THE RELATIVE EFFECTIVENESS OF ELECTROACUPUNCTURE AS COMPARED TO SINGLE DRY NEEDLE INSERTION IN THE TREATMENT OF TRAPEZIUS MYOFASCIITIS.

By

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I, Lee Anne Cumming, do hereby declare that this dissertation represents my own work both in concept and execution.

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DEDICATION

This work is dedicated to both my parents who have supported me throughout my life and who have encouraged me to reach my goals. They have given me every opportunity available to get this far and have never doubted my ability. Thank you for all your love and support, I am eternally grateful. (Yes, Dad I finally made it!).

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ABSTRACT

The purpose of this study was to determine the relative effectiveness of TENS electrodryneedling as compared to single dry needle insertion in the treatment of Myofascial Pain Syndrome.

This study was a prospective, unblinded, randomized, placebo-controlled clinical trial. A sample size of 60 patients from the Durban Metropolitan area was used. Only patients diagnosed with active trigger points in the Trapezius muscle were accepted into the study.

The sample was divided into two groups of 30 patients each. Group A received single dry needle insertion and Group B received electrodryneedling. Each patient received two treatments over a period of one week.

The short term effects of both treatments were noted. Data was obtained from the patients before and immediately after each consultation. Subjective data was obtained with the Numerical Pain Rating Scale (NRS 101) and the objective data was obtained from pressure threshold algometry.

Statistical analysis of the data involved parametric testing. Intra-group comparisons were made using the paired t-test for NRS 101 and algometer scores. Inter-group comparisons were made using the unpaired t-test for NRS

101 and algometer scores. All statistical analysis was completed at the 95% level of confidence.

Evaluation of the inter-group statistical analyses revealed that there was no significant difference, in terms of the subjective data, between the dry needling and electrodryneedling groups with regard to treatment. A constant, similar improvement was noted in both groups throughout the treatment period. However, objectively, even though there was no significant difference noted between the groups, there was a higher level of significance recorded before the second treatment in terms of pressure threshold readings. This may have been an indication of less post needling soreness experienced by the electrodryneedling group in the rest period.

Intra-group analyses, with regard to objective data, revealed improvement in both groups. Evaluation of the results taken before and after the rest period revealed a difference between the groups. There was no significant improvement noted in the dry needling group but, there was significant improvement noted in the electrodryneedling group. It is in the opinion of the author that the electrodryneedling group was not affected to the same degree by post needling soreness after the treatment and showed a significant improvement due to this.

It was concluded that both dry needling and electrodryneedling have been shown to be effective in the treatment of Myofascial Pain Syndrome in terms of

subjective and objective clinical findings. However, the electrodryneedling group experienced less post needling tenderness during the rest period, thus indicating the positive effect of the treatment in terms of objective measures. The indications from this study are that Electrodryneedling utilizes both the positive effects of dry needling and electrical stimulation when used as a treatment modality for Myofascial Pain Syndrome.

This study and observations made by the author, with respect to dry needling and electrodryneedling, hope to improve the clinical management of active trigger points and contribute new information to the available literature on these two techniques.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 THE PROBLEM AND IT'S SETTING

Myofascial Pain Syndrome is defined as the sensory, motor and autonomic symptoms caused by myofascial trigger points (TrPs), or hyperirritable spots within skeletal muscles that are associated with palpable nodules in a taut band. (Travell, Simons and Simons, 1999 1:5).

Trigger points can be active or latent. An active TrP is described by Travell, Simons and Simons (1999 1:1) as a "focus of hyperirritability in a muscle, or its fascia, that is symptomatic with respect to pain. It refers a pattern of pain at rest and/or with motion that is specific for that muscle." It is this referred pain that distinguishes an active TrP from a latent TrP. A latent TrP "is clinically quiescent with respect to spontaneous pain and is only painful when palpated" (Travell, Simons and Simons, 1999 1:2). All other characteristics of TrP's are common to both active and latent TrPs.

According to Fricton (1990: 43-106), myofascial pain is one of the most common physical disorders responsible for chronic pain and one of the most prevalent chronic illnesses costing society billions of dollars annually in lost work, lost productivity, healthcare and medication. It is also seen as a major cause of

activity limitation and long-term disability in the American and Canadian population (Lee 1994: 85-91). Despite the remarkable advances in modern healthcare, a void exists in understanding, evaluating and managing the day to day musculoskeletal aches and pains (Bruce 1995: 469).

MPS is a commonly encountered problem in an outpatient setting (Auleciems 1995:18). According to Han and Harrison (1997: 89), American studies based at pain clinics indicate that the incidence of MPS is as high as 85%. MPS is however still one of the least understood conditions, often being unrecognized, misdiagnosed or mistreated leading to unnecessary pain, suffering and disability (Auleciems 1995: 18).

Traditionally the chiropractic profession has primarily focused on joint dysfunction and osseus manipulation however chiropractors, such as Schneider (1995), suggest that there is a growing interest within the chiropractic profession towards the management of soft tissue disorders. In 1981, Sandman wrote an article in which she mentioned that the treatment of myofascial pain may become routine in chiropractic practice. The traditional model of chiropractic practice is evolving into a newer paradigm of practice in which the importance of muscle dysfunction is becoming recognized. Gatterman and Goe (1990 12:285) suggest that the primary emphasis of chiropractic therapy will remain treatment by manipulation of joint dysfunction however; treatment of the concomitantly injured muscles is paramount in shortening the healing time in musculoskeletal conditions. The

chiropractor not only has to deal with the joint dysfunction but also the muscles that relate to the joint complex to increase healing time (Cohen and Gibbons 1998: 167). Chiropractic can therefore work in conjunction with soft tissue therapy as a treatment protocol for MPS as correction of the fixated joints of the spine and other areas helps reduce mechanical stresses that perpetuate postural imbalances that lead to muscular stress (Gatterman 1990: 296-297).

The major goal of TrP therapy is to relieve pain and taut bands of the involved muscles (Esenyel et al. 2000: 49). Treatment protocols vary and include; spray and stretch, transcutaneous electrical nerve stimulation, ultrasound therapy, massage therapy, TrP injection therapy, dry needling and elimination of causative and perpetuating factors (Esenyel et al. 2000: 49). For all the above treatments the mechanism of action is thought to be hyperstimulation analgesia of the TrPs (Baldry 1998: 116) mediated through the gate control mechanism (Melzack and Wall 1982: 324-331). Treatment of MPS appears to be aimed at disrupting the reverberating neural circuits responsible for the self-perpetuation of the pain-spasm-pain cycle (Gatterman 1990: 296). It is noted by Anderson (1997) that choice of treatment is often a personal one, due to lack of clinical evidence to support one specific therapy over another.

Dry needling has been extensively studied and has been shown to decrease or even abolish MPS, an effect that appears to be mediated by the input into the central nervous system during needle stimulation (Hong 1994: 263).

Studies show that TENS therapy alone may not be sufficient for the effective treatment of MPS (Graff-Radford et al. 1989) due to, among other reasons, the presence of high skin surface resistance in certain patients (White et al. 1999). This phenomenon causes current to be dispersed over the surface tissues of the body, rather than being allowed to penetrate the deeper tissues where TrPs are located. This suggests that the application of TENS specific to the management of MPS may need to be refined in order to maximize it's therapeutic efficacy. What has not been established is the relative effectiveness of a method of combined hyperstimulation through TENS and dry needling, which may enhance the resultant analgesic effect.

Baldry (1998: 107-108) states that when one comes to compare manual needle stimulation of TrPs with electrical stimulation of needles inserted into TrPs, the stimulus delivered by briefly applied manual needling may not be as powerful or prolonged as that provided by adjunctive electrical stimulation. Hence the treatment of TrPs may be improved by using an electroacupuncture-type method namely electrodryneedling.

Therefore in an effort to further improve the clinical management of TrPs, this study compared the effect of electrodryneedling to dry needling in the treatment of MPS. According to the researchers knowledge, no study exists which has combined these two methods in the treatment of MPS although the two methods have been used separately to treat the same condition.

1.2 **STATEMENT OF THE PROBLEMS.**

The aim of this study is to determine the relative effectiveness of electrodryneedling as compared to dry needle insertion alone in the treatment of MPS in terms of subjective pain perception and pain threshold algometer findings.

1.2.1 **Sub-problem one**

To determine the relative effectiveness of electrodryneedling as compared to dry needle insertion alone in the treatment of MPS in terms of subjective pain perception.

1.2.2 **Sub-problem two**

To determine the relative effectiveness of electrodryneedling as compared to dry needle insertion alone in the treatment of MPS in terms of pain threshold algometer.

1.3 HYPOTHESES

1.3.1 The first hypothesis

It is hypothesized that electodryneedling will be more effective than dry needle insertion alone in the treatment of MPS in terms of subjective pain perception.

1.3.2 The second hypothesis

It is hypothesized that electrodryneedling will be more effective than dry needle insertion alone in the treatment of MPS in terms of pain threshold algometer.

1.4 BENEFITS OF THE STUDY.

Treatment protocols of this commonly occurring condition vary. Since electrodryneedling has never been investigated for treatment of this type of condition, most of the evidence for this type of therapy is based on anecdotal information rather than in formal experimental procedures. It is hoped that this study will provide important information regarding the use of this modality as a treatment for myofascial pain.

Research indicates that the use of dry needling produces significant post-treatment soreness (Rowley 2001 : 116) and needling methods used in the treatment of MPS may need to be refined. Therefore this clinical trial was designed to determine whether these two treatment modalities combined, namely in the form of electrodryneedling, would result in enhanced short-term recovery and less TrP tenderness in patients suffering from MPS when compared to dry needling alone. This research hopes to assist the practitioners in choosing a therapy that has been proven to be effective in the treatment of this condition.

It is hoped that this investigation provides information that may contribute to the limited literature available on electrodryneedling, providing the basis for future research into the value and use of this technique.

CHAPTER TWO

2.0 REVIEW OF THE RELATED LITERATURE

2.1 INTRODUCTION

This chapter gives a review of the available information on MPS and highlights the possible weaknesses in knowledge of the therapies used in treatment of this condition. The information reviewed will provide a clearer understanding of the development of the current concepts in trigger point etiology, pathogenesis, diagnosis and management.

2.2 PREVALENCE OF MYOFASCIAL PAIN SYNDROME

Myofascial Pain Syndrome (MPS) is a regional muscle disorder accompanied by trigger points (TrPs) (Han and Harrison 1997:89). It is one of the most predominant soft tissue syndromes seen in clinical practice and there is a growing interest within the Chiropractic profession towards the management of soft tissue disorders such as MPS (Schneider 1995). It is also one of the least understood yet commonly encountered problems in the outpatient setting (Auleciems 1995:18) and it has been identified as one of the most common causes of chronic pain (Fricton 1990:107). According to Bruce (1995:469), it is a common health problem afflicting a substantial portion of the population and interferes with every aspect of their lives.

Reports of the prevalence of MPS in specific patient populations are available from as early as the 1950's where physicians noted MPS as one of the most frequent problems seen by physicians (Sola, Rodenberger and Gettys, 1955:585). In their survey of 200 subjects, Sola, Rodenberger and Gettys (1955:587) found 49.5% of patients to have one or more TrPs, and those found in the Trapezius, Infraspinatous, Levator Scapulae and Scalene muscles were the most common.

Most of the studies on the incidence and prevalence of MPS have been carried out since the 1980's. Fricton et al (1985) found that, of 164 patients with head and neck pain of at least six months duration, 55% had a primary diagnosis of MPS with active TrPs. Fishbain et al (1986:197), reported that TrPs were the primary cause of pain in 85% of 283 consecutive admissions to a pain centre programme for chronic pain patients. Han and Harrison (1997:89) stated that American studies at pain clinics indicate that the incidence of MPS is as high as 85%. Their results were obtained through extensive periodical literature and textbook review with critical analysis of selected manuscripts. A study conducted in rural Thailand examined 2463 subjects and found that 36.2% had musculoskeletal pain of which MPS was the most common diagnosis. (Chaiamnuay et al 1998:1382).

The high prevalence of Myofascial Pain Syndrome can be subdivided further. The condition is more prevalent in women (2:1) but, it is clearly found in both

sexes (Han and Harrison 1997:89). Travell, Simons and Simons (1999 1:13) suggest that individuals in their mature years are more likely to suffer from the condition. In a population of hospitalized and ambulatory Physical Medicine and Rehabilitation Service patients with TrPs, the greatest number were between the ages of 31 and 50 years (Travell, Simons and Simons, 1999 1:13). However, the condition does occur in younger individuals.

The prevalence in a South African setting is yet to be established, but from the above mentioned authors we can see that MPS is a common disorder. One South African study on the prevalence and types of headaches in Afrikaans speaking high school children in the greater Durban area, TrP examination revealed a 24.95 – 37.1% prevalence of active Trapezius TrP's in a sample population of 1441 pupils (Jansen 1998).

2.3 AETIOLOGY OF MYOFASCIAL PAIN SYNDROME

Although a number of causes are speculated, there is no unified neurophysical or pathologic explanation for MPS (Auleciems 1995:18). There is still uncertainty over aetiology as no studies conducted indicate positive predictive values (PPV+) for any one or combination of factors. It is however, known, that both active and latent TrPs develop as a result of the same factors, but to varying degrees (Travell, Simons and Simons, 1999 1:19).

Some authors are of the opinion that TrPs may result from or be perpetuated by trauma, overuse, mechanical overload, postural faults or psychological stress (Hanten et al 2000:997). A study undertaken by Fricton et al (1985:621) supported a multi-factorial aetiologic basis for MPS and suggests that the development of TrPs can be divided into two basic concepts:

1) Factors that directly traumatize a muscle by direct injury or by repetitive micro trauma from habits that produce muscle tension. The most frequently mentioned of these include poor postural habits.
2) Factors that weaken a muscle and predispose it to the development of TrPs through such factors as nutritional disturbances, structural disharmony, lack of exercise, sleep disturbances or the presence of other disorders such as joint problems.

Travell, Simons and Simons (1999 1:19, 112) propose additional factors that lead to the development of TrPs:

3) Prolonged muscle spasm and more so, contraction of a muscle whilst in the shortened position.
4) Orthopedic anomalies that place the muscle in prolonged abnormal function. TrPs are often found in muscles that lie within the scleratogenous referred pain zones of inflamed joints, or the dermatomal referred pain zone of an inflamed nerve root (Schneider, 1995).

5) There is agreement that spinal nerve compression is associated with an increase in the numbers of active TrPs, especially in the paraspinal muscles. Nerve compression, as in radiculopathy caused by a ruptured intervertebral disc, leads to the development of TrPs in the muscles supplied by the compressed nerve root.
6) The “nervous tension” associated with emotional stress or psychological tension has been said to induce TrPs as it causes an increase in the autonomic nervous system activity.

It is of the opinion of Travell, Simons and Simons (1999:111) that in patients where the onset of symptoms is gradual, most of these patients cannot remember when or why the pain started. According to these authors it is important to establish the aetiology as chronic overload may perpetuate and intensify the trigger point’s symptoms. Examples of chronic stresses are discussed in more detail in section 2.4 of this chapter.

2.4 PERPETUATING FACTORS OF MYOFASCIAL PAIN SYNDROME

Contributing and perpetuating factors need to be identified and eliminated or treated appropriately to obtain good long-term relief in the treatment of MPS (Esenyel 2000:50). A variety of perpetuating factors are associated with recurrences of pain unresponsive to MPS treatment. They are primarily structural, systemic or behavioral (Auleciems 1995:24). Authors agree that once

perpetuating factors are corrected, pain is more likely to resolve (Esenyel 2000:50, Travell, Simons and Simons 1999 1:178).

