050 LB/	2500 G x	25 G	FDK 80	5 LB x	1 OZ/	2500 G x	25 G
FDK 10	10 LB x	.100 LB/	5 KG x	50 G	FDK 160	10 LB x	2 OZ/	5 KG x	50 G
FDK 20	20 LB x	.250 LB/	10 KG x	100 G					
FDK 40	40 LB x	.500 LB/	20 KG x	200 G					
FDK 60	60 LB x	.500 LB/	28 KG x	250 G					

FDN

NEWTON / GRAM GRADUATIONS

Model	Capacity/Graduation			
FDN1	1N x	.01N/	100G x	1G
FDN2	2N x	.02N/	200G x	2G
FDN5	5N x	.05N/	500G x	5G
FDN10	10N x	.1N/	1000G x	10G
FDN20	20N x	.2N/	2000G x	20G
FDN50	50N x	.5N/	5KG x	50G
FDN100	100N x	1N/	10KG x	100G
FDN200	200N x	2N/	20KG x	200G
FDN300	300N x	2.5N/	30KG x	250G

GENERAL

Your FORCE DIAL should not be used to measure forces below 25% of full scale since true accuracy is degraded as readings decrease from full scale. Before placing the FORCE DIAL into service it is also recommended to test for accuracy according to procedures found in the CALIBRATION section of this manual.

Model FDK FORCE DIALS have no zero on the dial, since setting the pointer at zero has no significance in calibration or accuracy: see CALIBRATION for details.

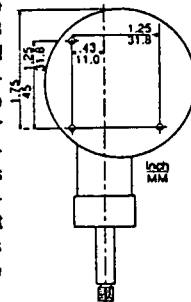
Lubrication of the FORCE DIAL is not recommended.

IMPORTANT

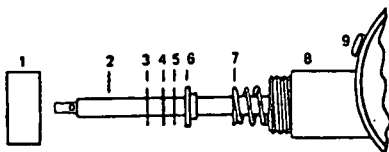
To prevent damage, keep an implement/ accessory on the plunger even when the gage is not in use and when using the pull hook. This provides a positive stop and prevents the plunger from being pushed too far.

MOUNT

Your FORCE DIAL may be mounted with three #6 (.138 in/3.5 mm O.D.) sheet metal screws using the hole pattern shown below. The three dimples on the rear housing will assist in starting the screws. Sturdy posts are located internally behind the dimples to accept the screws. The screws should penetrate no more than 3/8 inches or 10 mm.



PARTS



- | | | |
|--------------|-------------------------|-----------------|
| (1) Retainer | (5) Calibration Washers | (8) Case |
| (2) Plunger | (6) Plate | (9) Push Button |
| (3) Disc | (7) Spring | (10) Crystal * |
| (4) Clip | | (11) Pointer * |

ACCESSORIES: *

- (12) Flat Tip (thru 2 LB / 1000 G / 10 N)
- (13) Flat Tip (5 LB / 2500 G / 20 N & up)
- (14) Long Rod (thru 2 LB / 1000 G / 10 N)
- (15) Long Rod (5 LB / 2500 G / 20 N & up)
- (16) Pull Hook (thru 2 LB / 1000 G / 10 N)
- (17) Pull Hook (5 LB / 2500 G / 20 N & up)

* Not shown in diagram.

CALIBRATION

The calibration of the FORCE DIAL may be checked by attaching the pull hook and suspending test weights at 1/4, 1/2, 3/4, and full capacity in the vertical position. The weight of the plunger, flat, tip and pull hook (.03 LB, 17/32 OZ, 15 G) should be subtracted from test results. If it is determined that recalibration is required the instrument should be returned to the factory.

