THE EFFICACY OF MYOFASCIAL ADHESION MANIPULATION IN THE TREATMENT OF MYOFASCIAL PAIN SYNDROME.

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DEDICATION

This work is dedicated to two people:

My gramps, Ray Cole, who gave me the opportunity to get this far and for that I am eternally grateful.

My mom, Cheryl, who has shown me an abundance of love and support throughout all my years of study, and throughout my life.

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ABSTRACT

The purpose of this study was to determine the efficacy of Myofascial Adhesion Manipulation (grip and rip) in the treatment of Myofascial Pain Syndrome.

The study was a prospective, unblinded, randomized, placebo-controlled, clinical trial. The sample size used was 60 patients selected from the Durban Metropolitan Area. Only patients diagnosed with active trigger points in either the Trapezius and/or the Levator Scapulae muscles were accepted into the study.

The sample was divided into two groups of 30 patients each. One group received Myofascial Adhesion Manipulation, whilst the other group received placebo ultrasound. Each patient received four treatments over a maximum period of 3 weeks.

Data was obtained from the patients at the first and second consultations, prior to treatments, and at the fourth consultation, immediately following the treatment. Subjective data was obtained with the Numerical Pain Rating Scale (NRS 101) and the Short-Form McGill Pain Questionnaire (S-FMPQ). Objective data was obtained from pressure threshold algometry and the Myofascial Diagnostic Scale (MDS).

Statistical analysis of the data involved both parametric and non-parametric testing. Intra-group comparisons were made using the Friedman's test (for S-FMPQ and MDS) and the paired t-test (for NRS 101 and algometer scores). Inter-group comparisons were made using the Mann Whitney U-test (for S-FMPQ and MDS) and the unpaired t-test (for NRS 101 and algometer scores). All statistical analyses were completed at the 95 % level of significance.

Evaluation of the intra-group statistical analyses revealed significant improvements with regards to subjective and objective data for both the treatment and placebo groups. Although a significant placebo effect was obtained, the treatment group showed more favourable results than placebo, in terms of algometer readings (where there was a greater rate of improvement in the treatment group) and Myofascial Diagnostic Scale scores (where the treatment group showed a tendency for active trigger points to become latent).

Comparison between groups showed a significant difference with regards to algometer scores, Myofascial Diagnostic Scale scores and NRS 101 questionnaires, indicating that the treatment group responded more favourably than the placebo group.

It was concluded that Myofascial Adhesion Manipulation is an effective form of treatment for the active trigger points of Myofascial Pain Syndrome, in terms of both subjective and objective clinical findings. Suggestions were

made to double-blind further studies (by using one practitioner to carry out treatment procedures and another to record data) and to use a different from of placebo control, so as to minimize the positive placebo effect. This study and observations made by the author with respect to Myofascial Adhesion Manipulation are hoped to contribute to the limited literature available on this technique.

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CHAPTER ONE: INTRODUCTION

1.1 THE PROBLEM AND ITS 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 may be clinically 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 TrPs are common to both active and latent TrPs.

Sandman (1981:136) states that an active TrP will produce sufficient pain for a patient to seek health care and as a result, Myofascial Pain Syndrome has become one of the most predominant soft-tissue syndromes seen in clinical practice today (Schneider, 1995). As the largest single organ of the human body and accounting for nearly 50% of total body weight, skeletal muscle is a

large target for painful conditions and this cannot be overlooked (Travell, Simons and Simons, 1999 1:13).

At present, effective treatment of myofascial TrPs can be achieved by one or more of several methods, including TrP injection, dry needling, massage, ultrasound, exercise, electrical stimulation, spray and stretch and others. However, despite this array of modalities available to a clinician, authors agree that more studies are required to aid in more accurate delineation of the syndrome and to determine the efficacy of treatment (Murphy, 1989:629, Han and Harrison, 1997:98).

1.2 AIM OF THE STUDY

The purpose of this study is to determine the efficacy of Myofascial Adhesion Manipulation, in terms of objective and subjective clinical findings, for the treatment of Myofascial Pain Syndrome.

Objective 1- to determine the efficacy of Myofascial Adhesion Manipulation, in terms of objective clinical findings, for the treatment of Myofascial Pain Syndrome.

Objective 2- to determine the efficacy of Myofascial Adhesion Manipulation, in terms of subjective clinical findings, for the treatment of Myofascial Pain Syndrome.

1.3 NEED FOR A SOLUTION TO THE PROBLEM

Myofascial Adhesion Manipulation, or "grip and rip", is a manual soft-tissue technique which was developed by Chiropractor, Dr. Brian Nook. He and his colleagues have used the technique in clinical practice for over 8 years, for the treatment of adhesions, scar tissue and myofascial TrPs (Nook, 2000). The technique is performed by delivering a high velocity thrust, using an index contact over the TrP area, to the muscle in order to break adhesions and induce stretch to the contracted TrP fibres (Nook, 1998).

At present, very little written literature and no studies regarding the efficacy of this technique are available, for either the treatment of adhesions, or Myofascial Pain Syndrome.

1.4 HYPOTHESES

It is hypothesized that Myofascial Adhesion Manipulation will be effective in treating patients with Myofascial Pain Syndrome, in terms of both objective and subjective clinical findings, and that Myofascial Adhesion Manipulation will be more effective than placebo, for the treatment of this condition.

1.5 BENEFITS OF THE STUDY

It is hoped that this study will provide important information with regards to the efficacy of Myofascial Adhesion Manipulation as a treatment modality for myofascial pain, and that being the first study of its kind, it may provide the basis for further research to determine the effectiveness of the technique in comparison to other treatment modalities. It is also hoped that this study may provide information, in the form of observations made by the author, that will contribute to the limited literature available on Myofascial Adhesion Manipulation, providing the basis for future research into the value and use of this technique.

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

Myofascial Pain Syndrome is a regional muscle disorder accompanied by trigger points (TrPs) (Han and Harrison, 1997:89), which are extremely common and become a painful part of nearly everyone's life at some time or another (Travell, Simons and Simons, 1999 1:12). As a result, Myofascial Pain Syndrome 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 such soft tissue disorders (Schneider, 1995). The following chapter reviews the literature over predominantly the past 20 years, in order to provide a clearer understanding of the development of the current concepts in TrP aetiology, pathogenesis, diagnosis and management.

2.2 PREVALENCE

In the early 1950's, Myofascial Pain Syndrome was already noted 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, Infraspinatus, Levator Scapulae and Scalene muscles were the most common.

Since then, most studies on the incidence and prevalence of Myofascial Pain Syndrome have been carried out since the 1980's. In a study by Skootsky, Jaeger and Oye (1989), in which 172 patients presenting to a university primary care general internal medical practice were examined, 30% of the patients whose reason for the visit was pain, were diagnosed with Myofascial Pain Syndrome.

Three further studies by Gerwin, Fishbain and Fricton respectively, substantiate the high prevalence of Myofascial Pain Syndrome. Gerwin (1995) examined 96 patients at a community pain medical centre and found 93% of those patients had at least part of their pain caused by TrPs. Fishbain (1986) diagnosed Myofascial Pain Syndrome in 85% of 283 consecutive admissions to a comprehensive pain centre. Fricton (1985) found that, of 164 patients with head and neck pain of at least six months duration, 55% had a primary diagnosis of Myofascial Pain Syndrome with active TrPs.