Perpetuating factors may include any of the following, outlined by Travell, Simons and Simons (1999 1:110-112):

1) Mechanical stresses such as skeletal asymmetry (short leg or small hemipelvis), poor posture, misfitting furniture and prolonged immobility.
2) Nutritional inadequacies, such as B and C vitamins and calcium, potassium and iron, which all play a role in normal muscle functioning.
3) Psychological factors such as depression, tension and anxiety may inhibit rapid recovery.
4) Chronic infection due to either bacterial or viral disease.
5) Other factors such as impaired sleep, allergy and nerve impingement.
6) Metabolic and endocrine inadequacies which includes hypothyroidism, hypocalcaemia, hyperuricemia, hypoxia and anemia. These impair muscle metabolism.

Rachlin (1994:20) agrees with Travell, Simons and Simons on the above perpetuating factors but states that there is no data to support any of these claims. He suggests that mechanical factors (including trauma and abnormal posture), psychological stress, acute viral and or bacterial infections and non-restorative sleep would aggravate either regional or generalized musculoskeletal

pain. He states that there is no data currently available to support the notion that vitamin or endocrine deficiencies perpetuate MPS.

2.5 CLINICAL FEATURES OF MYOFASCIAL PAIN SYNDROME

2.5.1 Symptoms of MPS

Patients with Myofascial Pain Syndrome will typically present to a clinician complaining of regional persistent pain, most frequently located in the head, neck and shoulders, upper and lower extremities and lower back (Han and Harrison 1997:92). The patient may attribute this pain to a traumatic injury, where the muscles were damaged by strain or overload, or, in the case of chronic symptoms, relate it to repetitive strain, poor posture and other causes of chronic muscular tension (Schneider, 1995).

The pain may at first seem poorly localized, but is usually limited to one muscle region of the body (Schneider, 1995). It may range from a mild ache to excruciating pain and is either sharp or dull. Words such as “pressure”, “burning”, “throbbing” and “heavy” are frequently used to describe the pain. The patient may also complain of general fatigue and decreased range of motion and muscle strength (Han and Harrison 1997:92). Motor disturbances described by Travell, Simons and Simons (1999 1:21) include muscle weakness, spasm of other

muscles (synergistic and/or antagonistic muscles) and decreased muscle power or work tolerance.

Myofascial pain is often referred to a distant site from the TrP, in a characteristic pattern for that muscle and sometime patients are even aware of a numbness or parathesia rather than pain (Travell, Simons and Simons 1999 1:20).

Patients may present with additional symptoms which are a result of autonomic disturbances. These autonomic phenomena include vasoconstriction, pilomotor response, ptosis and hypersecretion (Hong and Simons 1998:863). Proprioceptive disturbances may also occur, including tinnitus, imbalance, dizziness and altered weight perception of lifted objects (Travell, Simons and Simons 1999 1:21).

Additional symptoms such as weather sensitivity, sleep disturbance, depression are often present but not diagnostic because they may be attributable to chronic severe pain perpetuated by mechanical and/or systemic perpetuating factors (Simons 1991:11).

2.5.2 Signs of MPS

On examination of a patient suffering with Myofascial Pain Syndrome, a number of physical findings are necessary for correct diagnosis of the condition.

Identification of a trigger point is essential for diagnosis and treatment. As there is no reputable biochemical, laboratory, electromyographic or diagnostic imaging criteria available for the diagnosis of MPS (Lewis and Tehan 1999:39), manual palpation, recognition of clinical features and patient feedback are primary methods used for diagnosis and treatment (Sciotti et al 2000:260).

Travell, Simons and Simons (1999 1:12) state that although there is still poor agreement on appropriate diagnostic criteria for MPS, there are certain common characteristics recognized by various authors such as Hong and Simons (1998: 863) that aid the clinician with evaluating the patient suffering with myofascial pain. Palpation of the affected muscles by applying sustained deep pressure is the method most frequently used in the diagnosis of TrPs (Han and Harrison 1997:94). Active TrPs are identified when patients recognize the pain that is induced by applying pressure to a TrP, as their pain (Travell, Simons and Simons 1999 1:21). The compression may elicit a local pain and/or referred pain. Snapping palpation, which is compression across the muscle fibers rapidly, may elicit a local twitch response (LTR). A LTR is a brisk contraction of the muscle fibres in and around the taut band which can also be elicited by rapid insertion of a needle into the TrP (Hong and Simons 1998:863). If the tenderness is severe enough, a behavioral sign known as the “jump sign” can be elicited when the TrP is palpated and causes the patient to withdraw from the examiners hand and cry out (Han and Harrison 1997:94).

Simons (1991:11) suggests the use of a set of diagnostic criteria to make the clinical diagnosis of Myofascial Pain Syndrome. The findings should include all five major criteria and at least one of the three minor criteria.

Major Criteria

1. Regional pain complaint
2. Pain complaint or altered sensation in the expected distribution of referred pain from the myofascial TrP.
3. Taut band palpable in an accessible muscle.
4. Exquisite spot tenderness at one point along the length of the taut band.
5. Some degree of restricted range of motion, when measurable.

Minor Criteria

1. Reproduction of clinical pain complaint, or altered sensation, by pressure on the tender spot.
2. Elicitation of a local twitch response by transverse snapping palpation at the tender spot or by needle insertion into the tender spot in the taut band.
3. Pain alleviated by muscular treatment, e.g. therapeutic stretching, ischemic compression or injecting the tender spot.

A recent study conducted by Gerwin et al (1997:72), successfully demonstrated interrater reliability in myofascial trigger point examination. This was particularly positive when examiners were trained together to establish agreement on

palpation skills. The study was conducted following a three hour training session and the examination technique among the doctors was assessed statistically and found to be reliable before proceeding with the study. This demonstrated that manual diagnosis is reliable when diagnosing MPS, on the provisor that clinicians are familiar with the criteria for identification and physical findings are interpreted similarly (Gerwin et al 1997:72).

Travell, Simons and Simons (1999 1:35) feel that, whilst there is no one diagnostic examination that is satisfactory for the clinical identification of a TrP, a combination of spot tenderness in a palpable taut band and subject recognition of the pain are minimum acceptable criteria. They also state that researchers investigating MPS should identify specifically which TrP examinations were used as diagnostic criteria and describe exactly how they were performed.

2.6 CONFIRMATORY DIAGNOSIS OF TRIGGER POINTS

At present, no satisfactory laboratory or imaging tests are available for making the diagnosis of a trigger point (Lewis and Tehan 1997:39). Three newly recognized and seemingly useful techniques have been recognized by Simons (1999) for diagnosing and confirming the presence of TrPs. However, there have not been a sufficient number of well-controlled studies to establish the clinical reliability of these tests, but the reports that have been written on them are promising (Travell, Simons and Simons 1999: 22).

These include firstly electromyographic recording and ultrasound imaging of local twitch responses. Electromyographic (EMG) activity has been recorded from tender spots within the taut bands, on stimulation of the band by snapping palpation (Hong and Simons 1998: 865) or by needling (Simons and Dexter 1995), to elicit a local twitch response (LTR). Ultrasound imaging can be used to visualize the local twitch responses which have been elicited from the TrP (Travell, Simons and Simons 1999 1:23).

The second confirmatory test is the demonstration of spontaneous electrical activity (SEA) of multiple active loci in the TrP. This was described in a study by Hubbard and Berkoff (1993:1806). They demonstrated the presence of spontaneous spikes of increased EMG activity when a fine needle electrode was placed precisely within the nidus of a Trapezius muscle TrP. They discovered that there was no such activity at adjacent non-tender sites.

The third test is biopsy of the TrP to demonstrate contraction knots which are seen in longitudinal section as fusiform enlargements filled with greatly shortened sarcomeres, and in cross section appear as giant, round, densely staining muscle fibers (Simons and Stalov 1976). These reported observations were based on canine muscle. In 1994, Gerwin reported that biopsy of tender areas have shown no consistent anatomical changes using light microscopy, electron microscopy or histochemistry. However, a progressive degeneration of the

muscle with disruption of mitochondria was noted. There was an associated increased glycogen and actin band synthesis noted in the long term occurrence of TrPs leading to a disintegration of the contractile fibers and a broken down amorphous compound (Gerwin 1994: 748).

It is the opinion of Travell, Simons and Simons (1999: 22) that these tests have much potential for the clinical application in the diagnosis and assessment of the therapeutic interventions of myofascial trigger points.

2.7 PATHOPHYSIOLOGY OF A MYOFASCIAL TRIGGER POINT

Researchers such as Lewis and Tehan (1999:40) believe that studies that have attempted to describe the pathophysiology of myofascial trigger points have reported conflicting results.

In 1984, Sola postulated that TrPs were a result of a self-sustaining cycle of local ischemia, release of bradykinins and prostaglandins and osmotic changes in pH, leading to an area of hyperactivity, increased motor activity and pain. Zohn (1988:27) later suggested an alternative hypothesis that active TrPs are a series of self-sustaining malfunctions of muscle contraction initiated by trauma which locally tears the sarcoplasmic reticulum, releasing calcium. This calcium binds with adenosine triphosphate (ATP) to repetitively activate local contractile

mechanisms, continually shortening the affected muscle bundles and producing chemical agents like prostaglandins that sensitize local sensory nerves. Around the same period Hong and Simons (1988:600) discovered that TrPs contained multiple loci that were related to nerve and motor endplates. The taut areas in the muscle were related to an excessive release of acetylcholine in abnormal endplates. Borg-Stein (1997:305) supported the hypothesis that the abnormality in TrPs is localized in the endplate zone of the muscle and is related to calcium metabolism. It is now becoming accepted that the area referred to as a TrP is a cluster of minute loci, of intense abnormality, that are scattered throughout the nodule, and the abnormality is a neuromuscular dysfunction of the motor endplate (Travell, Simons and Simons 1999:57).

Authors such as Travell, Simons and Simons (1999), Simons (1999) and Hong and Simons (1998) have expanded and added to the above theory on the pathophysiology of TrPs. It has been accepted that dysfunctional endplates, defined as active loci when in the vicinity of a TrP, are the areas in which TrPs originate. The following paragraphs are a synopsis of their theories.

An initiating event such as trauma or prolonged mechanical stress can result in a dysfunctional endplate releasing an excessive amount of acetylcholine from the nerve terminal. This causes a release of calcium from the sarcoplasmic reticulum and a resultant maximal contraction of the muscle fibre and an increased metabolic demand for oxygen and ATP results. This sustained contraction

produces a local ischaemia, which shuts down the energy supply and causes a failure of the calcium pump to return calcium to the sarcoplasmic reticulum. The contractile elements are continuously exposed to calcium and an abnormal cycle of contraction results. This sequence of events in the formation of a TrP is known as the “energy crisis theory”.

The areas of contraction at the dysfunctional endplates (active loci) are visible histologically as contraction knots. A collection of these within a taut band constitute a TrP. As a result of the energy crisis, sensitive loci develop from the production of vasoreactive substances that sensitize local nociceptors. The sensitive loci are believed to be sites from which pain, referred pain and local twitch responses are elicited. They can be widely distributed within the muscle but, are concentrated within the TrP region. When a sensitive locus and an active locus lie within the immediate vicinity of each other, a myofascial TrP locus develops. This is the basic unit of a TrP. Referred pain results when input from the sensitive locus persists and leads to the development of central sensitization in the spinal cord. The receptive field corresponding to the original dorsal horn neuron expands.

2.8 TREATMENT OF MYOFASCIAL PAIN SYNDROME

The treatment of Myofascial Pain Syndrome must take into account physiologic and psychosocial stresses that are often involved in the development and

perpetuation of the condition (Han and Harrison 1997:1995). The short term goals in therapy according to Friction (1994:868) are to reduce pain, restore the muscle to its normal length and reduce muscle activity. The long term goals include restoration of normal lifestyle activities and demonstration of proper use of the muscles to the patient. The clinician should also reduce any contributing factors and teach the patient stretching and postural conditioning exercises. He also states that failure to address all the factors related to the condition, including identification of all the involved muscles, concomitant diagnoses and contributing factors, may lead to failure of therapy and perpetuation of a chronic pain syndrome.

Bruce (1995:473) suggests that a multidisciplinary approach to treatment is important and states that treatment is directed first toward diagnosing and eliminating perpetuating factors. Therapy for MPS has consisted primarily of physical modalities, including spray and stretch techniques; massage; ice; heat; ultrasound; massage; dry needling and trigger point injections (Mc Clafflin 1994:64, Hanten et al 2000:4, Han and Harrison 1997:95). According to Han and Harrison (1997:95) the four most frequently used modalities in the treatment of MPS include trigger point injection; dry needling; spray and stretch and transcutaneous electrical nerve stimulation (TENS). Bruce (1995:473) feels that the most commonly used techniques are spray and stretch and TrP injections.

There is a wide variety of techniques available for the treatment of MPS and the choice of treatment by the clinician is often case dependant and/or preference of the clinician. Treatment methods can be divided into invasive and non-invasive methods. The decision to treat MPS with an invasive technique such as dry needling or TrP injection depends strongly on the training skill of the practitioner. All approaches should be equally available to the patient and used when indicated (Travell, Simons and Simons 1999: 151).

2.8.1 **The effectiveness of various techniques on Myofascial Pain Syndrome**

2.8.1.1 **Manual Soft Tissue Therapies**

Manual therapies include techniques such as the spray and stretch method, post-isometric relaxation and active release techniques (Schneider 1996:78).

2.8.1.1.1 Spray and Stretch

Spray and stretch, using a vapocoolant spray along with passive stretching of the muscle containing the Trp has been described as an effective treatment by Travell, Simons and Simons (1999:126). Jaeger and Reeves (1986:203) found that TrP sensitivity and pain intensity decreased following spray and stretch. It is hypothesized that decreasing TrP pain utilizing spray and stretch is due to the

elongation of the muscle to its full normal length (Travell, Simons and Simons 1999:27).

2.8.1.1.2 Ischaemic Compression

The most widely recognized form of manual therapy is ischaemic compression which was developed by Travell (Travell, Simons and Simons 1999:126). It is described as a firm, direct pressure to the centre of the TrP (Sandman 1981:138). This mechanically breaks up the fibrous bands of the TrP and improves point tenderness. The application of the deep pressure produces local ischemia, when pressure is released; a reactive hyperemia results improving circulation to the area (Auleciems 1995:26). Sandman (1981:138) suggests that the direct pressure provides a strong barrage of nerve impulses to the brain to inhibit the reflex pathways that perpetuate the TrP activity.

Ischemic compression has been shown to be clinically effective in treating TrPs by Hong et al. (1993) and Hanten et al. (2000). Hong et al. (1993) compared the effectiveness of ischemic compression, spray and stretch, moist heat and ultrasound for the treatment of active TrPs in the upper Trapezius muscles of 84 patients. Ischemic compression was found to be significantly better than the other three modalities. Hanten et al. (2000) found a home program of ischemic compression followed by sustained stretch effective in reducing both TrP sensitivity and pain intensity in individuals with neck and upper back pain.

There are two common mistakes made by practitioners when using ischemic compression. These are applying too much pressure and applying pressure for too long. Both of these errors result in increasing the patient's pain and/or cause muscle bruising or soreness (Schneider 1996:80). Sandman (1981:138) suggests that if pressure is painful, the patient may respond with muscle tightening in the area which may aggravate the condition.

2.8.1.1.3 Heat

Heat is one of the oldest and most widely used forms of physical modalities with natural forms of heat such as the sun, sand and thermal waters being used for as long as history can be traced (Gatterman 1990:331). Travell, Simons and Simons (1999:151) state that moist heat is more effective than dry heat possibly due to a more effective absorption of heat. They believe that moist heat relaxes the underlying muscles thereby diminishing the tension on the trigger points and reducing referred pain. Fricton (1994) believes that the moist heat provides skin and muscle temperature changes as a form of counter-stimulation. Mance et al (1986) suggest that heat is more effective when used during or immediately after passive or active stretching.