IMPLEMENT WEIGHT ADJUSTMENT

The FORCE DIAL is calibrated for use in the horizontal position. When using low capacity models - thru 2 LB/ 1000 G/ 10 N - in the vertical position, add or deduct the weight of the implements used from your readings, as follows:

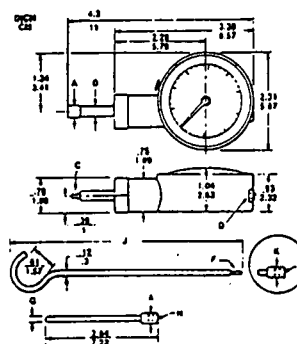
WEIGHT OF IMPLEMENTS:

- Plunger: .015 LB/ 1/4 OZ/ 7 G
- Flat Tip: .004 LB/ 1/16 OZ/ 2 G
- Long Rod: .009 LB/ 5/32 OZ/ 4 G
- Pull Hook: .013 LB/ 7/32 OZ/ 6 G

ADJUSTMENT:

USE	WITH	+/-
Pushing Down	Plunger/Flat Tip	+9 G
Pushing Down	Plunger/Long Rod	+11 G
Pulling Down	Plunger/Flat Tip/Hook	+15 G
Pushing Up	Plunger/Flat Tip	-9 G
Pushing Up	Plunger/Long Rod	-11 G
Pulling Up	Plunger/Flat Tip/Hook	-15 G

DIMENSIONS



High and low capacity models differ slightly in design. The lettered dimensions above, along with the corresponding measurements and comments shown below identify these small variations.

All dimensions are approximate.

Low Capacity (thru 2 LB / 1000 G)		High Capacity (5 LB / 2500 G & up)	
A .19"	.45 cm	A .26"	.65 cm
B .12"	.3 cm	B .24"	.6 cm
C M 3	male	C M 4	male
D M 3	male	D M 3	female
E M 3	female	F M 3	male
G .12"	.3 cm	G .14"	.35 cm
H M 3	female	H M 4	female
J 2.8"	7.1 cm	J 3.4"	8.6 cm
K .19"	.45 cm		

APPENDIX L

PATIENT NAME: _____

FILE NUMBER: _____

DATE: _____

GONIOMETER READINGS.

	FIRST RX	FINAL RX	FOLLOW-UP RX
NEUTRAL			
FLEXION			
EXTENSION			
RIGHT ROTATION			
LEFT ROTATION			
RIGHT LAT FLEX			
LEFT LAT FLEX			

Rotation Measurements

The magnetic angle meter measures to the magnetic reference placed on the spine thus eliminating unwanted spine movement below that point. An added advantage of this method is that measurements are made with the trunk in the vertical position. The meter unit is designed so when the examiner grasps the rib cage the unit becomes a part of the patient, thus eliminating tracking errors.

- 1) Utilize the markings made for S1 and T12 made during the flexion/extension measurements.
- 2) Place the belt between S1 and T12 with the velcro side out. Place the magnetic reference over the sacrum (approximately 4 cm below S1) and attach the velcro straps.
- 3) Have the patient sit erect on a non rotating stool facing west so the arrow on the magnetic reference points north. Feet should be flat on the floor. This sitting position will stabilize the pelvic area. The patient's arms should be crossed over the chest with the hands placed on the shoulders.
- 4) Demonstrate and have the patient do rotation movements. Emphasize the importance of smooth steady movements that go to end range.
- 5) Place the Rotation/Lateral Flexion Unit so the unit's feet are in line with T12. Hold the center of the unit firmly against the patient's back and zero the magnetic meter. Place the thumbs over the back of the unit's feet and grasp the rib cage with the fingers. Check that the meter is still zero.
- 6) Have the patient slowly turn the shoulders to the right making sure they go to full range. Record the reading (Typical Value is 10 degrees).

- 7) Have the patient slowly turn the shoulders to the left making sure they go to full range. Record the reading.

- 8) Repeat steps 5 & 6. If readings are within 2 degrees of the respective readings in steps 5 & 6 record the higher reading. If not repeat steps 5 & 6.

Thoracic/Lumbar rotation can be measured by leaving the magnetic reference on the sacrum and placing the Rotation/Lateral Flexion Unit at T1. To measure only thoracic rotation the belt should be moved up so the magnetic reference can be placed on T12 and the meter unit should be placed at T1.

Lateral Flexion Measurements

The meter unit is designed so when the examiner grasps the rib cage the unit becomes a part of the patient, thus eliminating tracking errors. The protocol eliminates unwanted hip rotation and flexion.