The high prevalence of Myofascial Pain Syndrome can be subdivided further. Sola, Rodenberger and Gettys (1955:587) state that whilst the condition is clearly found in both sexes, it is more common in women than in men. This statement is supported by Han and Harrison (1997:90). Furthermore, Travell, Simons and Simons (1999 1:13) indicate 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. Jansen (1998) found Myofascial Pain Syndrome to be the most important causative factor in tension type headaches amongst high school children in South Africa.

2.3 AETIOLOGY

Both active and latent TrPs develop as a result of the same factors, but at varying degrees (Travell, Simons and Simons, 1999 1:19). There is consensus amongst authors (Murphy, 1989:627, Schneider, 1995 and Travell, Simons and Simons, 1999 1:19) that the following factors are largely responsible for the development of TrPs:

1) Mechanical abuse or traumatic injury of a muscle. This may include acute or direct injury of a muscle, or sustained overload of a muscle in the form of repetitive strain leading to microtrauma.

    Nimmo, as quoted by Cohen and Gibbons (1998:169), gave the following examples of muscle strain: accidents, exposure to cold drafts and occupations requiring long periods of postural strain such as typing or driving for hours without rest.

2) Prolonged muscle spasm and more so, contraction of a muscle whilst in the shortened position.
3) 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). Travell, Simons and Simons (1999 1:19) agree that spinal nerve compression is associated with an increase in the numbers of active TrPs, especially in the paraspinal muscles.

Indirect activation of TrPs can also occur as a result of visceral disease, arthritic joints, other existing TrPs and by emotional distress (Travell, Simons and Simons, 1999 1:20).

2.4 PERPETUATING FACTORS

According to Travell, Simons and Simons (1999 1:178), when treating Myofascial Pain Syndrome, it is important to correct the factors that perpetuate the condition, in order to achieve long-term treatment results. These perpetuating factors may include any of the following, outlined by Travell, Simons and Simons (1999 1:178):

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.

2.5 CLINICAL FEATURES

2.5.1 Symptoms

Patients with Myofascial Pain Syndrome will typically present to a clinician with a history of pain that may at first seem poorly localized, but is usually limited to one muscle region of the body (Schneider, 1995). The pain may range from a mild ache to excruciating pain and words such as dull, pressure, burning and heavy are frequently used to describe the pain (Han and Harrison, 1997:92). Myofascial pain is often referred to a distant site from the TrP, in a characteristic pattern for that muscle and sometimes patients are even aware of a numbness or parasthesia rather than pain (Travell, Simons and Simons, 1999 1:20).

As discussed in the previous section, the pain complaint or history that a patient may present with is usually related to a traumatic injury, where the muscles were damaged by strain or overload, or, in the case of chronic

symptoms, related to repetitive strain, poor posture and other causes of chronic muscular tension (Schneider, 1995).

Travell, Simons and Simons (1999 1:21) describe additional symptoms that patients may present with, including disturbances of autonomic functions and motor functions. Autonomic disturbances may include abnormal sweating, increased lacrimation, coryza, excessive salivation and pilomotor activity. These symptoms are related to active TrPs in the postural muscles of the neck and shoulder. Proprioceptive disturbances may also occur, including tinnitis, imbalance, dizziness and altered weight perception of lifted objects.

The motor disturbances described by Travell, Simons and Simons (1999 1:21) include involved muscle weakness, spasm of other muscles (synergistic and/or antagonistic muscles) and decreased muscle power or work tolerance.

Often patients complain of disturbed sleep as a result of Myofascial Pain Syndrome, which can lead to a vicious cycle of increased pain sensitivity the following day (Travell, Simons and Simons, 1999 1:21).

2.5.2 Signs

On examination of a patient suffering with Myofascial Pain Syndrome, a number of physical findings are necessary for correct diagnosis of the condition. Although Travell, Simons and Simons (1999 1:12) state that there is still poor agreement on appropriate diagnostic criteria for Myofascial Pain

Syndrome, there are certain common characteristics recognized by various authors that aid the clinician with evaluating the patient suffering with Myofascial Pain (Hong and Simons, 1998:863).

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). This pain may be a local pain and/or referred pain. The TrP is always found in a taut band of muscle fibres, and snapping palpation across the muscle fibres may elicit a local twitch response (LTR), which is a brisk contraction of the muscle fibres in or around the taut band. The same effect is also achieved by rapid insertion of a needle into the TrP. (Hong and Simons, 1998:863). Tenderness of the TrP nodule may be severe enough for the patient to withdraw from the examiner's hand and cry out. This is a behavioral reaction known as a "jump sign" (Han and Harrison, 1997:94).

Schneider (1995) outlines a set of recommended diagnostic criteria for Myofascial Pain Syndrome:

To diagnose MPS, all five major criteria should be present and at least one of the three minor criteria.

Major criteria

1. Regional pain complaint

2. Pain pattern follows a known distribution of muscular referred pain.
3. Palpable taut band (in accessible muscles).
4. Exquisite focal tenderness at one point or nodule within a taut band.
5. Some restricted range of motion or slight muscle weakness (when measurable).

Minor criteria

1. Manual pressure on the TrP nodule reproduces chief pain complaint.
2. Snapping palpation of the taut band at the TrP elicits a Local twitch Response.
3. Pain is diminished or eliminated by muscular treatment,e.g., therapeutic stretch, ischaemic compression or needle injection of the TrP.

A study by Harden et al. (2000:64) assessed the clinical consensus regarding the signs and symptoms characterizing Myofascial Pain Syndrome, in a survey of pain management providers. Of the 403 surveys returned to the researchers (out of 1663 sent out), more than 80% of respondents agreed that regional location, a normal neurological examination, the presence of TrPs, taut bands, palpable nodules, muscle ropiness, decreased range of motion and pain exacerbated by stress were all signs and symptoms considered essential to, or associated with a diagnosis of Myofascial Pain.

It is the opinion of Travell, Simons and Simons (1999 1:35), that, whilst there is no one, lone, diagnostic examination that is satisfactory for the clinical

identification of a trigger point, a combination of spot tenderness in a palpable band and subject recognition of the pain are minimum acceptable criteria. They also state that researchers reporting on Myofascial Pain Syndrome should identify specifically which TrP examinations were used as diagnostic criteria and describe exactly how they were performed.

2.6 CONFIRMATORY DIAGNOSIS

At present, no laboratory test or imaging technique has been established as diagnostic of TrPs (Travell, Simons and Simons, 1999 1:22). However, Simons (1999) summarizes three newly recognized and seemingly useful techniques for identifying and moreso, confirming, the presence of TrPs. These include: the electromyographic recording and ultrasound imaging of local twitch responses, the spontaneous electrical activity of multiple active loci in the TrP, and biopsies of TrPs that show contraction knots and giant round muscle fibres.

In 1993, Hubbard and Berkoff demonstrated the presence of spontaneous electromyographic (EMG) activity at minute sites ("nidus") in a TrP region of the upper Trapezius muscle, and no such activity at adjacent non-tender sites (Hong and Simons, 1998:865). This EMG activity was a continuous low amplitude action potential, interrupted by high voltage spikes, which were recorded from the nidus (now defined as the active locus) of active TrPs. Only

low amplitude action potentials were recorded from clinically latent TrPs. (Hong and Simons, 1998:865).

EMG activity has also been recorded from tender spots within the taut bands, on stimulation of the taut band by snapping palpation, to elicit a local twitch response (Hong and Simons, 1998:865). At the same time, the LTR can be further confirmed by visualization using ultrasound imaging (Travell, Simons and Simons, 1999 1:23). Studies by Margolis, as well as Gerwin and Duranleau both confirm the presence of the LTR by ultrasound imaging, wherein the twitch was elicited by needle penetration of the TrP in a taut band. Not only does this provide a second manner, in addition to EMG recording, of substantiating the LTR, but it provides a much needed imaging technique that can be used in objective TrP research and clinical diagnosis of Myofascial Pain Syndrome (Travell, Simons and Simons, 1999 1:23).