2.8.1.1.4 TrP Injection and Dry Needling

Trigger point injections have been widely used to inactivate trigger points (Esenyul 2000:49) and are commonly used in the management of Myofascial

Pain Syndrome with widespread clinical acceptance (Borg-Stein 1997:305). According to Han and Harrison (1997:96) TrP injections can achieve the best results in chronic active TrPs with fibrotic scar formation. It is a technique often preferred to dry needling because of the analgesic effects that the local anesthetic agents offer to the surrounding tissue (Han and Harrison 1997:96).

In a double-blinded and controlled study by Hong (1994), the therapeutic effectiveness of trigger point penetration by injection, with and without local anesthetic agent, was compared. There were 26 patients who received injections with 0.5% lidocaine into the upper Trapezius muscle and 15 patients received dry needling. Improvement was shown in both groups with respect to pain intensity and pressure threshold measurements. Hong also demonstrated that it was essential to elicit local twitch responses during TrP injection or dry needling to achieve full relief. The patients in the dry needling group experienced post-needling tenderness whereas those treated with lidocaine did not. The author believes that post-injection soreness is related to post-injection hemorrhage. Hong's clinical experience led him to believe that patients with hemorrhage (swelling) at the injection/needle site have a higher intensity of post-injection soreness than those without swelling. In this study patient's in the dry needling group required more needle insertions to inactivate the TrP, therefore causing more hemorrhage in the area leading to a higher intensity of post-needling soreness. The disproportionate numbers in the groups studied may have had a bearing on the results.

In 1989, Garvey et al. conducted a randomized, double-blind study comparing four different treatment methods in 63 lower back pain patients with active TrPs. They evaluated trancutaneous injection of local anesthetic, injection of local anesthetic plus steroid, dry needling and acupressure combined with a vapocoolant spray procedure. The results of this study showed that dry needling and acupressure with the vapocoolant spray method to be more effective than the trancutaneous injections. This led the researchers to believe that relief is likely due to the mechanical stimulation of the trigger point by the needle, not the injection of a particular substance.

In another double-blinded study with a sample size of 107, local injection therapy using one of three solutions was applied by intracutaneous injection to trigger points of patients with MPS of the head and neck. Results using Bupivacaine 0.25%, lignocaine 1% and saline 0.9% were compared. There was no significant difference among the groups with respect to reduction of pain. The findings suggest that relief of pain is mainly due to reflex mechanisms rather than pharmacological effects of the injected solutions (Tschopp and Gysin 1996: 306).

It is proposed by Han and Harrison (1997) that the mechanisms by which both needling and local injection reduce TrP pain are:

1. The mechanical disruption of the muscle fibers and nerve endings.

2. The mechanical disruption of the muscle fiber, causing release of intracellular potassium, which depolarizes the nerve fibers.
3. Interruption of the positive feedback mechanism that perpetuates pain.
4. Local dilution of nociceptive substances by the local anesthetic or saline that is infiltrated.
5. Vasodilator effect of local anesthetics, which increases removal of metabolites.

Dry needling, a variant of needle injection, is the insertion of acupuncture needles into active myofascial trigger points in order to deactivate them (Liggins 1997:97). Various studies on dry needling have shown to decrease or even abolish MPS, an effect that appears to be mediated by the input into the central nervous system during needle stimulation (Han and Harrison 1997:96). The mechanical effect of needle penetration induces an electrical current, known as the current of injury (Chan Gunn 1989). This together with the direct mechanical trauma of needling produces hyperstimulation analgesia (Baldry 1998:116). This therapeutic effect is usually explained by the gate control mechanism proposed by Melzack and Wall (1982:324). They describe pain as a resultant ascending input modulated in the dorsal horn of the spinal cord, which acts like a gate, with inhibitory and excitatory effects from peripheral fibers. It was postulated that the large fiber input generally closes the gate, which is profoundly affected by descending inhibitors from the brain (Garvey et al 1989:963). Therefore the gate control mechanism involves stimulation of a neural mechanism which blocks pain

conducting substances. This is the proposed mechanism of pain relief for dry needling (Hong and Simons 1998:864). The needle effect is the immediate analgesia produced by needle puncture of the TrP (Han and Harrison 1997:97).

The efficacy of dry needling in the treatment of MPS was evaluated by Jones (1994), who found dry needling combined with a home programme of stretch exercises to be significantly more effective than placebo ultrasound therapy. This study reinforces Lewit's (1979) findings, where 86.8% of cases in his study experienced immediate pain relief when the most painful area of a TrP was needled or touched by a needle.

Broome (1996) investigated the therapeutic efficacy of invasive needling techniques in the management of MPS. He found that there was no statistically significant difference between saline injection therapy and dry needling when treating MPS. The author did, however, recommend dry needling over saline injection therapy due to dry needling being a quicker and easier form of treatment.

Dry needling appears to be as effective as the injection of medication into TrP's in the treatment of MPS, however post-needling tenderness is reported to be of a higher degree and experienced for longer duration in patients who receive dry needling (Hong 1994:258). A comparative, randomized clinical trial comparing the relative effectiveness of two dry needling techniques conducted by Rowley in

2001 showed that the use of both single dry needle insertion and multiple fanning dry needle insertion are equally effective in the treatment of MPS. It was noted in the study that multiple fanning needle insertion was responsible for excessive microtrauma in the area with resultant post-needling soreness. This statement supports the study conducted by Hong (1994) which was discussed earlier in this section.

Both dry needling and TrP injections have proven to be effective in the treatment of Myofascial Pain Syndrome but, both these therapies produce varying degrees of post-injection/post-needling soreness. TrP injections also carry the risk of serious complications associated with local steroid injection. These complications could be that of tendon atrophy and depression of plasma cortical levels (Han and Harrison 1997:96). A number of studies have been conducted on needling techniques in the treatment of MPS and dry needling has been shown to be an effective therapy, although some authors favor analgesic infiltration. The advantage of dry needling is that it falls within the scope of chiropractic practice.

2.8.1.2 **Electrotherapeutic Modalities**

Various electrotherapeutic modalities have been used to treat Myofascial Pain Syndrome. These include ultrasound therapy, interferential current, action potential therapy and transcutaneous electrical stimulation (TENS).

The use of ultrasound therapy as a treatment for MPS has been widely researched and has produced conflicting results. According to Gam et al. (1998:73) ultrasound therapy has achieved recognition as a suitable method in the treatment of acute and chronic musculoskeletal disorders. However, contradictory results were obtained in the study conducted by the above authors, of 58 patients with TrPs in the neck and shoulders. The two groups were administered with ultrasound and sham ultrasound. There was no difference shown between the two groups. Ultrasound was shown to give no pain reduction, and analgesic usage by the patients remained the same. In a study conducted by Hong et al. (1993), ultrasound was found to be effective in increasing pain threshold in 16 patients with active TrPs. In a later study, the effectiveness of ultrasound versus trigger point injections, in combination with neck stretching exercises, for the treatment of TrPs in the upper Trapezius muscle was compared. In a sample of 102 patients it was found that ultrasound treatment was equally effective as TrP injection (Esenyul, Caglar and Aldemir 2000:49).

A controlled study conducted by Christie (1995), compared the relative effectiveness of dry needling and interferential current (IFC) on two groups of 15 patients with TrPs in the shoulder girdle. The aim of the study was to determine whether the use of IFC provided a non-invasive alternative to dry needling. He found no significant difference between the two groups, although both groups showed an improvement in symptoms. Christie concluded that interferential current could be used in the treatment of MPS. Further study should be

conducted on this subject as larger sample size may have yielded different results.

Chettiar (2000) was the first researcher to test the efficacy of action potential therapy (APT) for MPS. His placebo controlled study of 60 patients found APT to be effective in reducing pain intensity and increasing pressure threshold levels in patients with active TrPs. Only the short-term therapeutic effects were noted in this study.

The efficacy of TENS as a treatment modality for Myofascial Pain Syndrome is questionable. TENS is not classified as a specific treatment modality for MPS (Han and Harrison 1997:98). There is a contradiction in results when comparing various studies previously done to investigate the efficacy of TENS in the treatment of TrPs. Hutchings (1998) conducted a clinical trial in which she investigated the effect of TENS with respect to electrode placement. The author concluded TENS was successful in treatment of MPS regardless of whether the electrode placement was either over the pain referral zone or directly over the TrP. Graff-Radford et al (1989) conducted a double blinded study involving 60 patients with active myofascial TrP's. Four modes of TENS and a control with no stimulation were compared. It was found that high frequency, high intensity TENS was effective in treating Myofascial Pain without alteration of local trigger point sensitivity. Since trigger point sensitivity was essentially unchanged (Graff-Radford et al 1989), authors Han and Harrison (1997:98) came to the conclusion

that TENS therapy alone may not be sufficient to produce long-term effect in treating MPS.

The mechanism by which TENS provides relief is based on the Gate Control theory. The Gate Control theory states that low intensity stimulation of TENS selectively activates large diameter fibers to close the pain gate in the dorsal horn of the spinal cord or at higher levels. There is also additional release of endogenous opiates, modulation of autonomic responses and partial block of c-fibers (Han and Harrison 1997:98).

There are a number of postulates that exist as to why TENS therapy alone may not be sufficient in treating MPS. One mechanism for reduced clinical effect is the variable skin resistance that is present among patients (White et al. 1999). This is most clearly visible in the variability of the point of perceived sensation in patients and consequent lack of standardization in intensity levels utilized in studies (White et al. 1999). This suggests that the application of TENS may need to be refined.

2.8.1.3 **Electrodryneedling**

A conventional TENS method was discussed in the previous section for the treatment of MPS. The stimulation used is a high frequency (10-300 Hz) and low intensity current. For this form of electrical stimulus to be effective it has to be

applied for at least 30 minutes and often much longer (Baldry 1998:107). The mechanism by which TENS provides relief was discussed in the earlier section (p33-34) and is based on the Gate Control theory.

The frequencies used in TENS treatment have a similar pattern of nerve fiber stimulation to those used in electrical stimulation via acupuncture needles (Bekkering and van Bussel 1998 8:110). Electrical stimulation via an acupuncture needle at low intensity and high frequency (50-100 Hz) will mainly stimulate the large nerve fibers, while high intensity and low frequency (1-3 Hz) will mainly stimulate the small nerve fibers (Bekkering and van Bussel 1998:110).

The Chinese were the first to develop the use of electricity to stimulate acupuncture points (Campbell 1998:31). The method used involved insertion of a needle into the point to be treated. One terminal was attached to this needle by means of a crocodile clip and the other was connected to a neutral electrode (Campbell 1998 3:31). Baldry (1998:106) explains that electroacupuncture (EA) was first introduced to the Western world in1825 when a French physician, Salandiere passed electricity through acupuncture needles. The main purpose for introducing EA to the Western world was for the purpose of controlling surgically-induced pain. It has consequently been used for the suppression of operative pain, post-operative pain and alleviation of neurogenic and musculoskeletal pain.

Baldry (1998:106) defines modern EA as the passing of a low frequency current of between 1-3 Hz through needles inserted either into acupuncture points, trigger points or motor units usually for about 20 minutes.

There is still a great deal of controversy as to the frequency that is most effective when using EA stimulation (MacDonald 1998 7:86). Cheng (1989) believes that low frequency stimulation produces an effect on many of the higher centers of the central nervous system such as the midbrain, the raphe nucleus and various reticular nuclei. These in turn stimulate the inhibiting descending dorso-lateral tracts that close the gate to the incoming nociceptive signals.

As was explained in the previous section (p29), the mechanism by which dry needling decreases pain is also mediated by input into the central nervous system during needle stimulation (Han and Harrison 1997:96). The mechanical effect of the needle penetration and the trauma that this produces results in hyperstimulation analgesia (Baldry 1998:116). However, post-needling tenderness is often experienced in patients who receive dry needling due to hemorrhage at the needling site (Hong 1994:258).

In a study conducted by Thomas and Lundeberg (1994) they compared the effectiveness of 3 types of therapy in 43 lower back pain patients. The patients were randomized into 4 groups, 10 patients remained as controls and the remaining 33 were given 3 initial treatment sessions; one each of manual

acupuncture, low frequency (2Hz) EA and high frequency (30 Hz) EA. The patients then continued throughout the study with the therapy that they preferred in order to eliminate the placebo effect. Each treatment group showed significant reduction in pain with activity at the end of the treatment but only the 2 Hz EA group maintained these improvements at the 6 month follow up.

White et al (1999) developed a therapy known as percutaneous electrical nerve stimulation (PENS). This is an analgesic therapy that combines the advantages of both EA and TENS. He states that PENS is preferable to TENS as it bypasses the resistance of the skin and delivers the electrical stimulus in closer proximity to the nerve endings located in the soft tissue, muscle and periosteum of the involved dermatomes.

In a study which evaluated the therapeutic effectiveness of PENS in 60 patients with lower back pain (LBP) secondary to degenerative disc disease, it was found to be highly effective in the short-term management of this population. The study compared four different types of treatments; PENS, sham PENS, TENS and lower back exercise therapy using a sham-controlled crossover study design. The results of the study showed that PENS was significantly more effective in decreasing pain visual analog scores after each treatment than the sham PENS, TENS and lower back exercise therapies. PENS was significantly more effective than the other three modalities in improving physical activity, quality of sleep, and the sense of patients well-being (White et al 1999).

Cummings (2001) reviewed published literature on the above therapy in order to compare PENS and EA specifically with regard to the stimulator parameters, the selection of points and the reported efficacy. He came to the conclusion that PENS is neither different in principle nor practice from EA. For the purpose of this study the treatment used will be referred to as electrodryneedling. Electrodryneedling involves the passing of a low frequency current through an acupuncture needle to target myofascial trigger points. The source of the current was provided by a TENS unit. As does PENS and EA, electrodryneedling bypasses the cutaneous barrier and delivers the electrical current to a focal point that is directly into the TrP.

To date, no known studies have been conducted to determine the efficacy of electrodryneedling for the treatment of myofascial pain syndrome and it's active trigger points. Baldry (2000 6:83) states that a trial is needed to compare the effectiveness of EA with that of manually inserted dry needles in the treatment of TrPs. He also states that when one compares manual stimulation of needles with electrical stimulation of needles, the stimulation delivered may not be as powerful or prolonged as that provided by adjunctive stimulation of the needle (Baldry 1998:107). It is in the opinion of the author that should this technique be found effective for the treatment of TrPs, it's mechanism of action may be a combination of theories explained in previous sections. The technique may have an added advantage in reducing the effect of post-needling tenderness often

experienced with dry needling alone. These hypotheses provide an open avenue for future research into the treatment of MPS.

2.9 **BRIEF OVERVIEW OF THE TRAPEZIUS MUSCLE**

Trigger points can arise in any muscle group, however the Trapezius muscle appears to be the most frequently cited in clinical settings (Sciotti et al. 2000:259). Gerwin (1994) and Travell, Simons and Simons (1999 1:278) support this statement.

The Tapezius Muscle is a large, flat, triangular muscle which covers the posterior aspect of the neck and trunk. The entire muscle extends from the occiput to T12 and laterally to the clavicle in front and to the spine of the scapula at the back. The muscle is tripartite with upper, middle and lower fibers which function independently. The upper fibers elevate the scapula and rotate the glenoid fossa so that the socket of the shoulder faces upwards. The upper and lower fibers can act together in superior rotation of the scapula. The middle fibers retract the scapula and the lower fibers, when acting alone, depress the scapula and lower the shoulder (Moore 1991 6:530, Travell, Simons and Simons 1999 1:278).

Six TrPs can be located in the Trapezius Muscle which refer pain and a seventh which refers autonomic phenomena. Two TrPs are found in the upper fibers of

the muscle, namely TrP 1 and TrP 2. The middle fibers contain TrP's 5, 6 and 7 and the lower fibers TrP's 3 and 4 (Travell, Simons and Simons 1999 1:278).