- 1) Demonstrate and have the patient do lateral flexion movements. Emphasize the importance of smooth steady movements that go to end range.
- 2) Have the patient stand erect with nose nearly touching the wall. This position will keep the patient from bending forward during lateral flexion measurements.
- 3) Place the Rotation/Lateral Flexion Unit so the unit's feet are in line with T12. Place the thumbs over the back of the unit's feet and grasp the rib cage with the fingers. Adjust the unit's position on the back until the inclinometer reads zero.
- 4) For right lateral flexion have the patient slide their right hand down the back of their leg with the body weight shifted to the left foot and keeping the legs straight. Record the reading (Typical Value is 25 degrees).
- 5) For left lateral flexion have the patient slide the left hand down the back of the leg with the body weight shifted to the right foot and keeping the legs straight. Record the reading (Typical Value is 25 degrees).
- 6) Repeat steps 4 & 5. If readings are within 2 degrees of the respective readings in steps 4 & 5 record the higher reading. If not repeat steps 4 & 5.

Thoracic/Lumbar Lateral Flexion can be measured by placing the Rotation/Lateral Flexion Unit at T1.

APPENDIX M2:

Flexion/Extension Measurements

The Flexion/Extension Unit is a modified inclinometer that eliminates the need to measure sacral flexion. The pointer is part of the base that is placed on the sacrum so all readings are relative to the sacrum. The arm moves the scale with the upper measuring point so that the reading is the range of motion relative to the sacrum. Since only one hand is required for holding the BROM II the second hand is available to assist the patient in achieving maximum flexion. The reading (in centimeters) on the sliding arm scale can be used in future evaluations so the same spine segment will be measured. This assures that the measurements can be easily reproduced by a second examiner.

- 1) For lumbar measurements palpate and mark S1 and T12.
- 2) Place the BROM Flexion/Extension Unit on the sacrum with the pivot point on S1. Have the patient stretch the velcro straps across the lower abdomen. Check that both contact points on the unit are held firmly against the sacrum. The downward pull of the straps is essential to maintain the contact points against the sacrum during flexion and extension.
- 3) Demonstrate and have the patient perform flexion and extension movements. Emphasize the importance of smooth steady movements that go to end range. Check that both contact points remain on the sacrum and the pivot point remains on S1 during patient flexion and extension.
- 4) Have the patient stand erect. Feet should be shoulder width apart. Place the moveable arm on the upper measuring point T12 and record the arm reading. This reading is the distance in centimeters between S1 and T12 and can be used to position the arm during future measurements to assure that the same segment of spine is measured. The typical reading for an adult is 15 centimeters.
- 5) With the arm tip on T12 record the initial reading from the outer scale. Remove the arm tip from T12 and place a finger securely on T12. Have the patient slowly bend forward trying to lay the palms of the hands on the floor. Replace the arm tip on T12 and record the full flexion reading. Subtract the initial flexion reading from the full flexion reading to obtain true flexion (Typical value is 30 degrees). By placing a finger on the spine the examiner can follow the spine instead of a mark on the skin which would move relative to the spine during bending. Also by placing the finger on the spine the examiner can monitor if the patient is going to full flexion or extension.

- 6) Repeat step 5. If this true flexion reading is within 2 degrees of the first reading record the higher reading. If it is not within 2 degrees repeat step 5.
- 7) Extension Measurements. Check that the patient is standing erect. Have the patient put their arms across the chest with hands on their shoulders. Place the arm tip on T12 and record the initial reading from the outer scale. Remove the arm tip from T12 and have the patient extend backward (provide the necessary support to prevent the patient from falling backward). Place the arm tip on T12 and record the full extension reading. Subtract the full extension reading from the initial reading to obtain true extension (Typical value is 12 degrees).
- 8) Repeat step 7. If this true extension reading is within 2 degrees of the first reading record the higher reading. If it is not within 2 degrees repeat step 7.
- 9) Pelvic Tilt Measurement. Remove the arm. Have the patient stand erect. Move the dial until the vial bubble is between the two lines. Record the pelvic tilt reading from the inner scale.

Thoracic Flexion can be measured by placing the pivot point on T12 and placing the tip of the long arm on T1.