2.7 PATHOPHYSIOLOGY OF TrPs

Current studies on the above mentioned EMG activity, ultrasound imaging and biopsies of TrPs have lead to a new and better understanding of the pathophysiology of Myofascial Pain Syndrome, which has been recorded by authors such as Travell, Simons and Simons (1999), Simons (1999), Schneider (1995) and Hong and Simons (1998). This new understanding provides the basis for effective treatment, and choice of treatment, of the condition.

An overview of muscle structure and function and the new concepts in TrP formation is outlined below. This outline is a summary of the works of Travell, Simons and Simons (1999 1:45-60) and Hong and Simons (1998:865-868).

A muscle is a bundle of fascicles, each of which consists of striated muscle cells or fibres. Each fibre contains approximately 1000 myofibrils surrounded by sarcoplasmic reticulum, the sac-like structure, which is the source of the contractile force of the muscle. It is the sarcoplasmic reticulum that releases calcium, which stimulates the actin and myosin filaments of the myofibrils to contract in the presence of ATP (adenosine triphosphate). This calcium is only released when an action potential reaches the sarcoplasmic reticulum via T-tubules. The contractile force is maintained until the free calcium is pumped back into the sarcoplasmic reticulum or until the ATP energy supply is depleted.

The pathway through which the above mentioned action potential reaches the muscle and its contractile elements is called the motor unit. A motor unit consists of the cell body of a α-motorneuron in the anterior horn of the spinal cord, its axon, which passes through the spinal nerve and muscle nerve to branch out to many muscle fibres, and the multiple motor endplates. One motor endplate terminates on a single muscle fibre. It is the cell body of the

motor neuron that initiates the action potential, which is ultimately relayed chemically across the synaptic cleft of the motor endplate, causing the muscle fibre to contract.

It is now becoming accepted that the area we call a TrP or tender nodule 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. Hence, Myofascial Pain Syndrome is a neuromuscular disease. (Travell, Simons and Simons, 1999 1: 57).

Dysfunctional endplates are defined as active loci, when in the vicinity of a TrP, and are motor structures. 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. A resultant sustained release of calcium from the sarcoplasmic reticulum causes maximal contracture of the muscle fibre and an increased metabolic demand for oxygen and ATP. However, the sustained contraction also 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. A vicious cycle of further contraction results, as the contractile elements are continuously exposed to calcium. This hypothesis of TrP formation is known as the "energy crisis theory". The areas of contraction found in the location of dysfunctional endplates or active loci are visible histologically as contraction knots. A

collection of these contraction knots within a taut band constitute a TrP and are the structures which most likely make the TrP feel nodular. It is the active loci that show spontaneous electromyographic activity, therefore confirming the validity of this diagnostic tool.

It is further hypothesized that the energy crisis that results from dysfunctional endplate activity can stimulate the production of vasoreactive substances that can sensitize local nociceptors. These sensory nociceptors are known as sensitive loci and it is believed that they are the sites from which pain, referred pain and LTRs are elicited. Sensitive loci are widely distributed within the entire muscle, but are concentrated within the TrP region. When a sensitive locus lies within the immediate vicinity of an active locus, a myofascial TrP locus- the basic unit of a TrP- develops. When the input from the sensitive loci persists, central sensitization in the spinal cord may develop and the receptive field corresponding to the original dorsal horn neuron may be expanded, resulting in referred pain.

2.8 TREATMENT OF MYOFASCIAL PAIN SYNDROME

In the treatment of Myofascial Pain Syndrome, the goal is not only to reduce pain as quickly as possible, but to enable a patient to cope with the pain as well (Han and Harrison, 1997:95). Fischer (1999) agrees with this statement, but adds that recurrence of pain must be prevented and this can only be achieved by removal of the aetiological factors. Once a clinician has

determined that a patient is harboring the TrPs characteristic of Myofascial Pain Syndrome, he must then decide on a clinical course of treatment (Schneider, 1996:78). A range of treatment modalities including TrP injection, dry needling, spray and stretch, ultrasound and massage among others, are available for the clinician to choose from (Han and Harrison, 1997:95). Deciding on which of these modalities to use is often case dependent and/or the preference of the clinician, but an understanding of the pathophysiology of the disease, as discussed in the previous section, may aid the clinician in choosing the most effective form of treatment for the patient.

Travell, Simons and Simons (1999 1: 72) state that the energy crisis theory of TrP formation provides an explanation for the effectiveness of essentially any treatment technique that elongates the TrP portion of the muscle to its full stretch length, even briefly. They explain this by the fact that the continued actin-myosin interaction depends on physical contact between the actin and myosin molecules. The molecules show a significant decrease in overlap contact when stretched to full length, therefore, treatment techniques that achieve this stretch effect may break the cycle of energy consuming contractile activity.

Sandman (1981:138) also mentions the importance of stretching the muscle fibres to normal maximal length for effective treatment of TrPs. She adds, that in order to restore normal stretch, it is necessary to passively stretch the

muscle while initiating a strong barrage of nerve impulses from the skin. This distracting stimulus inhibits reflex pathways that perpetuate the TrP activity via the spinal cord and possibly higher centres of the brain. A firm, non-painful, direct pressure to the centre of the TrP (ischaemic compression) can initiate this barrage of nerve impulses (Sandman, 1981:38).

2.8.1 The effectiveness of various techniques on Myofascial Pain TrPs.

2.8.1.1 TrP injection and Dry needling

According to Han and Harrison (1997:96), TrP injections are one of the most effective therapeutic approaches for the treatment of Myofascial Pain and achieve the best results in chronic active TrPs with fibrotic scar formation. It is a technique which is 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 study by Hong (1994), injections with 0.5% lidocaine were given to 26 patients into TrPs of the upper Trapezius muscle, while dry needling was performed on TrPs in 15 patients. The results showed a significant improvement in both groups, with respect to pain intensity and pressure threshold measurements. However, the patients treated with dry needling experienced post-injection soreness of greater intensity and longer duration than those treated with lidocaine. Hong therefore recommends lidocaine over dry needling, in order to reduce the intensity and duration of

post-injection soreness. However, different results may have been recorded had the two sample sizes been more closely matched.

The efficacy of dry needling in the treatment of Myofascial Pain Syndrome was evaluated by Jones (1994), who found dry needling combined with a home program of stretch exercises to be significantly more effective than placebo ultrasound therapy. This study reinforces Lewit's findings (1979), 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.

The mechanisms by which both needling and local injection are proposed to reduce TrP pain are as follows:

- Mechanical disruption of muscle fibres and nerve endings, causing increased intracellular potassium, which leads to depolarization of nerve fibres.
- Interruption of the positive feedback mechanism that perpetuates pain. (Han and Harrison, 1997:96).

Although both needling and injection have been proven effective in the treatment of Myofascial Pain Syndrome, they cannot be used in all cases presenting to a clinician. Patients presenting with contraindications to TrP injection, including allergy to anaesthetic agents, bleeding disorders and those on anticoagulation therapy, require alternative forms of treatment for their pain (Han and Harrison, 1997:96). Similarly, the post needling soreness

experienced after dry needling, as described by Hong (1994), may discourage patients from enduring this form of treatment. More serious complications associated with local steroid injection include tendon atrophy, depression of plasma cortical levels and complications in patients with insulin-induced hypoglycaemia (Han and Harrison, 1997:96).