According to Travell, Simons and Simons (1999 1:278) the referral for each point is as follows:

TrP 1 : Pain is referred unilaterally along the posterolateral aspect of the neck to the mastoid process. This point can be a major source of tension headaches and temporal headaches. When the pain is intense it can be referred up the head centering in the temple and orbital region. This may include the angle of the jaw. It can also produce symptoms of vertigo and dizziness.

TrP 2 : Pain is experienced posterior to the cervical referred pattern of TrP1.

TrP 3 : The referred pattern starts paraspinally and then extends to the cervical region, adjacent mastoid area and acromion**.** This point can also produce a deep ache over the suprascapular region.

TrP 4 : This point produces a steady burning pain down and medial to the vertebral border of the scapula.

TrP 5 : Superficial burning pain is referred medially between the TrP and the spinous processes of C7 and T1.

TrP 6 : An aching-type pain is referred over the shoulder and acromial process.

TrP 7 : This point produces autonomic phenomena such as pilomotor erection (goose flesh) on the lateral aspect of the arm. This TrP is infrequently found.

2.10 SUMMARY OF THE LITERATURE

The above literature review outlines the high prevalence and common etiological factors of Myofascial Pain Syndrome. From this, one can substantiate the need for ongoing research into the effective management of such patients presenting in a clinical setting. Han and Harrison (1997) believe that more studies that aid in the delineation of the syndrome and the efficacy of treatment are required.

In the management of MPS, it is difficult to reverse the pathophysiology of the trigger point, due to the inconclusive evidence regarding mechanisms of trigger point activity (Lewis and Tehan 1999:40). Therefore, a multidisciplinary approach to management is taken and the choice of treatment made by the clinician is often case dependant and/or preference of the clinician. It is more a clinical decision taken by the clinician and new forms of treatment need to be evaluated in order to effectively treat this condition.

Very little literature exists regarding electrodryneedling for the treatment of MPS. The efficacy of dry needling and TENS have already been proven to be beneficial in the management of MPS but, there are various shortcomings discussed earlier in this chapter of these two treatments. It is pertinent to evaluate the efficacy of electrodryneedling in order to determine its' value in the pool of management protocols that already exist for MPS.

CHAPTER THREE

3.0 MATERIAL AND METHODS OF THE STUDY

3.1 INTRODUCTION

A detailed description of the study design, subjects used, data measurement and procedures followed for the completion of the study will be discussed in this chapter. Methods of statistical analysis used for evaluation of the data collected will also be included.

3.2 STUDY DESIGN AND PROTOCOL

3.2.1 Study Design and Sample Size

The study was a prospective, randomized, comparative clinical trial involving 60 patients divided into 2 groups of 30 individuals each. The sample size was large enough to utilize parametric statistical analysis which is considered more appropriate for the purposes of drawing inferences, in a trial of this nature. Only patients presenting to the Durban Institute of Technologies (D.I.T.) Chiropractic Day Clinic (Durban) were considered for the study. Advertisements for patients suffering from neck and shoulder pain, and/or headaches, were posted around the D.I.T. campus, local sporting institutes and health shops. An advertisement was also placed in the local newspaper and fliers were distributed around local

suburbs. Presentation for the trial therefore occurred initially through self-selection.

3.2.2 Process of Randomization

Each patient was accepted into the study based on the inclusion and exclusion criteria which will be discussed later in the chapter. Once accepted into the study, each patient was randomly assigned to either the dry needling (group A) or the electrodryneedling (group B) groups. Sample random allocation was utilized in order to draw equal samples of 30 subjects.

3.2.3 Standard of Acceptance

On presentation, the patients were only accepted into the study if a positive diagnosis of Myofascial Pain Syndrome of the Trapezius muscle was made by the researcher. In addition, all patients were only accepted into the study based on the following criteria.

Inclusion criteria:

1. Only patients between the ages of 30 and 55 were accepted into the study. This range was used because the peak incidence of MPS is within this age range (Travell, Simons and Simons 1999 1:13). This age group was also used to limit variables associated with advancing age and concomitant age related disease.

2. Both male and female volunteers of all race groups were able to participate in the study.
3. A positive diagnosis of Myofascial Pain Syndrome was made by the presence of active TrP's in the Trapezius muscle. These active TrP's were diagnosed according to various criteria outlined by Travell, Simons and Simons (1999 1:34-35) –
    - Either a history of rapid onset during, or shortly following acute overload stress, or a history of gradual onset with chronic overload of the affected muscle.
    - A pattern of pain referred from the TrP that is characteristic for that of the Trapezius muscle.
    - A taut palpable band in the affected muscle.
    - Intense focal tenderness of the taut band to applied pressure.
    - A local twitch response produced by needling or snapping palpation of the TrP.
    - Reproduction of the characteristic pain patterns by needling or palpating the TrP.
    - Elimination of the clinical presentation by specific TrP therapy.

    For standardization purposes the inclusion criteria were set by the use of the Myofascial Diagnostic Scale (Chettiar 2001) (Appendix A).
4. Patients with concomitant cervical facet syndrome were accepted into the study but were not treated for this.

Exclusion criteria:

1. Due to the use of an electrotherapy modality, TENS, any subject that had a cardiac pacemaker, cardiac arrhythmia or suffered from epilepsy were excluded from the study (Frampton 1998 18:295).
2. Patients who had broken or aesthetic skin in the area to be treated were excluded.
3. Patients who were suffering from local or systemic pathology (e.g. RA, SLE, TB) which may have been contributing to there awareness of MPS in the Trapezius muscle were excluded.
4. Patients with cervical or thoracic radiculopathy, degenerative disc disease, vertebral fractures or dislocations and muscle disorders (Myopathy) confirmed by the clinical history taken were not considered for the study.
5. Patients who were using analgesic, anti-inflammatory or muscle relaxant medication were excluded from the study. However, should the patient have wished to re-enter the study they could after a 48 hour wash-out period.
6. Patients who were receiving other treatment for the condition were not included unless they discontinued the other treatment and entered the study a minimum of one week later.
7. Patients who were using anti-coagulant therapy were excluded.
8. Patients with emotional upset or adverse feelings to the use of needles were not accepted.

It was therefore the intention to identify subjects falling within the selection parameters who were suffering from Myofascial Pain Syndrome without systemic causes, in order to homogenize the population under investigation.

3.3 DETAILED PATIENT PROCEDURE AND INTERVENTIONS

On presentation to the clinic the study criteria and implications of the study for the patient was explained to each patient. The patient received an information sheet outlining the nature and requirements of the study (Appendix B). A full case history (Appendix C), basic physical examination (Appendix D) and regional cervical spine examination (Appendix E), including screening of the Trapezius muscle for active TrP's, was performed by the researcher. Once accepted into the study, the patients were asked to give signed consent (Appendix F), before commencement of the treatments. Each patient received 2 treatments over a period of 1 week. In previous clinical studies conducted by Rowley (2001) and Backland (1998), a similar dosage was used and it was indicated that a greater frequency of intervention was not required if the short-term effects only are to be assessed. The short-term effects of the two treatment modalities were noted.

Those patients assigned to Group A received single dry needle insertion, whilst those assigned to Group B received electrodryneedling to the involved TrP's. The treatment intervention was explained in detail to both groups.

3.3.1 Dry Needling

Patients in the dry needling group were treated according to the fanning method as stated by Rowley (2001) (Plate 1). This was as follows:

- The area to be treated was sterilized with alcohol.
- A 30mm, 0.3G acupuncture needle was inserted into the identified active Trapezius TrP.
- A fanning technique was used whereby the needle was repeatedly withdrawn out of the TrP (not the skin) and redirected to penetrate a new point. This was continued until the twitch response was elicited.
- The needle was no longer manually stimulated and remained in the TrP for duration of 10 minutes.
- The needle was removed and the area cleaned once again with alcohol.

The rationale for this treatment method is also based on the study conducted by Rowley (2001) in which he concluded that there is no significant difference between single dry needle insertion and multiple fanning dry needle insertions. In the authors conclusion he suggested a modified technique such as the above in order to obtain the needle effect and elicit a local twitch response which is essential to improve the efficacy of the treatment (Hong 1994).

3.3.2 Electrodryneedling

The patients in this group were treated according to the electroacupuncture method as stated by Baldry (1998 : 109), but instead of the needle being inserted into an acupuncture point it was inserted into a TrP (Plate 2). This was as follows:

- The area to be treated was sterilized with alcohol.
- A 30mm, 0.3G acupuncture needle was inserted into the identified active Trapezius TrP by using the fanning method (Rowley 2001).
- A twitch response was elicited to standardize the procedure. No further manual stimulation was performed.
- The negative lead from the TENS unit was connected to the inserted needle by means of a crocodile clip.
- The positive electrode from the TENS unit was placed approximately 1 inch distal to the needle by means of a self-adhesive skin electrode.
- The unit was set a frequency of 2 Hz, pulse width 220μs and continuous mode.
- The unit was switched on and intensity turned up to a point just below the patient's threshold of pain.
- The unit was activated for duration of 10 minutes after which it was switched off by reducing the intensity to 0.
- The needle and electrode were removed and the area was cleaned once again with alcohol.

Both groups were treated with the same dosage of 2 treatments in 1 week with at least 2 days break in between treatments. This dosage is similar to the one used by Rowley (2001).

3.4 THE DATA

Both primary and secondary data were incorporated in this study.

3.4.1 The Primary Data

The primary data included information for each patient obtained from the following:

- Case history (Appendix C)
- Physical examination (Appendix D)
- Cervical spine regional examination (Appendix E)
- Subjective Data: Numerical Pain Rating Scale (NRS 101) (Appendix G)
- Objective Data: Pressure threshold algometer readings (Appendix H)

Myofascial Diagnostic Scale (Appendix A)

3.4.2 Secondary Data

Secondary Data was collected from the current related literature found in journal articles, textbooks and the Internet, as well as through personal communications with Chiropractic colleagues.

3.5 METHODS OF MEASUREMENT

The subjective and objective measurements were obtained from each patient at the initial consultation before any treatment had commenced and then again after the first treatment. The same collection of data occurred at the second treatment.

3.5.1 Subjective Data

3.5.1.1 Numerical Pain Rating Scale 101

The NRS 101 (Appendix G) was used to monitor the patients progress, with a decrease in pain indicating improvement. The scale asks the patient to rate his/her pain intensity on the numerical scale from 0-100, where 0=no pain and 100=pain at it's worst.

This questionnaire has been found to be an accurate tool for the measurement of pain intensity in clinical trials (Jensen et al. 1986). Whilst similar in most respects to other pain intensity scales, in a study by the above authors, comparing 6 methods on 75 chronic pain patients, the NRS 101 was deemed the most practical index to use. They came to this conclusion due to the following reasons:

- It is simple to administer and score.
- It can be administered in either the written or verbal form.
- Difficulty with the scale is not associated with patient age.

In a study later conducted by Brievek et al. (2000), the use of various pain rating scales was evaluated by using multiple simultaneous pain assessments of patients in acute pain after oral surgery. In this acute pain model the simulation results demonstrated similar sensitivity between the Visual Analog Scale (VAS) and NRS-101 scales. They concluded that use of either scale could be based on the researcher's subjective choice.

Lundenberg et al. (2001) later criticized the NRS-101 scale, in a study conducted by them, by stating that it is bounded by a fixed end-point and that it's range of measurement may be limited by this however, they still found it to be a reliable measurement for pain.

On completion of the scale, for pain at its least and pain at its worst, the two scores were added together and a mean percentage was obtained for each consultation.

3.5.2 Objective Data

3.5.2.1 Pressure Threshold Algometry

Objective clinical findings were obtained through the use of a pressure algometer. The algometer used was the force dial manufactured by Wagner instruments: P.O. Box 1217, Greenwich CT 06836. The pressure range of the algometer was 11 kilograms. Readings were taken to measure changes in pressure pain threshold for each patient over the course of research treatments

(Appendix H). Fischer (1987:207) refers to pressure threshold as the minimum pressure that induces pain or discomfort. It has been proven that this form of measurement is useful for diagnosis of trigger points and particularly for the assessment of treatment results. It's reliability as a tool for quantifying TrP sensitivity has further been demonstrated in studies by Reeves et al (1986) and Fischer (1996 and 1997).

The procedure as recommended by Fischer (1996) was as follows:

- The dial on the gauge was set to 0.
- The 1 cm rubber disc was placed perpendicular to the skin's surface on the point of maximal tenderness.
- The pressure was increased at a rate of 1 $kg/cm^{-2}/sec$.
- The patient was asked to indicate the point at which pain was first perceived by saying "yes".
- The pressure was stopped at this point by removing the gauge from the skin and the reading was noted.
- The patient was asked to remember this level of pain discomfort and to apply the same criteria to the next measurement. Three repetitive measurements were performed at each active TrP.
- The average values of the three readings were used for data analysis of the pain threshold measurement.

3.6 ETHICAL CONSIDERATIONS

The rights and welfare of the patient were at all times protected. Informed consent (Appendix F) was obtained from each patient before commencement of any treatment. The patient was not coerced into participating in the study as participation was voluntary and did not involve financial benefit. Information was given to the patient verbally and written in the form of an information sheet (Appendix B) in an understandable language. There was no more than a minimal risk for the patients involved in the study and confidentiality was maintained at all times. The patient could withdraw from the study at any stage without any detriment to him/her.

3.7 TREATMENT OF THE DATA

- The subjective data from the NRS 101 questionnaires were expressed as mean percentages for each consultation.
- The objective data received from the algometer readings were expressed in $kg.cm^{-2}$. A single score was obtained for each consultation by determining the mean of the recorded values.
- The subjective and objective data obtained was statistically analyzed.

3.8 STATISTICAL ANALYSIS

The SPSS statistical package (as supplied by SPSS Inc., Marketing Department,444 North Michigan Avenue, Chicago, Illinois, 60611) was used for data entry and analysis.

3.8.1 Methods of Data Analysis

The sample size for each group was n≥30 therefore; parametric tests were used for inter- and intra-group analysis. In this respect inter-group comparison utilized the unpaired T-Test and intra-group comparison utilized the paired T-Test.

3.8.2 Inter-group Comparison using the Unpaired T-Test

The unpaired T-Test was used for inter-group comparison of each of the continuous variables (NRS 101 and Algometer). In each test, the null hypothesis (H_0) states that there is no difference between the two independent samples being compared, with respect to the variable being tested, at the $\alpha=0.05$ level of significance. The alternative hypothesis (H_1) states that there is a difference.

H_0: There is no difference between treatment groups.

H_1: There is a difference between treatment groups.

$\alpha = 0.05$

Decision rule- If $p<\alpha$, reject H_0

If $p\geq\alpha$, accept H_0

Where p is the observed significance level or P-value.

3.8.3 Intra-group Comparison using the Paired t-test

The paired t-test was used for intra-group comparison of the continuous variables (NRS 101 and algometer readings). In each test, the null hypothesis (H_0) stated that there is no improvement between the two related samples being compared, with respect to the variable being tested, at the $\alpha=0.05$ level of significance. The alternative hypothesis (H_1) states that there is an improvement.

H_0: There is no improvement between treatments.

H_1: There is an improvement between treatments.

$\alpha=0.05$ (one-tailed test)

Decision rule for one-tailed test- If $p<\alpha$, reject H_0

If $p\geq\alpha$, accept H_0

Where p=reported P-value / 2 if {H_0 is of form < and z is negative

{H_0 is of form > and z is positive

Or

P=1-(reported P-value / 2) if {H_0 is of form < and z is negative

{H_0 is of form > and z is positive

3.9 FLOW DIAGRAM OF METHODOLOGY

Advertisements for patients suffering with neck and shoulder pain and/or headaches were posted to various areas.

↓

60 patients who met the inclusion and exclusion criteria were accepted into the study.

↓

The subjects were randomly assigned into 2 equal groups of 30.

↓

Each patient received 2 treatments of the intervention pertaining to the group they had been allocated to over a period of 1 week.

Group A = Dry Needling

Group B = Electrodryneedling

↓

Data was collected from the case history, physical examination, cervical spine regional examination, NRS-101 scale and pressure threshold Algometer measurements.

↓

The data was statistically analyzed using the SPSS Statistical package.

Plate 1: Demonstration of patient positioning for dry needling of the active Myofascial TrP in the upper Trapezius muscle, with the patient in the prone position. The arrows indicate the direction of fanning.

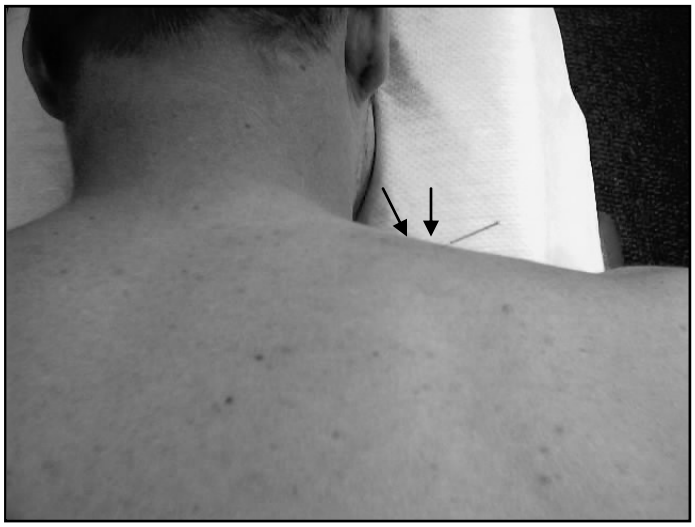
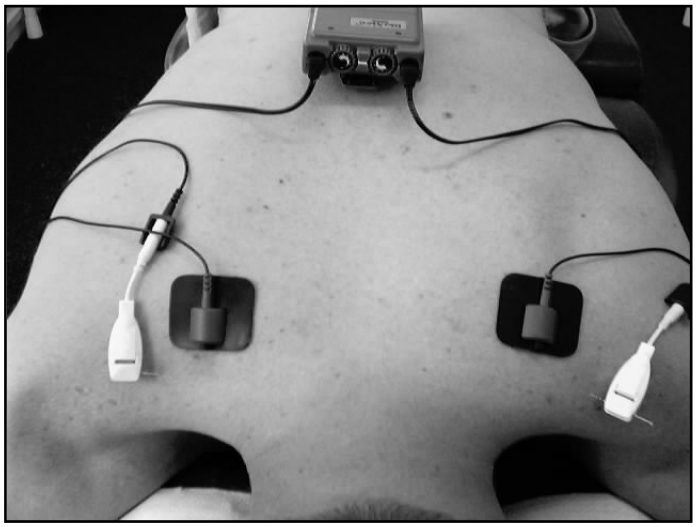


Plate 2: Demonstration of patient positioning for electrodryneedling of the active Myofascial TrP's in the upper Trapezius muscle, with the patient in the prone position.



3.10 CONCLUSION

From this chapter it is evident that the aim of the methodology was to isolate a possible added effect of electrical current (TENS) during the intervention (needling) process.

CHAPTER FOUR

4.0 RESULTS

4.1 INTRODUCTION

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

- Numerical Pain Rating Scale 101 (NRS 101)
- Pressure threshold algometer readings

4.2 CRITERIA GOVERNING THE ADMISSIBILITY OF DATA

Data was collected only from those patients who met the research criteria and who participated for the full duration of the research program. Only objective pressure threshold readings recorded by the researcher were utilized. Only subjective pain perception data that was completed by the patients under supervision of the researcher were utilized.

4.3 TABLES OF DEMOGRAPHIC DATA

Table 1: Gender distribution

Gender	Group A (dry needling)	Group B (electrodryneedling)	Total % of patients
No. of males	5	11	26.7
No. of females	25	19	73.3

Table 2: Age distribution

Age group	Group A (dry needling)	Group B (electrodryneedling)	Total % of patients
30	3	2	8.3
31-35	6	8	23.3
36-40	5	4	15
41-45	4	3	11.7
46-50	7	5	20
51-55	5	8	21.7

Table 3: Race distribution

Race	Group A (Dry Needling)	Group B (electrodryneedling)	Total % of patients
White	19	23	70
Black	1	0	1.7
Indian	9	7	26.6
Mixed race	1	0	1.7

Table 4: Occupation

Occupation	Group A (Dry Needling)	Group B (electrodryneedling)	Total % of patients
Student	1	1	3.3
Housewife	3	6	15
Nurse	4	1	8.3
Secretary/Receptionist	3	1	6.6
Sales	2	3	8.3
Bookkeeper	4	2	10
Driver	2		3.3
Teacher/Tutor	1	1	3.3
Engineer	1		1.7
Hypnotherapist		1	1.7
Unemployed	1	3	6.6
Businessman/woman	2	4	10
Quantity surveyor		1	1.7
Superintendent		1	1.7
Chiropractor		1	1.7
Interior decorator		1	1.7
Architect		1	1.7
Internal broker	1		1.7
Administrator	2		3.3
Customs and excise	1		1.7
Property consultant	1		1.7
Snr revenue clerk	1		1.7
Missionary		1	1.7
Fitter		1	1.7

Table 5: Activity most commonly associated with aggravating the pain

Activity	Group A (Dry needling)	Group B (electrodryneedling)	Total % of patients
Work at desk/ computer	4	7	18.3
Carrying heavy objects	3	1	6.7
Driving	2	3	8.3
Sport		2	3.3
Sleeping posture	3	5	13.3
Sitting posture	2	1	5
Emotional stress	13	9	36.7
Housework	1		1.7
Walking	1		1.7
Dog training	1		1.7
Gardening		2	3.3

4.4 TABLES OF THE STATISTICAL RESULTS

S.D=Standard deviation S.E=Standard error mean

4.4.1 Tables of the statistical results of inter-group comparison for groups A & B, with regards to subjective and objective findings

Table 6: Inter-group comparison between groups A & B, using the Unpaired t-test to analyze results obtained from the NRS 101 questionnaire, at consultations 1 & 2.

NRS 101							
Group A					Group B		
Consultation	mean	S.D.	S.E.	P-value	mean	S.D.	S.E.
Cons. 1	46.05	17.667	3.226	**0.828**	45.167	13.438	2.453
Cons. 2	29.467	19.165	3.499	**0.951**	29.183	16.343	2.984

For consultation 1, the null hypothesis was accepted for the NRS 101 questionnaire, indicating that there was no difference between groups A&B, at the $\alpha = 0.05$ level.

For consultation 2, the null hypothesis was accepted for the NRS 101 questionnaire, indicating that there was no difference between groups A&B, at the $\alpha = 0.05$ level.

Table 7: Inter-group comparison between Groups A&B, using the Unpaired t-test to analyze results obtained from the Algometer readings that were taken from consultations 1&2.

Algometer threshold readings							
Group A					Group B		
Consultation	mean	S.D.	S.E.	P-value	mean	S.D.	S.E.
Before tx1	1.3317	0.3344	0.061	**0.137**	1.71	1.3331	0.2434
After tx1	1.5213	0.2905	0.053	**0.153**	1.8627	1.2566	0.2294
Before tx2	1.539	0.3573	0.0652	**0.096**	2.0697	1.6778	0.3063
After tx2	1.7803	0.3528	0.0644	**0.154**	2.2537	1.758	0.321

For consultation 1, *before* treatment, the null hypothesis was accepted for the algometer readings, indicating that there was no difference between groups A&B, at the $\alpha = 0.05$ level.

For consultation 1, *after* treatment, the null hypothesis was accepted for the algometer readings, indicating that there was no difference between groups A&B, at the $\alpha = 0.05$ level.

For consultation 2, *before* treatment, the null hypothesis was accepted for the algometer readings, indicating that there was no difference between groups A&B, at the $\alpha = 0.05$ level.

For consultation 2, *after* treatment, the null hypothesis was accepted for the algometer readings, indicating that there was no difference between groups A&B, at the $\alpha = 0.05$ level.

4.4.2 Tables of the statistical results of intra-group comparison for groups A & B, with regards to subjective and objective findings

Table 8: Intra group comparison for groups A&B using the Paired-t test to analyze results obtained from the NRS 101 Questionnaire between consultations 1&2.

NRS 101				
	Group A		Group B	
	Cons 1	Cons 2	Cons 1	Cons 2
Mean	46.050	29.467	45.167	29.183
S.D	17.667	19.165	13.438	16.343
S.E	3.226	3.499	2.453	2.984
P-Value	**0.000** (< .001)		**0.000** (< .001)	

For group A, the null hypothesis was rejected for the NRS 101 questionnaire, indicating that there was a statistically significant difference between consultations 1&2, at the $\alpha = 0.05$ level.

For group B, the null hypothesis was rejected for the NRS 101 questionnaire, indicating that there was a statistically significant difference between consultations 1&2, at the $\alpha = 0.05$ level.

Table 9: Intra group comparison for groups A&B using the Paired-t test to analyze results obtained from the Algometer threshold readings taken before and after consultation 1.

ALGOMETER THRESHOLD READINGS				
	Group A		Group B	
	Before Cons 1	After Cons 1	Before Cons 1	After Cons 1
Mean	1.3317	1.5213	1.7100	1.8627
S.D	0.3344	0.2905	1.3331	1.2566
S.E	0.0610	0.0530	0.2434	0.2294
P-Val/2	0.003/2 = 0.0015		0.011/2 = 0.0055	
P-Value	**0.0015**		**0.0055**	

For Group A, the null hypothesis was rejected for the algometer threshold readings, indicating that there was a statistically significant difference between readings taken before and after consultation 1, at the $\alpha = 0.05$ level.

For Group B, the null hypothesis was rejected for the algometer threshold readings, indicating that there was a statistically significant difference between readings taken before and after consultation 1, at the $\alpha = 0.05$ level.

Table 10: Intra group comparison for groups A&B using the Paired-t test to analyze results obtained from the Algometer threshold readings taken before and after consultation 2.

ALGOMETER THRESHOLD READINGS				
	Group A		Group B	
	Before Cons 2	After Cons 2	Before Cons 2	After Cons 2
Mean	1.5390	1.7803	1.7100	1.8627
S.D	0.3573	0.3528	1.3331	1.2566
S.E	0.0652	0.0644	0.2434	0.2294
P-Val/2			0.006/2 = 0.003	
P-Value	**0.000** (< .001)		**0.003**	

For Group A, the null hypothesis was rejected for the algometer threshold readings, indicating that there was a statistically significant difference between readings taken before and after consultation 2, at the $\alpha = 0.05$ level.

For Group B, the null hypothesis was rejected for the algometer threshold readings, indicating that there was a statistically significant difference between readings taken before and after consultation 2, at the $\alpha = 0.05$ level.

Table 11: Intra group comparison for groups A&B using the Paired-t test to analyze results obtained from the Algometer threshold readings taken after consultation 1 and before consultation 2.

ALGOMETER THRESHOLD READINGS				
	Group A		Group B	
	After Cons 1	Before Cons 2	After Cons 1	Before Cons 2
Mean	1.5213	1.5390	1.8627	2.0697
S.D	0.2905	0.3573	1.2566	1.6778
S.E	0.0530	0.0652	0.2294	0.3063
P-Val/2	0.824/2 = 0.412		0.032/2 = 0.016	
P-Value	**0.412**		**0.016**	

For Group A, the null hypothesis was accepted for the algometer threshold readings, indicating that there was no difference between readings taken after consultation 1 and before consultation 2, at the $\alpha = 0.05$ level.

For Group B, the null hypothesis was rejected for the algometer threshold readings, indicating that there was a statistically significant difference between readings taken after consultation 1 and before consultation 2, at the $\alpha = 0.05$ level.

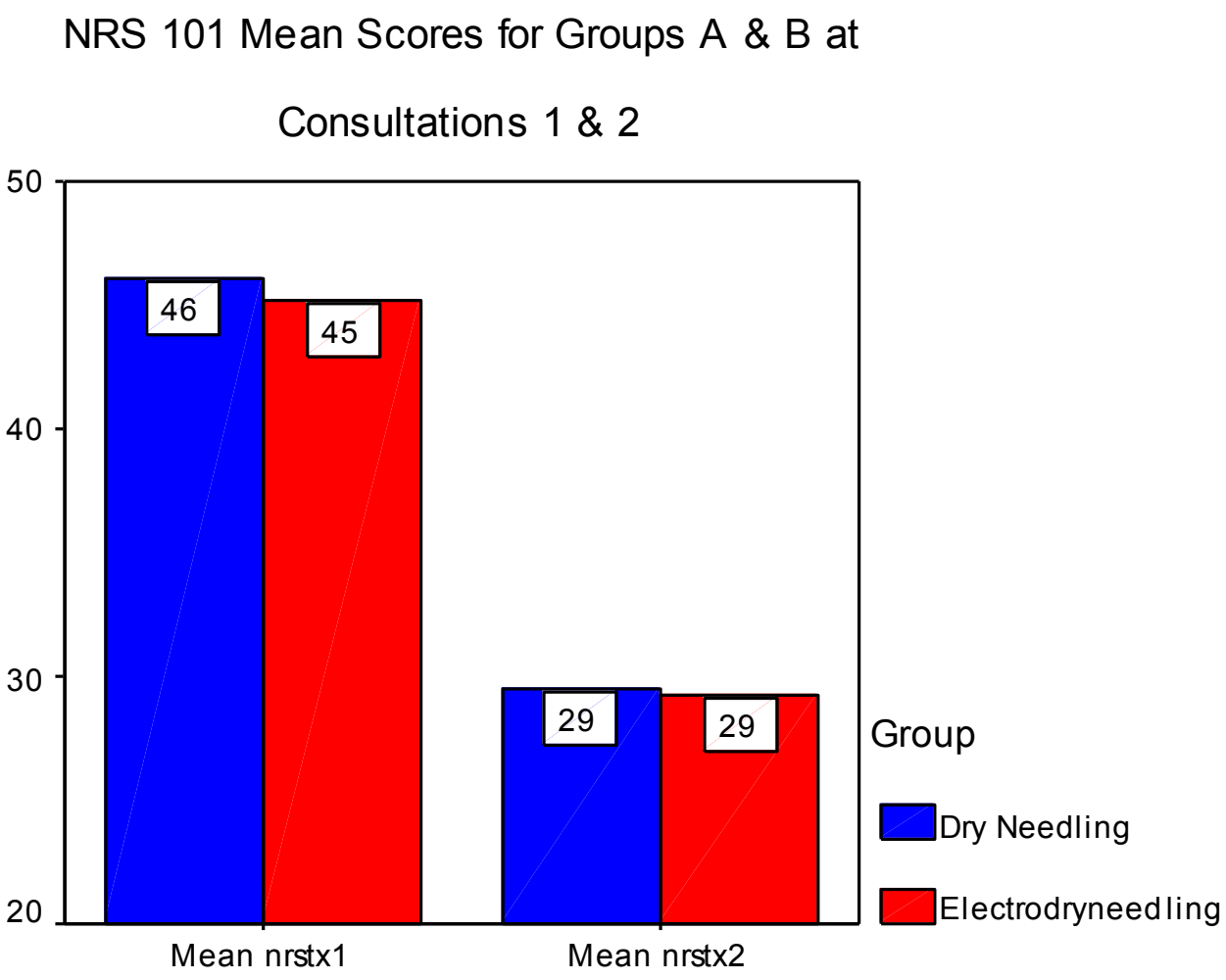
Table 12: Intra group comparison for groups A&B using the Paired-t test to analyze results obtained from the Algometer threshold readings taken before consultation 1 and after consultation 2.