2.8.1.2 Electrotherapeutic Modalities

Electrotherapeutic modalities that have been shown to have beneficial effects in the treatment of Myofascial Pain Syndrome include transcutaneous electrical nerve stimulation (TENS), ultrasound therapy, interferential current and action potential therapy. (Han and Harrison 1997, Esenyel, Caglar and Aldemir 2000, Christie 1995 and Chettiar 2001).

The efficacy of TENS as a treatment modality for Myofascial Pain is questionable. TENS has only shown a reduction in myofascial pain with no alteration of local trigger point sensitivity. Therefore, TENS therapy alone may not be sufficient to produce a long-term beneficial effect in treating Myofascial Pain Syndrome. (Han and Harrison, 1997:98)

The use of ultrasound therapy as a treatment for Myofascial Pain Syndrome has been widely researched, with conflicting results. Esenyel, Caglar and Aldemir (2000) investigated the effectiveness of ultrasound versus trigger point injections, in combination with neck stretching exercises, for the

treatment of TrPs in the upper Trapezius muscle. In a sample of 102 patients, they found ultrasound treatment to be equally effective as TrP injection. Hong et al. (1993) also found ultrasound to be effective in increasing pain threshold in patients with active TrPs, where the sample used was 16.

Contradictory results were obtained by Gam et al. (1998), whose study of 58 patients with TrPs in the neck and shoulders showed no difference between groups given ultrasound or sham ultrasound. Ultrasound was shown to give no pain reduction, and analgesic usage by the patients remained the same. With such varied results amongst studies, the value of ultrasound as a therapeutic tool for this condition is questionable and requires further study.

Christie (1995) conducted a controlled study involving 30 patients with TrPs in the shoulder girdle, where half of the patients received dry needling and the other half received interferential current across the area of pain. He found no significant difference between the two groups, although both groups showed an improvement in symptoms. Christie concluded that interferential current was a viable alternative treatment for Myofascial Pain Syndrome. However, he also believed that a larger sample size may have yielded different results. This has not yet been studied.

Chettiar (2001), in his placebo controlled study of 60 patients with Myofascial Pain Syndrome, found action potential therapy (APT) to be effective in

reducing pain intensity and increasing pressure threshold levels in patients with active TrPs. This was the first study of its kind to test the efficacy of APT for this condition, with no determination of its long-term therapeutic effects.

In regard to the above literature search, it can be argued that the use of electrotherapuetic modalities for the treatment of myofascial pain syndrome may not be the first treatment protocol of choice in most cases, as further research is greatly needed in this area. Schneider (1996:78) advocates the use of manual soft tissue therapies instead. He states that they have the advantage of not requiring any sophisticated machinery other than the practitioner's own two hands, and, that they are easy to use, quick to apply and are non-invasive.

2.8.1.3 Manual Soft Tissue Therapies

At present, the most widely recognized form of manual therapy used in the treatment of Myofascial Pain Syndrome is ischaemic compression, first developed by Travell and now known as trigger point pressure release (Travell, Simons and Simons, 1999 1:126). Adjunctive manual therapies include the spray and stretch method, post-isometric relaxation and active release techniques (Schneider, 1996:78).

Ischaemic compression has been shown to be clinically effective in treating Myofascial TrPs by Hong et al. (1993) and Hanten et al. (2000). Hong et al.

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

Sandman (1981:138) describes ischaemic compression as a firm, non-painful, direct pressure to the centre of the TrP, which provides a strong barrage of nerve impulses to the brain to inhibit the reflex pathways that perpetuate the TrP activity. She also adds, however, that if the pressure is painful, the patient may respond with muscle tightening in the area, which may aggravate the condition. Schneider (1996:80) agrees that the two most common mistakes for practitioners to make when applying ischaemic compression are applying too much pressure and applying pressure for too long. Both of these errors will result in increasing the patient's pain and/or causing muscle bruising or soreness (Schneider, 1996:80).

2.8.1.4 Myofascial Adhesion Manipulation

Nook (2000) describes a technique known as "grip and rip", which he also terms Myofascial Adhesion Manipulation, as the high velocity, low amplitude

thrust delivered to a muscle, used for the treatment of TrPs, adhesions and old scar tissue.

Soft tissue motion palpation is used to evaluate muscles through their fascial planes and to search for adhesions and/or local areas of hypertonicity (myofascial TrPs) within the muscle. Adhesions are characterized by a local area of restriction of movement in a muscle, whilst TrPs are characterized by their symptoms and signs described in the sections above. A muscle must be stressed in the neutral position in all directions, including posterior to anterior and vice versa, medial to lateral and vice versa, and in a rotational direction in order to find a restriction of movement/adhesion. If a muscular adhesion is palpated, the restriction of movement in the muscle is further palpated in different positions, with the muscle contracted, to find the most fixated position. Myofascial Adhesion Manipulation is then delivered in that position. (Nook 1998:42).

Myofascial Adhesion Manipulation, or "grip and rip", is performed by taking a firm, reinforced index contact on the adhesion, in the position of most restriction, and a high velocity, low amplitude thrust is delivered in the direction of the restriction (Nook 1998:43). Nook (2000) also states that he and many of his colleagues use Myofascial Adhesion Manipulation for the treatment of Myofascial TrPs, where the same contact is taken directly over an active TrP and a thrust is delivered in the direction of the muscle fibres.

Contraindications to Myofascial Adhesion Manipulation according to Nook (1998:43) include:

1) Vascular compromise
2) Anticoagulant use
3) Severe diabetes (with peripheral neuropathy)
4) Sensory deficit
5) Infection
6) Severe trauma to the area being treated.

To date, no known studies have been conducted to determine the efficacy of Myofascial Adhesion Manipulation for the treatment of muscular adhesions and/or Myofascial Pain Syndrome and its active TrPs.

It is the opinion of the author that, should this technique be found effective for the treatment of active TrPs, its mechanism of action may be a combination of the theories explained in the previous sections. The high velocity thrust applied to the affected muscle induces a localized stretch to the contracted actin and myosin filaments, causing them to decrease contact with each other, thereby breaking the cycle of contractile activity within the TrP, as described by Travell, Simons and Simons (1999 1: 72). Simultaneously, the firm index contact over the TrP may provide the distracting stimulus needed to inhibit the reflex pathway that perpetuates TrP activity, as discussed by Sandman

(1981:138). The thrust that is delivered is quick, therefore it minimizes the chances of aggravating the patient's condition by applying pressure to the muscle for too long, as may sometimes be the case with ischaemic compression (Schneider 1996:80). Finally, this technique may have the added advantage in chronic Myofascial Pain cases, where resultant scar tissue formation can be broken down and normal muscle movement restored. These hypotheses provide an open avenue for future research into the treatment of Myofascial Pain Syndrome and for determining the effectiveness of the above technique as a short and/or long-term treatment modality for combating both acute and chronic TrPs.

2.9 AN OVERVIEW OF THE TRAPEZIUS AND LEVATOR SCAPULAE MUSCLES

2.9.1 The upper Trapezius muscle

According to Travell, Simons and Simons (1999 1:278), the Trapezius muscle is the muscle most often troubled with myofascial TrPs. For the purpose of this study, only the fibres of the upper Trapezius muscle will be reviewed. Travell, Simons and Simons (1999 1:278) discusses two TrPs found in these upper fibres, namely TrP_1 and TrP_2. TrP_1 is located by pincer palpation of the free margin of the muscle and is found in the upper Trapezius, approximately midway between the spinous processes and acromion, in the anterior fibres. Referred pain from this TrP is unilateral, along the posterior aspect of the neck

to the mastoid process. When severe, this pain may extend to the side of the head and temple as well as the back of the orbit, and may include the angle of the jaw. It is a common cause of tension neckache and temporal headache. (Travell, Simons and Simons, 1999 1:278).