ALGOMETER THRESHOLD READINGS				
	Group A		Group B	
	Before Cons 1	After Cons 2	Before Cons 1	After Cons 2
Mean	1.3317	1.7803	1.7100	2.2537
S.D	0.3344	0.3528	1.3331	1.7580
S.E	0.0610	0.0644	0.2434	0.3210
P-Val/2				
P-Value	**0.000** (<.001)		**0.000** (< .001)	

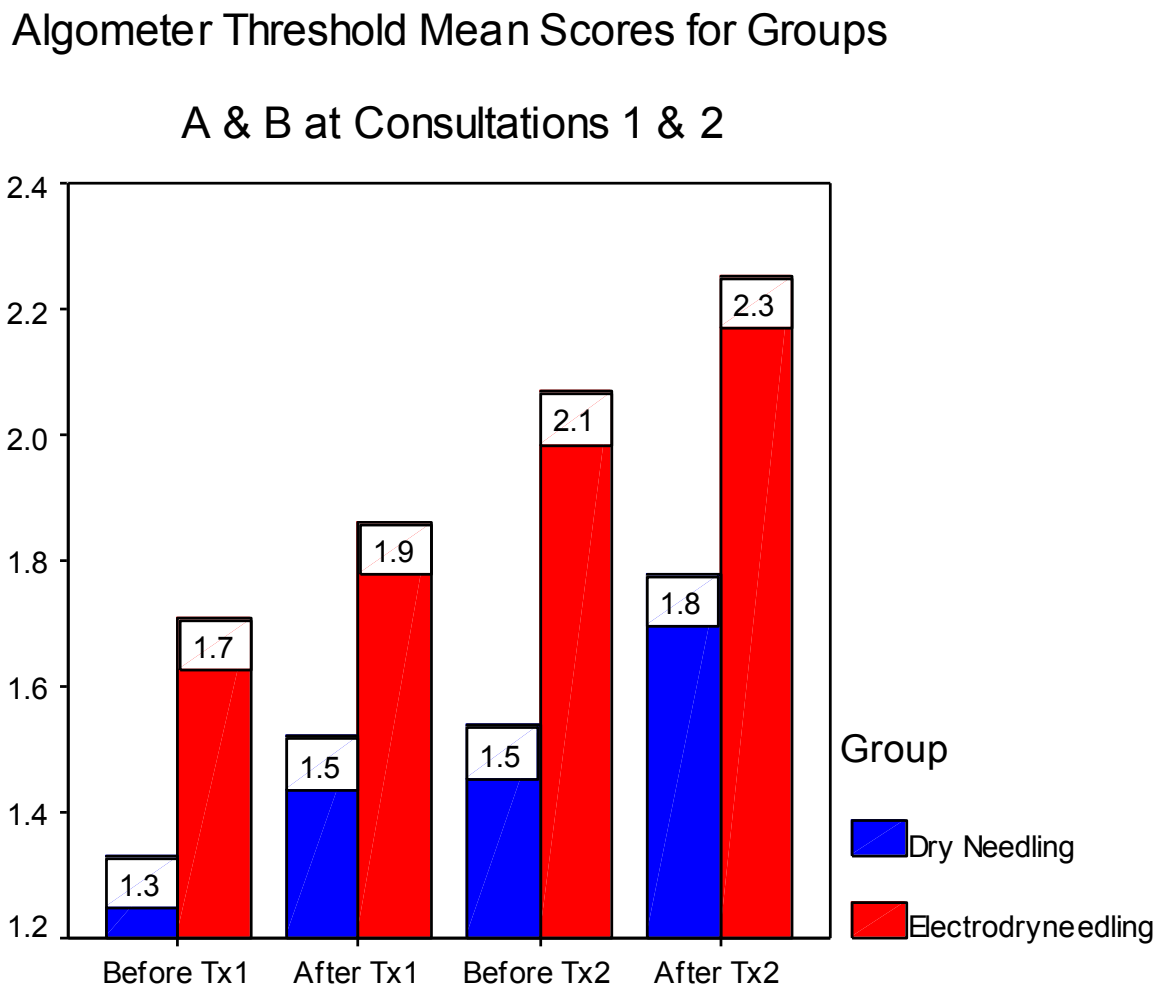
For Group A, the null hypothesis was rejected for the algometer threshold readings, indicating that there was a statistically significant difference between readings taken before consultation 1 and after consultation 2, at the $\alpha = 0.05$ level.

For Group B, the null hypothesis was rejected for the algometer threshold readings, indicating that there was a statistically significant difference between readings taken before consultation 1 and after consultation 2, at the $\alpha = 0.05$ level.

Graph 1: Mean values for groups A&B, NRS 101 scores, at consultations 1&2.



Graph 2: Mean values for groups A&B, Algometer readings, before and after each consultation.



CHAPTER FIVE

5.0 DISCUSSION OF THE RESULTS

5.1. INTRODUCTION

This chapter consists of a discussion of the demographic data and results of the statistical analysis of the subjective and objective data. Discussion of the problems encountered throughout the research program is also included in the chapter.

The results of the statistical analysis are discussed in two parts, namely, subjective results from the NRS 101 questionnaire and objective results from the algometer threshold readings. Each measurement parameter is discussed and involves inter- and intra-group comparisons.

5.1.1 INTER-GROUP COMPARISON

Evaluation of the inter-group results of the first consultation reveals any variance in the subjective and objective mean values between the two groups at the start of the study. Similar evaluation at the second consultation reveals any difference in the mean overall improvement between each group throughout the week treatment period.

5.1.2 INTRA-GROUP COMPARISON

The assessment of the subjective (NRS 101) and objective (algometer threshold) results of before the first to after the second consultation gives an indication of the overall effectiveness of the treatment regime over time. Evaluation of the results of before and after each consultation gives an indication of the initial effectiveness of the treatment regime. Evaluation of results between the first and second consultation gives an indication of the progression of the initial intervention.

5.2 DISCUSSION OF THE DEMOGRAPHIC DATA

The gender distribution of the study is tabulated in table 1 (p56). Of the 60 patients that participated in the research program, 44 were female and 16 were male. The gender distribution within groups A and B were similar and from the above statement it can be seen that there were twice as many females as there were males. This correlates with Han and Harrison's (1997:90) and Travell, Simons and Simon's (1999 1:13) statements that Myofascial Pain Syndrome is more common in females than males.

All patients who were accepted into the study had to be between the ages of 30 and 55. The age distribution of the study can be seen in table 2 (p56). The mean ages for each group were similar. Travell, Simons and Simons (1999 1:13) state

that individuals in their mature years, between 30 and 50 years, are most likely to suffer from the condition. It was found in the study that there was a fairly even distribution of patients within each age group, averaging around 20%. The highest prevalence was seen in the age range between 30 and 35 at 31.6%.

Evaluation of the race groups, seen in table 3 (p56), show the majority of the patients to be of Caucasian (70%) and Indian (26.6%) races respectively. Black and mixed race patients made up 1.7% of the sample group each. This does not give a true representation of the race distribution of the general South African population. It is the opinion of the author that the race group distribution resulted in this way due to the fact that advertisements were posted mainly to Caucasian and Indian suburbs. These were the areas with the highest response rate in previous clinical studies conducted at D.I.T. Advertisements for the study were also posted in the area surrounding the D.I.T. The low response rate of black people to the study may have been due to the age group criteria of the study. Most students fell under this age range and therefore could not participate in the study.

Of those patients accepted into the study the most common occupations, recorded in table 4 (p57), were those of housewife (15%), businessman/woman (10%), nursing (8.3%) and sales (8.3%). Patients that were unemployed made up 6.6% of the sample group. The same percentage of patients worked as secretaries or receptionists. These percentages correlate with the high

percentage (36.7%) of the patients who reported that emotional stress as being the factor that most commonly associated with aggravating their condition (table 5, p58). It also correlates with 18.3% of the patients reporting that working at a desk or in front of a computer aggravated their condition. Poor posture associated with prolonged sitting at a desk may explain the high prevalence of the condition in people whose occupations entail this activity (Han and Harrison 1997: 92). Fricton et al (1985) states that trigger points are most frequently found in the head, neck, shoulders and lower back. This illustrates the important role that posture and ergonomics play in the prevalence of TrP's.

The prevalence of the specific trigger points in the Trapezius muscle was also noted in the study. Trapezius TrP's 1 and 2 were found to be the most prevalent in patients of both groups. TrP's 3, 4 and 5 were seen less commonly and TrP's 6 and 7 were not seen at all. According to Travell, Simons and Simons (1999 1:278) TrP 1 is the most observed of all the myofascial TrP's in the body and TrP 7 is seldom found. A correlation with the above statement was found in this study. Van Aardenne (2002) also reported similar findings in her study recently conducted at D.I.T.

5.3 DISCUSSION OF THE SUBJECTIVE RESULTS

5.3.1 NUMERICAL PAIN RATING SCALE 101

5.3.1.1 INTER-GROUP COMPARISON

Statistical comparison of the two groups, using the Unpaired t-test at consultation 1, revealed no significant difference between groups, indicating minimal variance with regards to NRS 101 data collected at the initial consultation (Table 6). This suggests a similarity between the two groups with respect to pain perception as evaluated by the NRS 101.

Analysis of the data obtained from consultation 2, revealed again no statistically significant difference between the two groups, again indicating minimal variance with regards to NRS 101 data collected at the second consultation. When comparing the two mean values for each group, one can see that a constant improvement was maintained for both groups throughout the treatment period.

5.3.1.2 INTRA-GROUP COMPARISON

Evaluation of the results of intra-group comparison using the Paired t-test for the NRS 101 scores revealed a statistically significant improvement between consultations 1 and 2 for both groups A and B (Table 8).

These findings suggest that both the dry needling and electrodryneedling groups showed a significant reduction in pain intensity over the research program.

5.4 DISCUSSION OF THE OBJECTIVE RESULTS

5.4.1 ALGOMETER THRESHOLD READINGS

Evaluation of the algometer threshold mean scores for groups A and B (Graph 2) showed an unusual pattern of response as there is usually a decrease in pressure pain tolerance noted directly after needling. This type of response was noted in Van Aardenne's (2002) study conducted at the D.I.T. The response shown in this study was that of an increase in pressure pain tolerance in both groups directly after needling.

5.4.1.1 INTER-GROUP COMPARISON

Statistical comparison of groups A and B using the Unpaired t-test at consultation 1, before treatment, revealed no significant difference between the groups, which implied that there was minimal variance between groups with regards to the algometric threshold readings collected before any treatment commenced (Table 7). Comparison of results taken directly after consultation 1, revealed no significant difference between the groups. This implied that there was again minimal variance between the two groups even after treatment.

Similar comparisons made before and after consultation 2 revealed that there was no statistical difference between the groups following the second treatment. This again indicated minimal variance with regards to the algometric

measurements taken. Although, there was no significant difference shown between the two groups at the beginning of the second treatment, the p-value (0.096) was at a higher level of significance than after the second treatment. The difference was not great enough to translate into a statistically significant difference between the two groups however, the mean pressure threshold values appeared higher in Group B. This may be viewed as indirect evidence that Group B experienced less post needling soreness. A larger sample size may have rendered a statistically significant difference between the two groups. When comparing the mean values, before and after each consultation, one can see that a constant improvement was maintained for both groups throughout the treatment period.

5.4.1.2 INTRA-GROUP COMPARISON

Evaluation of the results of the Paired t-test on the algometric threshold measurements, taken before and after the first and second consultations separately, revealed a statistically significant improvement for the dry needling group. Similar evaluation for the electrodryneedling group also revealed a statistically significant improvement before and after each consultation (Tables 9 and 10).

Evaluation of the results taken after consultation 1 and before consultation 2 (i.e. the rest period), revealed a statistically significant improvement between this time period for the electrodryneedling group. Similar evaluation for the dry needling

group revealed that there was no improvement for this time period (Table 11). This indicates a significant short-term change for group B. Again, this represents indirect evidence of increased pain threshold which may be viewed as evidence of less post needling soreness. This is also demonstrated in a study by Hong (1994) when comparing pain intensity immediately after the first and second treatments of dry needling in patients where a twitch response was elicited. Post needling soreness usually develops 2-8 hours after the needling procedure and is described as a pain different from the patients original myofascial pain (Hong 1994). Patients in Group B, who received the electrodryneedling procedure, responded better clinically during the rest period in regards to an increase in pain tolerance over the trigger points. It is the opinion of the author that electrodryneedling decreased the level of post needling soreness due to various reasons. As with the dry needling group, electrodryneedling not only produced hyperstimulation analgesia, it also produced effects such as the release of endogenous opiates, modulation of autonomic responses and partial block of the c-fibres from the electrical stimulation itself. This leads to immediate relief and less post needling soreness experienced in the electrodryneedling group.

Evaluation of the results taken before consultation 1 and after consultation 2 revealed a statistically significant improvement over the entire treatment period for the dry needling group. Similar evaluation of results for the electrodryneedling group also revealed a statistically significant improvement over the entire treatment period (Table 12).

These findings suggest that both groups showed an increase in pressure threshold levels over the entire research program and that the rate of improvement was the same for both. There was however, a difference between the groups at the start of the second treatment and this suggests that the electrodryneedling showed a more rapid response after the rest period due to less post needling soreness experienced by the group.

5.5 SUMMARY OF THE CLINICAL FINDINGS

The hypotheses that electrodryneedling would be more effective than dry needle insertion alone in the treatment of Myofascial Pain Syndrome in terms of subjective pain perception (hypothesis 1) and pain threshold algometer (hypothesis 2) were both rejected by this study.

Inter-group analysis of the data obtained from the electrodryneedling and dry needling groups revealed no significant differences between the groups at the end of the research in terms of the NRS 101 questionnaire and algometric measurements. These results suggest that the electrodryneedling group responded as favorably as the dry needling group. This is supported by the constant improvement seen in both groups with regards to the mean values for the NRS 101 questionnaire and algometric readings. Although there was no significant difference found between the two groups in terms of algometric

threshold measurements before treatment two, there was a higher level of significance noted according to the p-value. This could be viewed as less post needling soreness experienced by group B as the mean values for the pressure threshold recorded were higher in this group.

Intra-group analysis of the data obtained from the electrodryneedling group revealed significant improvements between consultations 1&2 in terms of subjective findings. In terms of objective findings, analysis of the data obtained revealed significant improvements for the time periods before and after each consultation, before consultation 1 and after consultation 2 (overall) and after consultation 1 to the beginning of consultation 2 (rest period).

Similar results were obtained from the dry needling group, in terms of both subjective and objective data. This indicates that both groups responded well to treatment however, there was one difference in the dry needling group. The difference being, that there was no significant improvement in the break after consultation 1 to the beginning of consultation 2.

It is the opinion of the author that the effect of post-needling tenderness contributed to this result. The electrodryneedling group showed a significant improvement during this break and suggests that this group was not affected by post-needling tenderness. There is definitely cause to think that post needling soreness can be reduced by adding the electrical stimulation. It is also in the

author's opinion that post-needling tenderness is usually experienced to a greater degree after the first treatment of dry needling than any other successive treatment.

5.6 PROBLEMS ENCOUNTERED WITH THE DATA

5.6.1 THE SUBJECTIVE DATA

The NRS-101 scale is a questionnaire used to monitor levels of pain perception and quality experienced by the patients. The scale did not allow the researcher to specifically record measurements for post needling soreness and therefore the patients perception of this remained unrecorded. Another problem encountered by the researcher in the study was the inability of some of the patients to understand the concept of the NRS 101 questionnaire which may have affected their response. The researcher had to explain this concept to the best of her ability without influencing the patient's own feelings on their level of pain. The researcher also believed that some patients introduced bias into the study by recording improvements beyond what they actually felt in order to please her. The NRS 101 scale did not reveal any significant inter group differences which may be due to patients recording a similar reading to that of their first treatment or the tendency to deviate from the extremes.

5.6.2 THE OBJECTIVE DATA

The algometer was a fairly reliable tool to use however; a few problems were encountered by the researcher when using it. The apparatus sensitivity, which is operator dependant, is strongly influenced by the force and speed the examiner uses when applying pressure to the tender TrP's. It was felt that some patient's responded to a lower pressure in order to prevent themselves from feeling the pain. Some patients, on the other hand, responded too late after the point where they first perceived pain as they did not understand the instruction clearly. It was felt that certain factors such as relocation of the exact same TrP at the second consultation and the direction of the pressure applied through the shaft of the algometer could affect the readings as well. In future research, it is suggested that the patient is marked before the first treatment with Henna, in order to relocate the exact point of the original TrP at the next treatment.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

Evaluation of the statistical results showed that both the dry needling and electrodryneedling groups responded favorably in terms of subjective and objective findings.

Inter-group comparison between the dry needling and electrodryneedling groups revealed no significant differences with regards to the response to treatment in terms of the NRS 101 scale. A constant, similar improvement for both groups was revealed throughout the treatment period.

However, objectively, even though there was still no significant difference between the groups at various stages during treatment, there was a greater significance value obtained before the second treatment when comparing the two groups. This indicated that there was a higher level of significance showing that Group B may have experienced less post needling soreness during the rest period due to higher mean pressure threshold values recorded in that group.

Different results were obtained from the groups with regards to intra-group analysis of the break between treatment sessions. In terms of pressure threshold

readings, analysis of the data measured before and after each consultation and before consultation 1 and after consultation 2 (overall), revealed improvements in both groups. This indicates that both groups responded well to treatment. There was, as mentioned previously, a difference noted between the groups with regards to the break between consultation 1 and consultation 2. There was no significant improvement in the dry needling group but, there was improvement noted in the electrodryneedling group. It is the opinion of the author that the effect of post-needling tenderness contributed to this result. The electrodryneedling group showed a significant improvement during this break and suggests that this group was not as affected by post-needling tenderness.

From the results it appears that both treatment groups, dry needling (Group A) and electrodryneedling (Group B) have been shown to be effective in the treatment of Myofascial Pain Syndrome with regards to subjective and objective measures in the short-term. Statistical analysis showed that Group A did not show a significant difference in improvement during the rest period with regards to intra-group analysis of algometer readings however, Group B did. This can be interpreted as less post needling soreness experienced by this group during this period, thus indicating the positive effect of the electrodryneedling in terms of objective measures. The placebo effect also needs to be taken into consideration as a factor which could have contributed to the positive response of the electrodryneedling group.

It is in the opinion of the author that electrodryneedling should be used when treating Myofascial Pain Syndrome as there is a more consistent improvement when using this modality as the patient experiences minimal post needling tenderness. Electrodryneedling utilizes both the positive effects of dry needling and electrical stimulation when used as a treatment modality for MPS. From this study it can be seen that electrodryneedling appears to reduce the effect of post needling tenderness, which appears to be a drawback when using dry needling alone. Although it was not specifically tested in this study, dry needling contributes to post needling tenderness and it is important to get patients better in the shortest possible time therefore, Electrodryneedling may consequently aid in achieving a more promising outcome when dealing with MPS.

6.2 RECOMMENDATIONS

It is suggested that further studies in this field use a double blind procedure. This could be administered by having an unbiased independent observer administer both treatment interventions. The researcher, who is unaware of the treatment administered, can then collect the measurements from the patients. This will aid in reducing researcher bias toward a favored treatment protocol.

Stricter inclusion criteria with regards to sex, onset and duration of the pain should be taken into consideration. This will produce a higher compatibility between groups, which according to Haldeman (1992:418), allows for a more valid trial conclusion. A limited variation in patient occupation, hobbies and

sporting activities with respect to patient selection may also help to increase the strength of the study.

It is suggested that further studies in this field be directed at obtaining epidemiological data on the prevalence and incidence of MPS in the black South African population as this type of information is non-existent.

It is common clinical practice to advise the patients on ergonomics and stretching exercises. This advice was not given until the study was complete. This does not reflect true clinical practice and future researchers should take this into consideration when interpreting results from this clinical trial.

With regards to data measurement, it is suggested by the researcher, that a questionnaire that is specifically directed at post needling soreness be used in conjunction with the NRS 101 scale. This will allow the researcher to obtain important data in order to determine the significance of post needling soreness in other clinical trials similar to this one.

From the data, it is evident that electrodryneedling is as effective as dry needling in treating Myofascial Pain Syndrome. Further studies may be conducted to assess the relative effectiveness of this modality compared to other modalities, other than dry needling, in the treatment of MPS. However, before these comparisons can be made, a study should be carried out to evaluate the most

effective treatment time and number of treatments needed to treat patients with this condition using modality. The most effective frequency and intensity settings should also be evaluated.

It is recommended that one month, three month and/or six month follow up consultations be used in further studies to obtain data on the long term effects of this technique. Follow-up consultations were not used in this study; therefore, conclusions could only be made regarding the short term effects of dry needling and electrodryneedling.

Although the sample size for this study was large enough to use parametric statistical analysis, a larger sample size would have yielded more accurate results.

LIST OF REFERENCES

Anderson, M. 1997. The Relative Effectiveness of Cryotherapy versus Moist Heat in the Treatment of Myofasccial Trigger Points. M.Deg.Tech: Chiropractic dissertation, Technikon Natal, Durban.

Auleceims, L.M. 1995. Myofascial Pain Syndrome: A multidisciplinary approach. Nurse Practitioner, 20 (4): 18-24

Backland, G.C. 1998. The Relative Effectiveness of Stretch and Spray to Stretch and Ice in the Treatment of Myofascial Trigger Points. M.Deg.Tech: Chiropractic dissertation, Technikon Natal, Durban.

Baldry, P.E. 1998. Acupuncture, Trigger Points and Musculoskeletal Pain, 2nd ed. UK; Churchill Livingston, New York. 295p. ISBN 0-443-04580-1.

Bekkering, R. and van Bussel, R. 1998. Segmental Acupuncture. In: Medical Acupuncture : A Western Scientific Approach. Churchill Livingston. ISBN 0443 049769. Filshie, J. and White, A. (ed.s.).

Borg-Stein, J. 1997. Trigger points and tender points. Physical Medicine and Rehabilitation, 22(2):305-322.

Brievek, E.K., Bjornsson, G.A. and Skovlund, E. 2000. A Comparison of Pain Rating Scales by Sampling from Clinical Trial Data. Clinical Journal of Pain, 17(1):104-105.

Broome, R. 1996. The Therapeutic Efficacy of Invasive Needling Techniques in the Management of Myofascial Pain and Dysfunction Syndrome. M.Deg.Tech: Chiropractic dissertation, Technikon Natal, Durban.

Bruce, E. 1995. Myofascial Pain Syndrome. American Association of Occupational Health Nurse, 43 (9): 469-473.

Campbell, A. 1998. Methods of Acupuncture. In: Medical Acupuncture : A Western Scientific Approach. Churchill Livingston.
ISBN 0443 049769. Filshie, J. and White, A. (ed.s.).

Chaiamnuay, P., Darmawan, J., Muirden, K.D. and Assawatanabodee, P. 1998. Epidemiology of Rheumatic disease in Rural Thailand : a WHO-ILAR COPCORD study. Community orientated program for the control of rheumatic disease. Journal of Rheumatology, 25 (7): 1382-7.

Chan Gunn, C. 1989. Treating Myofascial Pain: intramuscular stimulation (IMS) for Myofascial Pain Syndrome. University of Washington, Seattle.

Cheng, A.C.K., 1989. Scientific Evaluation of Acupuncture. In: Acupuncture, Trigger Points and Musculoskeletal Pain. Churchill Livingston. ISBN 0-443-03991-7. Baldry, P.E.

Chettiar, A. 2001. The Therapeutic Efficacy of Action Potential Therapy in the Treatment of Myofascial Pain Syndrome. M.Deg.Tech: Chiropractic dissertation, Technikon Natal, Durban.

Christie, K.R. 1995. Study into the treatment of Active Myofascial Trigger Points using Interferential Current as an Alternative to Dry Needling Agitation. M.Dip.Tech: Chiropractic dissertation, Technikon Natal, Durban.

Cohen, J.H. and Gibbons, R.W. 1998. Raymond Nimmo and the Evolution of Trigger Point Therapy, 1929-1986. Journal of Manipulative and Physiologic Therapeutics, 21(3): 167-172.

Cummings, M. 2001. Percutaneous electrical nerve stimulation – electroacupuncture by another name? A comparative review. Acupuncture Medicine, 19(1): 32-35.

Esenyul, M., Caglar, N. and Aldemir, T. 2000. Treatment of Myofascial Pain. American Journal of Physical Medicine and Rehabilitation, 79(1): 48-52.

Fischer, A.A. 1987. Pressure Threshold Measurement for Diagnosis of Myofascial Pain and Evaluation of Treatment Results. The Clinical Journal of Pain, 2: 207-214.

Fischer, A.A. 1996. Pressure Threshold Meter : It's use for Quantification of Tender Spots. Archives of Physical Medicine and Rehabilitation, 67:36-38.

Fischer, A.A. 1997. Pressure Threshold Measurement for Diagnosis of Myofascial Pain and Evaluation of Treatment Results. The Clinical Journal of Pain, 2(4):207-214.

Fishbain, D.A., Goldberg, M., Meagher, B., Steele, R. and Rosomoff, H. 1986. Male and female chronic pain patients categorized by DSM III psychiatric diagnostic criteria. Pain, 26: 181-197.

Frampton, V. 1998. Electrical Stimulation of Nerve and Muscle. In: Clayton's Electrotherapy : Theory and Practice. Ninth edition. Balliere Tindall. ISBN 0-7020-1100-2. Forster, A. and Palastanga, N.

Fricton, J.R., Kroening, R., Haley, D. and Siegert, R et. al. 1985. Myofascial Pain Syndrome of the Head and Neck: A review of clinical characteristics of 164 patients. Oral Surgery, 60: 615-623.

Fricton, J.R. 1990. Myofascial Pain Syndrome. Characteristics and Epidemiology. Advances on Pain Research and Therapy, 17:43-106.

Fricton, J.R. 1994. Myofascial Pain. in Coopman, W.J. Clinical Rheumatology. P857-880. Philadelphia: Balliere 1637p. ISBN 0-7216-1451-5.

Gam, A.N., Warming, S., Larson, L.H., et. al. 1998. Treatment of Myofascial Trigger Points with Ultrasound combined with Massage and Exercise – a Randomized Controlled Trial. Pain, 77(1): 73-79.

Garvey, T.A., Marks, M.R. and Wiesel, S.W. 1989. A prospective, randomized, double blind evaluation of trigger point injection therapy for low back pain. Spine, 14: 962-964.

Gatterman, M.I. and Goe, D.R. 1990. Chiropractic Management of Spine Related Disorders, USA, Williams and Wilkins. 473p. ISBN 0-6830-3438.

Gerwyn, R.D. 1994. Neurobiology of the Myofascial Trigger Point. Ballieres Clinical Rheumatology, 8(4):747-762.

Gerwin, R.D. 1995. A Study of 96 subjects examined both for Fibromyalgia and Myofascial Pain. Journal of Musculoskeletal Pain, 3:121.

Gerwin, R.D. and Daranleau, D. 1997. Ultrasound Identification of the Trigger Point. Muscle Nerve, 20: 767-768.

Gerwin, R.D., Steven, S., Hong, C.Z., Hubbard, D. and Gerwitz, R. 1997. Interrater Reliability in Myofascial Trigger Point Examination. Pain, 69: 65-73.

Graaf-Radford, S.B., Reeves, I.L., Baker, R.L., Chiu, D. 1989. Effects of Transcutaneous Electrical Nerve Stimulation on Myofascial Pain and Trigger Point Sensitivity. Pain, 37: 1-5.

Haldeman, S. 1992. Principles and Practice of Chiropractic. Second edition. Appleton and Lange. Division of Prentice Hall. ISBN 0-8385-6360-0.

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

Hanten, W.P., Olsen, S.L., Butts, N.L., Nowicki, A.L. 2000. Effectiveness of a home program of ischemic pressure followed by sustained stretch for treatment of Myofascial Trigger Points. Physical Therapy, 80(10): 997-1003.

Hong, C.Z. 1994. Lidocaine injection versus dry needling to Myofascial Trigger Point: the importance of the Local Twitch Response. American Journal of Physical Medicine and Rehabilitation, 73(4): 256-263.

Hong, C.Z. and Simons, D.G. 1998. Pathophysiologic Mechanisms of Myofascial Trigger Points. Archives of Physical Medicine and Rehabilitation, 79: 863-870.

Hong, C.Z., Chen, Y.C., Pon, C.H. and Yu, J. 1993. Immediate Effects of various physical modalities on Pain Threshold of an Active Myofascial Trigger Point. Journal of Musculoskeletal Pain, 1: 37-53.

Hubbard, D.R. and Berkoff, G.M. 1993. Myofascial Trigger Points show spontaneous needle EMG activity. Spine, 18: 1803-1807.

Hutchings, T.A. 1998. The treatment of Myofascial Pain Syndrome using Trancutaneous Electrical Nerve Stimulation: a comparison of two types of electrode placements. M.Deg.Tech: Chiropractic dissertation, Technikon Natal, Durban.

Jaeger, B. and Reeves, J.L. 1986. Quantification of changes in Myofascial Trigger Point sensitivity with the pressure algometer following passive stretch. Pain, 27: 203-210.

Jansen, C. 1998. The Prevalence and Types of Headaches in Afrikaans speaking High School Children in the Greater Durban area. M.Deg.Tech: Chiropractic dissertation, Technikon Natal, Durban.

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

Jones, A.D. 1994. The Effectiveness of Myofascial Trigger Point Therapy on Myofascial Pain Syndrome Trigger Points. M. Dip. Tech: Chiropractic dissertation, Technikon Natal, Durban.

Lee, P. 1994. The Economic Impact of Musculoskeletal Disorders. Quality of Life Research, 3(1): 85-91.

Lewis, J. and Tehan, P. 1999. A blinded pilot study investigating the use of diagnostic ultrasound for detecting active Myofascial Trigger Points. Pain, 79: 39-44.

Lewit, K. 1979. The Needle Effect in the Relief of Myofascial Pain. Pain, 6: 83-90.

Liggins, C. 1997. Myofascial Pain Syndromes, Trigger Point Therapy and Dry Needling Acupuncture. In: Acupuncture and Related Techniques in Physical Therapy. Churchill Livingston. ISBN 0 443 05593 9. Hopwood, V., Lovesey, M., Mokone, S. (ed.s.).

Lundeberg, T., Lund, I., Dahlin, L., Borg, E., Gustafsson, C., Sandin, L., Rosen, A., Kowalski, J. and Eriksson, S.V. 2001. Reliability and Responsiveness of three different Pain Assessments. Journal of Rehabilitative Medicine, 33(6):279-283.

MacDonald, A.J.R. 1980. Abnormally tender muscle regions and associated painful movements. Pain, 8: 197-205.

McClafflin, R. 1994. Myofascial Pain Syndrome. Postgraduate Medicine, 96(2): 60-73.

Melzack, R. and Wall, P. 1988. The Challenge of Pain. 2nd ed. London. Penguin Books. ISBN 0-1401-5660-7.

Moore, K.L. 1991. Clinically Orientated Anatomy. 3rd ed. Williams and Wilkins, Baltimore. ISBN 0-683-06133-X.