TrP_2 is located very close to TrP_1, but slightly posterior and inferior, just caudal to the free border of the upper Trapezius. Palpation of this TrP is performed in a similar manner as for TrP_1, but larger patients may require flat palpation. Referred pain from this TrP also lies slightly posterior to that of TrP_1, blending with its distribution behind the ear (Travell, Simons and Simons, 1999 1:278).

2.9.2 The Levator Scapulae muscle

The Levator Scapulae muscle is one of the most commonly involved shoulder-girdle muscles, with respect to Myofascial Pain (Travell, Simons and Simons, 1999 1:491). TrPs within this muscle develop in two locations: a primary TrP at the angle of the neck, where the muscle emerges beneath the anterior border of the upper Trapezuis, and a secondary TrP just above the muscle's attachment to the superior angle of the scapula (Travell, Simons and Simons, 1999 1:491). Referred pain from these TrPs is concentrated at the angle of the neck, with some spillover pain along the vertebral border of the scapula. Involvement of this muscle results in a stiff neck that consistently limits neck rotation due to pain. (Travell, Simons and Simons, 1999 1:491).

2.10 SUMMARY OF THE LITERATURE

The above literature review, which outlines the high prevalence and common aetiological factors of a condition like Myofascial Pain Syndrome, substantiates the need for ongoing research into the effective management of such patients presenting in a clinical setting. Although many forms of treatment have been shown to be beneficial for patients suffering with TrPs, there is still agreement amongst authors that more studies that aid in the delineation of the syndrome and the efficacy of treatment are required (Han and Harrison, 1997). Since no known studies and very little literature exists regarding Myofascial Adhesion Manipulation for the treatment of this and other conditions, it is pertinent to evaluate the efficacy of this technique, in order to determine its value in the pool of management protocols that already exist for Myofascial Pain Syndrome.

CHAPTER THREE: METHODOLOGY

3.1 INTRODUCTION

This chapter includes a detailed description of the study design, subjects used, data measurement and procedures followed for the completion of the study. It also includes methods of statistical analysis used for evaluation of the data collected.

3.2 STUDY DESIGN AND PROTOCOL

3.2.1 Study design and sample size

This study was a prospective, randomized, placebo-controlled clinical trial involving 60 patients divided into 2 groups of 30 individuals each. The purpose of the study was to evaluate the efficacy of Myofascial Adhesion Manipulation, in terms of subjective and objective clinical findings, for the treatment of myofascial pain syndrome.

Objective 1- to evaluate the efficacy of Myofascial Adhesion Manipulation, in terms of subjective clinical findings, for the treatment of myofascial pain syndrome.

Objective 2- to evaluate the efficacy of Myofascial Adhesion Manipulation, in terms of objective clinical findings, for the treatment of myofascial pain syndrome.

3.2.2 Process of Randomization

Once accepted into the study, based on the inclusion and exclusion criteria to be discussed later, each patient was randomly assigned to either the placebo control group 1, or to the experimental treatment group 2.

The process of randomization was performed with the help of an independent observer. Sixty slips of paper (30 marked group 1, 30 marked group 2) were drawn out of a hat by the observer before commencement of the study. Consecutive patients that were accepted into the study were then assigned to the relevant pre-selected group.

3.2.3 Standard of Acceptance

Only patients presenting to the Technikon Natal Chiropractic Day Clinic (Durban) were considered for the study. These patients presented to the clinic in response to posted advertisements or referrals, over the year 2001. On presentation, the patients were only accepted into the study if a positive diagnosis of Myofascial Pain Syndrome of the upper Trapezius and /or Levator Scapulae muscles was made by the researcher. In addition, all patients were only accepted into the study based on the following criteria.

Inclusion criteria- a) Only patients between the ages of 16 and 55 years were accepted into the study.

b) Both male and female volunteers of all race groups were able to participate in the study.

c) A positive diagnosis of Myofascial Pain Syndrome was made by the presence of active TrPs in one / both of the upper Trapezius and / or Levator Scapulae muscles. These active TrPs, as outlined by Travell, Simons and Simons (1999 1:34-35) are characterized by -

- Recognized referred pain that reproduces the patient's pain complaint on compression of the TrP by palpation.
- The TrP is palpated within a palpable taut band.
- Snapping palpation of the TrP produces a local twitch response.
- Spot tenderness of the TrP.

d) Patients with a concomitant cervical facet syndrome were accepted into the study but were not treated for this.

Exclusion criteria- a) Patients exhibiting any of the contra-indications to massage and massage-type therapies were excluded from the study. These included: infection due to bacterial action; rheumatoid, gouty or infective arthritis; bursitis and calcification in the soft tissue structures (eg. Supraspinatus tendon), as outlined by Basmajian (1985:284-285).

b) Those patients who exhibited any of the contra-indications to myofascial adhesion manipulation, advised by Nook (1998:43), were excluded from the study. These included: vascular compromise, anticoagulant therapy, severe

diabetes mellitus, sensory deficit, infection (local and systemic) and history of recent severe trauma of the involved area (including cervical spine whiplash injury).

c) Patients where a diagnosis of Fibromyalgia Syndrome was suspected were excluded from the study. Fibromyalgia Syndrome is diagnosed by a history of widespread pain for at least 3 months (pain on both sides of the body, above and below the waist), located in 11 of the 18 tender point sites on digital palpation (Schneider, 1995).

d) Patients were not allowed to receive any other form of treatment for Myofascial Pain Syndrome or related musculoskeletal conditions for the duration of their involvement in the study. This included allopathic, homoeopathic or other forms of medication and any form of manual or electrotherapeutic therapy.

3.3 DETAILED PATIENT PROCEDURE AND INTERVENTIONS

On presentation to the clinic, the objectives and implications of the patient's involvement in the study, was explained to each patient (Appendix A). A full case history (appendix C), basic physical examination (appendix D) and regional cervical spine examination (appendix E), including screening of the Trapezius and Levator Scapulae muscles for active TrPs, was performed by the researcher. Once accepted into the study, the patients were asked to give

signed consent (appendix B), before commencement of the treatments. Each patient received 4 treatments over a maximum period of 3 weeks.

Those patients assigned to group 1 received placebo treatment in the form of detuned ultrasound, whilst those assigned to group 2 received myofascial adhesion manipulation of the involved TrPs. The patients in group 1 were not informed until the end of the research program that their treatments were placebo.

3.3.1 Placebo ultrasound

The placebo treatment was administered as follows: The ultrasound machine was set to 5min at 0 $W.cm^{-2}$. Ultrasound transmission gel was applied over the affected muscles and the ultrasound head was used to gently massage over the area. Every effort was taken to ensure that the rubbing of the ultrasound head over the muscles was at a minimum pressure, so as not to induce massage type effects. This treatment was repeated in the same manner for each follow-up consultation.

3.3.2 Myofascial adhesion manipulation

Those patients in group 2 received Myofascial Adhesion Manipulation (grip and rip), as outlined by Nook (1998), of all active TrPs identified in the upper

Trapezius and Llevator Scapulae muscles. The procedure was performed as follows:

The patient was treated in the side lying position, with the involved TrP side up. Fig. 1 shows the position of the practitioner with respect to the patient. The technique may also be performed with the patient in the seated or prone position (Nook 2001), as shown in Fig. 2 and Fig. 3. For the purpose of this study, all patients were treated in the side-lying position.