Rachlin, E.S. 1994. Myofascial Pain and Fibromyalgia: Trigger Point Management. 11830 Westline Industrial Drive, St. Louis, Missouri. Mosby. ISBN 0-8385-0570-8.

Reeves, J.L., Jaeger, B., Graff-Radford, S.B. 1986. Reliability of the pressure algometer as a measure of myofascial trigger point sensitivity. Pain, 24(3): 313-321.

Rowley, N.E. 2001. The Relative Effectiveness of a Single Dry Needle Insertion compared to Multiple Fanning Dry Needle Insertion in the treatment of Myofasciitis in the Cervical and Upper Thoracic Spine. M.Deg.Tech: Chiropractic dissertation, Technikon Natal, Durban.

Sandman, K.B. 1981. Myofascial Pain Syndromes: Their Mechanism, Diagnosis and Treatment. Journal of Manipulative and Physiologic Therapeutics, 4(3):135-140.

Schneider, M.J. 1995. Tender Points / Fibromyalgia vs. Trigger Points / Myofascial Pain Syndrome: A Need for Clarity in the Differential Diagnosis. Journal of Manipulative and Physiologic Therapeutics, 18(6): 1-8.

Schneider, M.J. 1996. Chiropractic Management of Myofascial and Muscular Disorders. In: Advances in Chiropractic: volume 3. St. Louis, Missouri: Mosby-Year Book Inc. 459. ISBN 0-8151-5308-2. Lawrence, D.J., Cassidy, J.D., McGregor, M., Meeker, W.C. and Vernon, H.T. (ed.s).

Sciotti, V.M., Mittack, V.L., Di Marco, L., Ford, L.M., Plezbert, J., Santipadri, E., Wigglesworth, J., Ball, K. 2001. Clinical Precision of Myofascial Trigger Point Location in the Trapezius Muscle. Pain, 93: 259-266.

Simons, D.G. 1991. Muscle Pain Syndromes. Journal of Manual Medicine, 6:3-23.

Simons, D.G. 1999. Diagnostic Criteria of Myofascial Pain Caused by Trigger Points. Journal of Musculoskeletal Pain, 7(1,2) : 111-120.

Simons, D.G. and Stalov, W.C. 1976. Microscopic Features and Transient Contraction of Palpable Bands in the Canine Muscle. Americal Journal of Physical Medicine, 55: 65-88.

Simons, D.G. and Dexter, J.R. 1995. Comparison of Local Twitch Responses elicited by Palpation and Needling of Myofascial Trigger Points. Journal of Musculoskeletal Pain, 3(1): 35-98.

Sola, A.E. 1984. Treatment of Myofascial Pain Syndromes. Advances in Pain Research and Therapy, 7:467-485.

Sola, A.E., Rodenberger, M.L. and Gettys, B.B. 1955. Incidence of Hypersensitive areas in Posterior Shoulder Muscles. American Journal of Physical Medicine, 34: 585-590.

Thomas, M. and Lundeberg, T. 1994. Importance of Modes of Acupuncture in the Treatment of chronic Nociceptive Low Back Pain. Acta Anaesthesiology Scandinavia, 38(1):63-69.

Travell, J.G., Simons, D.G. and Simons, L.S. 1999. Travell amd Simons' Myofascial Pain and Dysfunction: The Trigger Point Manual: Volume 1, Upper Half of the body. Second edition. Baltimore, Maryland: Williams and Wilkins. 2 vols. ISBN 0-683-08366-X.

Tschopp, K.P. and Gysin, C. 1996. Local Injection Therapy in 107 Patients with Myofascial Pain Syndrome of the Head and Neck. Ornirhinolaryngology, 58: 306-310.

Van Aardenne, S. 2002. The Efficacy of Tissue Salts, as an adjunct to Dry Needling, in the Treatment of Myofascial Pain Syndrome. M.Deg.Tech: Chiropractic dissertation, Technikon Natal, Durban.

White, P.F., Phillips, J., Proctor, T.J., Craig, W.F. 1999. Percutaneous Electrical Nerve Stimulation (PENS): A promising alternative medicine approach to pain management. American Pain Society, Volume 9, number 2.

Zohn, D.A. 1988. Musculoskeletal Pain: Diagnosis and Physical Treatment.

Second edition. Little, Brown and Company Boston/Toronto.

ISBN 0-316-98897-9.

Appendix A

Myofascial Diagnostic Scale

Patient's name: Muscle:

Signs:

1) Soft tissue tenderness

Grade		
0	No tenderness	0
I	Tenderness to palpation WITHOUT grimace or flinch	1
ii	Tenderness WITH grimace and/or flinch to palpation	2
iii	Tenderness with WITHDRAWAL (+ "Jump Sign")	
iv	Withdrawal (+ "Jump Sign") To non-noxious stimuli (ie. Superficial Palpation, pin prick, gentle percussion)	3 4

2) Snapping palpation of the trigger point evokes a local twitch response. 4

3) The trigger point is found in a palpable taut band. 4

4) Moderate, sustained pressure on the trigger point causes or intensifies pain in the reference zone. 5

Total

Appendix B

Letter to patient

Dear Patient

Welcome to Technikon Natal Chiropractic Day Clinic. You are invited to participate in a research study to compare the relative effectiveness of electrodryneedling to that of a single dry needle insertion in the treatment of Trapezius muscle trigger points. The study conducted will be a comparative clinical trial.

Participants will be randomly assigned to one of two groups by selecting a piece of paper out of a box with either the word electrodryneedling or dry needling on it. One group will receive the electrodryneedling technique and the other group will receive the dry needling technique. Each group will receive the respective treatments for myofascial pain syndrome over one week. This will include two treatments in the week with two days break in between. You will receive the same treatment at each visit. The treatment consists of needling active trigger points or hyperirritable spots that are found within the muscle. Dry needling is where the muscle is needled without the injection of any solution into the muscle, hence the term "dry" needling. Electroneedling includes the same process but with the addition of an electric current generated by a TENS unit being passed through the needle.

Patients who suffer from any contra-indications to the dry needling or electroneedling process will be excluded from the study. Contraindications include anticoagulant therapy, local skin infection and malignancies. Due to the use of an electrotherapy modality, TENS, any subjects with a cardiac pacemaker, cardiac arrhythmia, or epilepsy will be excluded from the study. The needling techniques may aggravate these conditions, and therefore pose as a risk factor in the treatment given. The treatment site is swabbed with 70% alcohol prior to the insertion of the needle thus sterilising the area and a new needle is used with each patient and treatment, therefore eliminating the chance of any infection. The needling process may initially aggravate any signs and symptoms experienced with active trigger points, but this will be eliminated with continued treatment. Patients may experience an increase in muscle tenderness, spasm or a haematoma (small area of bruising) may form at the site of needle penetration. None of the mentioned signs and symptoms pose as risk factors in the participants overall health. The needle used is a 30mm 0.3G acupuncture needle and is inserted superficially, along the angle of the rib and directed towards the trigger point. This rules out any chance of the needle penetrating any internal structures. I am currently a 6th year chiropractic intern and therefore have had 2

years clinical experience with dry needling. All treatment is done under the supervision of a qualified clinician. The process is performed with great care, experience and confidence, and patients have no need to worry about the needling process.

Treatment will be free of charge and will be performed under supervision of a qualified chiropractor.

Your involvement is voluntary and confidentiality will be ensured. Should you require any further information pertaining to this study, please do not hesitate to ask. You are free to withdraw from the study at any time without having to give any reason and without affecting your future health care. You are asked for the duration of the study to avoid the use of any pain relieving medication or other forms of treatment for the condition, including chiropractic adjustments, electrotherapy or massage. Should you need to receive any therapy such as the above mentioned, please inform me of this as it will affect the outcome of the study results.

Your participation in this study will aid in contributing to developing new treatment for this commonly occurring, painful condition.

Thank you for your interest and support.

Yours Sincerely

Lee Cumming
Chiropractic Intern.

DURBAN INSTITUTE OF TECHNOLOGY
CHIROPRACTIC DAY CLINIC
CASE HISTORY

Appendix C

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

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

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

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

FOR CLINICIANS USE ONLY:

Initial visit

Clinician: Signature :

Case History:

Examination:

Previous: Current:

X-Ray Studies:

Previous: Current:

Clinical Path. lab:

Previous: Current:

Case Status:

PTT:	Signature:	Date:

CONDITIONAL:
Reason for Conditional:

Signature: Date:

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

Signed off:	Date:

Intern's Case History:

1. **Source of History:**
2. **Chief Complaint : (patient's own words):**
3. **Present Illness:**

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

4. **Other Complaints:**

5. **Past Medical History:**

- ▹ General Health Status
- ▹ Childhood Illnesses
- ▹ Adult Illnesses
- ▹ Psychiatric Illnesses
- ▹ Accidents/Injuries
- ▹ Surgery
- ▹ Hospitalizations

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

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

7. **Immediate Family Medical History:**

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

8. **Psychosocial history:**

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

9. **Review of Systems:**

- General
- Skin
- Head
- Eyes
- Ears
- Nose/Sinuses
- Mouth/Throat
- Neck
- Breasts
- Respiratory
- Cardiac
- Gastro-intestinal
- Urinary
- Genital
- Vascular
- Musculoskeletal
- Neurologic
- Haematologic
- Endocrine
- Psychiatric

TECHNIKON NATAL

Appendix D

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

Patient:_____File#: _____Date:_____
Clinician:_____Signature:_____
Intern:_____Signature:_____

1. VITALS

Pulse rate:
Respiratory rate:
Blood pressure: R L
Temperature:
Height:
Weight:

2. GENERAL EXAMINATION

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

Urinalysis:

3. CARDIOVASCULAR EXAMINATION

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

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

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

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

Percussion: - borders of heart

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

4. RESPIRATORY EXAMINATION

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

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

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

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

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

5. ABDOMINAL EXAMINATION

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

Inspection
- Shape:
- Scars:
- Hernias:

Palpation
- Superficial:
- Deep = Organomegally:

- Masses (intra- or extramural)
- Aorta:

Percussion - Rebound tenderness:
- Ascites:
- Masses:

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

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

6. G.U.T EXAMINATION

External genitalia:
Hernias:
Masses:
Discharges:

7. NEUROLOGICAL EXAMINATION

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

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

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

Evidence of head trauma:

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

Cranial Nerves:

I Any loss of smell/taste:
Nose examination:

II External examination of eye:
- Visual Acuity:
- Visual fields by confrontation:

- Pupillary light reflexes = Direct:
  = Consensual:
- Fundoscopy findings:

III Ocular Muscles:
Eye opening strength:

IV Inferior and Medial movement of eye:

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

b. Motor - Masseter:
- Jaw lateral movement:

c. Reflexes - Corneal reflex
- Jaw jerk

VI Lateral movement of eyes

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

b. Taste - Anterior two-thirds of tongue:

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

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

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

XII Inspection of tongue (deviation):

Motor System:

a. Power
- Shoulder = Abduction & Adduction:
  = Flexion & Extension:
- Elbow = Flexion & Extension:
- Wrist = Flexion & Extension:

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

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

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

Sensory System:

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

b. Joint position sense
- Finger:
- Toe:

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

Cerebellar function:

Obvious signs of cerebellar dysfunction:
= Intention Tremor:
= Nystagmus:
= Truncal Ataxia:

Finger-nose test (Dysmetria):
Rapid alternating movements (Dysdiadochokinesia):
Heel-shin test:
Heel-toe gait:
Reflexes:
Signs of Parkinsons:

8. **SPINAL EXAMINATION:**(See Regional examination)

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

9. **BREAST EXAMINATION:**

Summon female chaperon.

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

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

Appendix E

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC
REGIONAL EXAMINATION - *CERVICAL SPINE*

Patient: _____ File: _____

Date: _____ Intern/Resident: _____

Clinician: _____ Sign: _____

OBSERVATION:

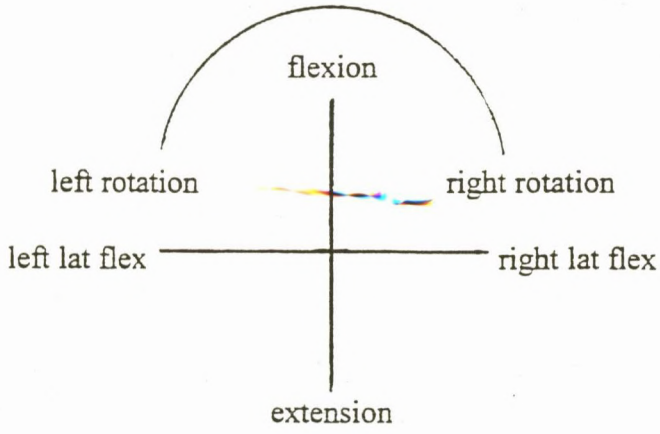
Posture
Swellings
Scars
Discolouration
Hair Line
Bony & Soft Tissue Contours

Shoulder position:
Left:
Right:
Muscle spasm
Facial expression

RANGE OF MOTION:

Flexion (45'):
L/R Rotation (70'):

Extension (70'):
L/R Lat Flex (45'):



PALPATION:

Lymph Nodes
Thyroid Gland

Trachea

ORTHOPAEDIC EXAMINATION:

Tenderness
Trigger Points:

SCM
Scalenii
Post Cervicals

Trapezius
Lev Scap

Doorbell sign
Kemp's test
Cervical distraction
Halstead's test
Hyperabduction test
Shoulder abduction test

Cervical compression
Lateral compression
Adson's test
Costoclavicular test
Eden's test
Shoulder depression test

Dizziness rotation test
Brachial plexus tension

Lhermitte's sign

NEUROLOGICAL EXAMINATION:

Dermatomes	Left	Right	Myotomes	Left	Right	Reflexes	Left	Right
C2			C1			C5		
C3			C2			C6		
C4			C3			C7		
C5			C4					
C6			C5					
C7			C6					
C8			C7					
T1			C8					
			T1					

VASCULAR:

	Left	Right
Blood Pressure		
Carotid arts.		
Subclavian arts.		
Wallenberg's test		

MOTION PALPATION & JOINT PLAY:

Left: Motion Palpation:
Joint Play:

Right: Motion palpation:
Joint Play:

Basic Exam: Shoulder:
Case History:

ROM: Active:
Passive:
RIM:
Orthopaedic/Neuro/
Vascular:
Observ/Palpation:

Upper T horacics:
Motion Palpation:
Joint Play:

Basic Exam: Thoracic Spine:
Case History:

ROM: Motion Palp:
Active:
Passive:
Orthopaedic/Neuro/
Vascular:
Observ/Palpation:

Appendix F

INFORMED CONSENT FORM
(To be completed by patient / subject)

Title of research :The relative effectiveness of electroacupuncture as compared to single dry needle insertion in the treatment of Trapezius myofasciitis.

Name of supervisor : Dr Myburgh

Name of research student: Lee Cumming

Please circle the appropriate answer **YES/NO**

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 the study? Yes/No
8. Do you understand that you are free to withdraw from this study? Yes/No
    1) at any time
    2) without having to give any a reason for withdrawing, and
    3) without affecting your future health care.
9. Do you agree to voluntarily participate in this study? Yes/No

If you have answered no to any of the above, please obtain the necessary information before signing.

Please print in block letters:

Patient/Subject Name:_____Signature:_____

Parent/Guardian:_____Signature:_____

Witness Name:_____Signature:_____

Research Student Name:_____Signature:_____

Appendix G

Numerical Pain Rating Scale 101

Date:_____ **File no.:**_____ **Visit no.:**_____

Patient Name:

Please indicate on the line below, the number between 0 and 100 that best describes the pain you experience **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.

Please indicate on the line below, the number between 0 and 100 that best describes the pain you experience **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.

Appendix H

ALGOMETER:

THRESHOLD READINGS

Treatment 1:

Before treatment	After treatment

Treatment 2:

Before treatment	After treatment