The location of the TrPs was determined by flat or pincer palpation (Travell, Simons and Simons, 1999), as shown in Figs 4 and 5. Once located, the researcher used a firm, reinforced index contact over the TrP. Tissue slack was removed from the muscle by exerting pressure to the TrP in the long axis direction of the muscle fibres. Once all tissue slack was removed, a high velocity, low amplitude thrust was delivered to the TrP, in the same direction. The treatment was repeated for each of the involved TrPs and was the same for each patient, at each consultation.

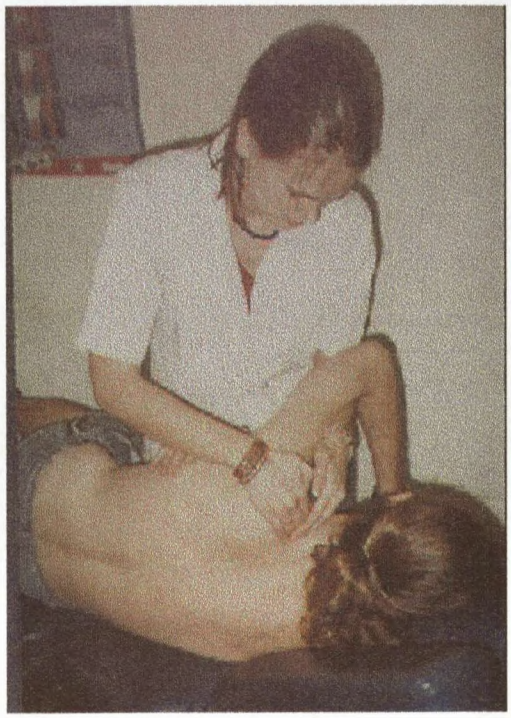


Plate 1: Demonstration of patient/ practitioner positioning for Myofascial Adhesion Manipulation of the upper trapezius muscle, with the patient in the side-lying position.

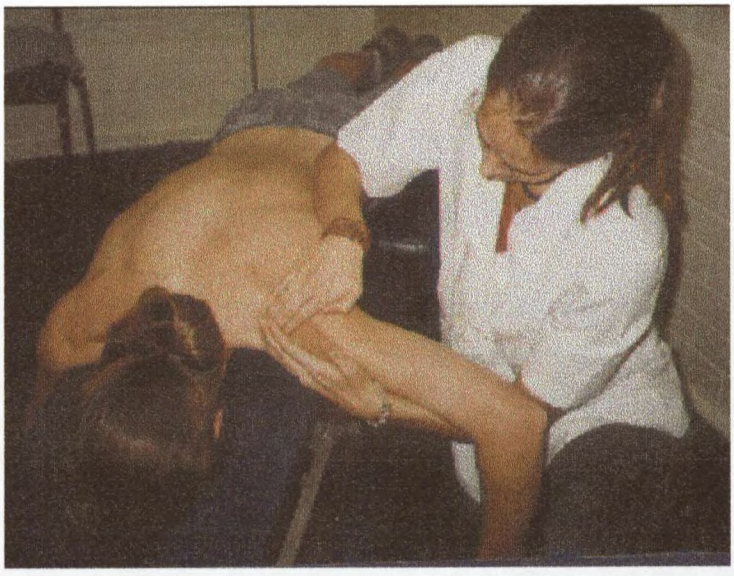


Plate 2: Demonstration of patient/ practitioner positioning for Myofascial Adhesion Manipulation of the upper trapezius muscle, with the patient in the prone position.

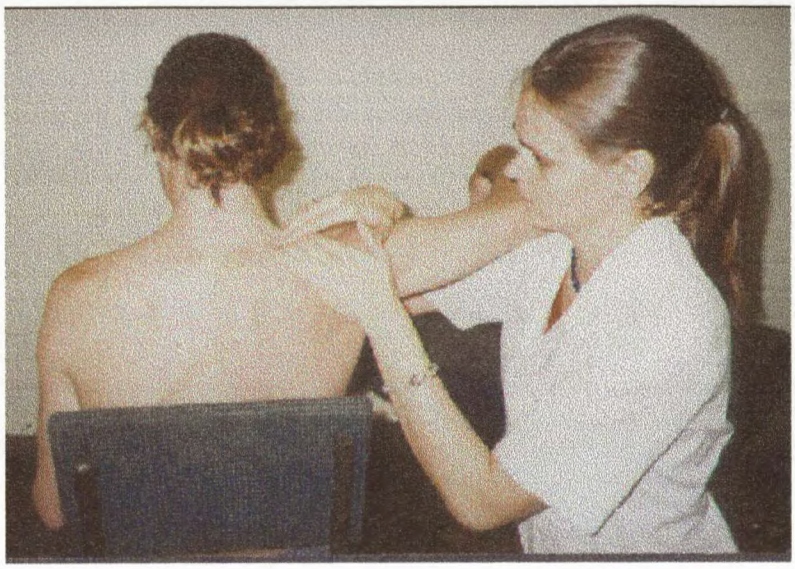
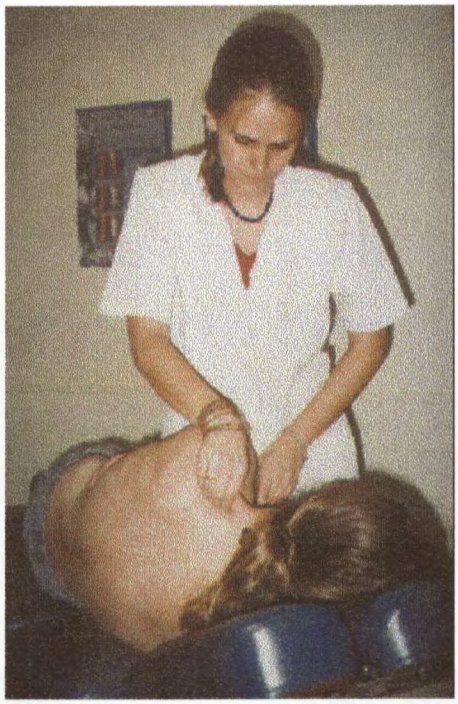
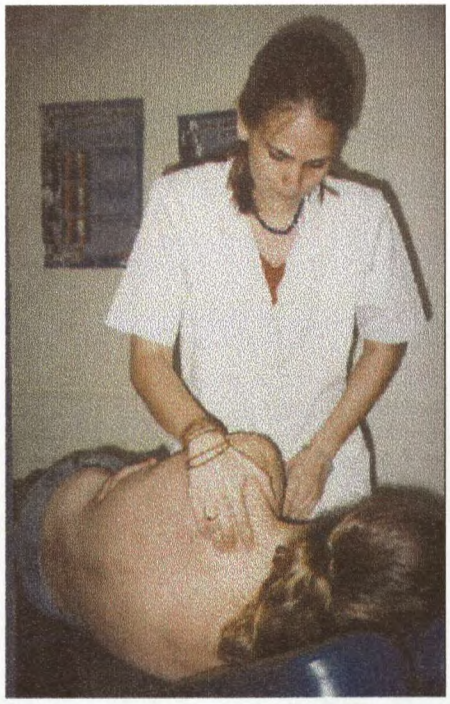


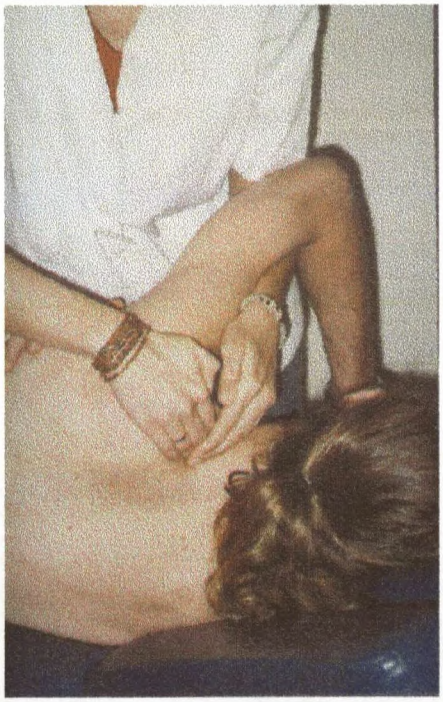
Plate 3: Demonstration of patient/ practitioner positioning for Myofascial Adhesion Manipulation of the upper trapezius muscle, with the patient in the seated position.

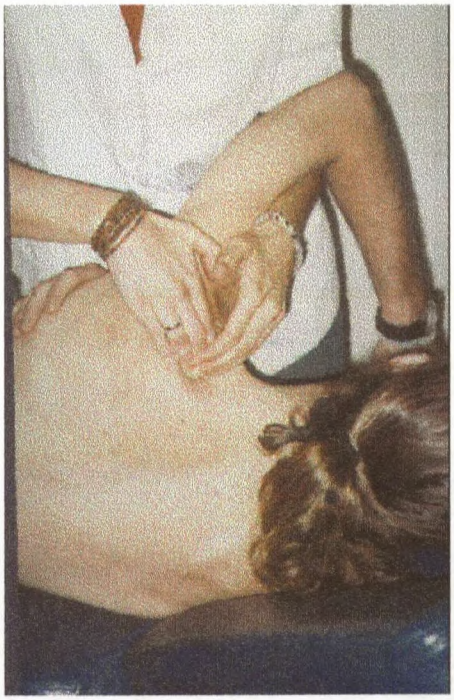




Plates 4 (left) and 5 (right): Demonstration of palpation of TrPs in the upper trapezius muscle by pincer palpation (plate 4) and TrPs in the levator scapulae muscle by flat palpation (plate 5).

Plates 6 (left) and 7 (right): Demonstration of Myofascial Adhesion Manipulation of the upper trapezius muscle. Plate 6 shows the reinforced contact directly over a TrP. Plate 7 shows the direction of the high velocity thrust applied to the TrP, which is in the direction of the muscle fibres, from medial to lateral.





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 101 (NRS 101) (appendix F)

  Short-form McGill Pain Questionnaire (S-FMPQ) (appendix G)
- Objective data: Algometer readings (appendix H)

  Myofascial diagnostic scale (appendix F)

3.4.2 Secondary data

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

3.5 METHODS OF MEASUREMENT

The subjective and objective measurements were obtained from each patient at the initial consultation, prior to the first treatment, and again at the second consultation (prior to the second treatment) and finally at the fourth consultation, immediately following the final treatment.

3.5.1 Subjective measurements

3.5.1.1 Short-form McGill Pain Questionnaire

The S-FMPQ (appendix G) is an easy to understand and quick to use derivation of the widely used Long-form MPQ, used for the measurement of pain (Melzack, 1987:191). It consists of 15 descriptors of pain, rated on an intensity scale as 0=none, 1=mild, 2=moderate or 3=severe, and it provides information on the sensory, affective and overall intensity of pain (Melzack, 1987:191).

The S-FMPQ was chosen as a subjective measurement for this study, as it has been reported by Melzack (1987:191) to be sensitive to traditional clinical therapies (eg. analgesics, TENS), it takes 2-5 minutes to administer and the intensity ranking of mild/ moderate/ severe was easy to understand by all patients presented with the form.

On completion of the questionnaire, the points were added to form a final score out a maximum of 45 points for each consultation.

3.5.1.2 Numerical pain rating scale 101

The NRS 101 (Appendix F) is a scale which asks the patient to rate his/her pain intensity on a numerical scale form 0-100, where 0=no pain and 100=pain as bad as it could be.

Whilst similar in most respects to other pain intensity scales, in a study by Jensen, Karoly and Braver (1986), comparing 6 methods on 75 chronic pain patients, the NRS 101 was deemed the most practical index to use for 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.

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

3.5.2 Objective measurements

3.5.2.1 Pressure threshold Algometry

Algometer readings were taken to measure changes in pressure pain threshold for each patient over the course of research treatments (Appendix H). Pressure threshold is referred to by Fischer (1987:207), as the minimum pressure that induces pain or discomfort. This form of measurement has been proven to be useful for diagnosis of trigger points and particularly for the assessment of treatment results (Fischer 1987:207). It's reliability as a tool for quantifying TrP sensitivity has further been demonstrated in studies by Reeves et al. (1986) and Fischer (1986 and 1987).

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.

The procedure as recommended by Fischer (1986) was as follows:

- The dial on the gauge was set to zero.
- The 1cm rubber disc was placed on the point of maximum tenderness (perpendicular to the skin's surface).
- The pressure was increased at a rate of $1kg/cm^{-2}/sec$.
- The patient was asked to indicate by saying "now", the point at which pain was first perceived.
- The pressure was stopped at this point by removing the gauge from the skin and the reading was taken.

For patients with more than one active TrP, a single measurement was obtained for each consultation by determining the mean of the recorded values.

3.5.2.2 Myofascial Diagnostic Scale

The Myofascial Diagnostic Scale (appendix F) is an objective scale, which was designed and used to evaluate the clinical signs of Myofascial Pain Syndrome, for a similar study by Chettiar (2001).

The Myofascial Diagnostic Scale is based on a combination of diagnostic signs of Myofascial Pain Syndrome as outlined by Travell, Simons and Simons (1999 1:34-35). These include: recognized referred pain that reproduces the patient's pain complaint, local twitch response, palpable taut band and spot tenderness.

As outlined by Chettiar (2001), the Myofascial Diagnostic Scale is made up of 4 indicators. The first indicator consisted of 5 grades of soft tissue tenderness:

0=no tenderness (0 points)

1=tenderness to palpation without grimace or flinch (1 point)

2=tenderness to palpation with grimace or flinch (2 points)

3=tenderness with withdrawal (3 points)

4=withdrawal to non-noxious stimulus (4 points).

The second and third indicators represent the presence of a local twitch response and taut band respectively (each given a value of 4 points). The fourth indicator is the presence of a recognized referred pain complaint to compression of the TrP (given a value of 5 points, as it is the strongest indicator of active TrPs as stated by Travell, Simons and Simons, 1999 1:34). Total point values of 9 or more for each TrP evaluated were indicative of active TrPs and these values were used to standardize the inclusion of patients (Chettiar, 2001).

For patients with more than one active TrP, a single score was obtained for each consultation by determining the mean of the recorded values.

Although no studies have been conducted determining the reliability of this scale, it was used in this study to provide some form of comparison to Chettiar's study (2001). Problems encountered with the scale and recommendations for its further use are discussed in chapters 5&6.

3.6 ETHICAL CONSIDERATIONS

The rights and welfare of the patient were protected.

Informed consent was obtained (appendix I).

The patient was not coerced into participating in the study.

Information was given to the patient in an understandable language.

The research involved no more than minimal risk.

Confidentiality was maintained.

Participation was voluntary and did not involve financial benefit.

The patient was free to withdraw from the study at any stage.

3.7 TREATMENT OF THE DATA

The subjective data were treated as follows:

-The scores obtained from the NRS 101 questionnaires were expressed as mean percentages for each consultation.

-The scores obtained from the Short-form McGill Pain Questionnaire were expressed as whole numbers with a highest possible score of 45. A whole number was obtained for each consultation by adding the value of the ticks ascribed to each column (0= none, 1= mild, 2= moderate, 3= severe).

-The data was then statistically analyzed.

The objective data were treated as follows:

-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 Myofascial Diagnostic Scale scores were expressed as whole numbers, the highest possible score being 17. A single score for each consultation was also obtained by determining the mean of the recorded values.

-The data was then 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

Since the sample size for each group was large ($n \geq 30$), both parametric and non-parametric tests were used for inter- and intra-group analysis. Non-

parametric tests were used to analyze categorical variables (variables measured in nominal or ordinal scales). Parametric tests were used to analyze continuous variables.

3.8.2 Inter-group comparison using Mann Whitney U-test

The Mann Whitney U-test was used for the inter-group comparison of each of the categorical variables (McGill and Myofascial Diagnostic Scale). In each test, the null hypothesis (H_0) states that there is no difference between the 2 independent samples being compared, with respect to the variable being tested, at the α=0.05 level of significance. The alternative hypothesis (H_1) states that there is a difference.

H_0: There is no difference between groups.

H_1: There is a difference between 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 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 2 independent samples being compared, with respect to the variable being tested, at the α=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.

α =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.

3.8.4 Intra-group comparison using Friedman's test

The Friedman's test was used for intra-group comparison of each of the categorical variables (McGill and Myofascial Diagnostic Scale). This test compares three or more related samples, giving only an overall significance level. In each test, the null hypothesis (H_0) stated that there is no difference among the three related samples (repeated measures) being compared, with respect to the variable being tested, at the α=0.05 level of significance. The alternative hypothesis (H_1) states that there is a difference.

H_0: There is no difference between treatments.

H_1: There is a difference between treatments.

$\alpha = 0.05$

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.

If the null hypothesis is rejected for the Friedman's test, then a multiple comparison procedure is applied to determine which of the treatments were significantly different. The Dunn's post test is performed (Daniel, 1978).

Let R_j and $R_{j'}$ be the j^{th} and j'^{th} treatment rank totals.

Let α be the experimentwise error rate. Usually $\alpha = 0.10$.

Decision rule for Dunn's procedure-

If $|R_j - R_{j'}| \geq z\sqrt{\frac{bk(k+1)}{6}}$, then R_j and $R_{j'}$ are declared significant.

In the above formula:

b = no. of blocks/treatments

k = no. of treatments

z = value in the inverse nomal distribution corresponding to $(1-[\alpha/k(k-1)])$.

To compute the treatment rank totals, the values in each block were ranked and the sum of ranks for each treatment were computed. These ranks are shown in brackets in the computed tables in chapter 4.

When $k = 3$, $\alpha = 0.10$, $z = 2.12$

3.8.5 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 2 related samples being compared, with respect to the variable being tested, at the α=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

CHAPTER FOUR: 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)

-Short-form McGill Pain Questionnaire (S-FMPQ)

-Algometer readings

-Myofascial Diagnostic scale.

4.2 CRITERIA FOR GOVERNING THE ADMISSIBILITY OF DATA

The data collected was only used from those patients who met the research criteria and who participated for the full duration of the research program. Only objective data (Algometer readings, MDS scores) that were recorded by the researcher were utilized. Only subjective data (NRS and McGill) that were completed by the patients under the supervision of the researcher were utilized.

4.3 TABLES OF DEMOGRAPHIC DATA

Table 1: Gender distribution

Gender	Group 1 (placebo)	Group 2 (treatment)	Total % of patients
No. of males	6	11	28.3
No. of females	24	19	71.7

Table 2: Age distribution

Age group	Group 1 (placebo)	Group 2 (treatment)	Total % of patients
16 – 20	8	3	18.3
21 – 25	4	8	20
26 – 30	5	3	13.3
31 – 35	3	4	11.7
36 – 40	2	2	6.7
41 – 45	5	1	10
46 – 50	3	6	15
50 – 55	0	3	5

Table 3: Race distribution

Race	Group 1 (placebo)	Group 2 (treatment)	Total % of patients
White	13	21	56.7
Black	4	1	8.3
Indian	10	8	30
Mixed race	3	0	5

Table 4: Patient occupations

Occupation	Group 1 (placebo)	Group 2 (treatment)	Total % of patients
Student	13	10	38.3
Businessman/woman	3	6	15
House-wife	5	1	10
Designer	1	1	3.3
Secretary/ receptionist	4	4	13.3
Sales assistant	1	0	1.7
Reflexologist/therapist	1	1	3.3
Accountant	1	0	1.7
Restaurant manager	0	1	1.7
Lawyer	0	1	1.7
Unemployed	1	1	3.3
Security officer	0	1	1.7
Lecturer	0	3	5

Table 5: Activity most commonly associated with aggravating the pain

Activity	Group 1 (placebo)	Group 2 (treatment)	Total % of patients
Working at a P.C/desk, incl. studying	18	16	56.7
Carrying heavy objects/ children	6	3	15
Driving	0	2	3.3
Using the phone	0	2	3.3
Sport (incl. Weight training and surfing)	1	3	6.7
Sleeping posture	0	1	1.7
Exposure to cold	2	1	5
Massaging	1	1	3.3
Emotional stress	1	1	3.3
House work	1	0	1.7

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 1 & 2, with regards to objective findings

Table 6 : Inter-group comparison between groups 1&2, using the Unpaired t-test to analyze results obtained from the Algometer readings, at consultations 1, 2 & 4.

Algometer readings							
	Group 1 (placebo)				Group 2 (treatment)		
	mean	S.D	S.E	P-value	mean	S.D	S.E
Cons. 1	2.2947	0.7247	0.1323	**0.121**	2.6258	0.8970	0.1638
Cons. 2	2.3687	0.7087	0.1294	**0.013**	2.9145	0.9221	0.1684
Cons. 4	2.5287	0.7161	0.1307	**0.000**	3.5673	1.1636	0.2124

For consultation 1, the null hypothesis was accepted for the algometer readings, indicating that there was no difference between groups 1&2, at the $\alpha = 0.05$ level.

For consultation 2, the null hypothesis was rejected for the algometer readings, indicating that there was a statistically significant difference between groups 1&2, at the $\alpha = 0.05$ level.

For consultation 4, the null hypothesis was rejected for the algometer readings, indicating that there was a statistically significant difference between groups 1&2, at the $\alpha = 0.05$ level.

Table 7 : Inter-group comparison between groups 1&2, using the Mann Whitney U-test to analyze results obtained from the Myofascial Diagnostic Scale, at consultations 1, 2 & 4.

Myofascial Diagnostic Scale							
	Group 1 (placebo)				Group 2 (treatment)		
	mean	S.D	S.E	P-value	mean	S.D	S.E
Cons. 1	13.367	0.8899	0.1625	**0.270**	12.275	1.1302	0.2063
Cons. 2	11.677	2.1103	0.3853	**0.056**	10.795	1.9236	0.3512
Cons. 4	9.5000	2.6482	0.4835	**0.049**	8.0233	3.0911	0.5644

For consultation 1, the null hypothesis was accepted for the Myofascial Diagnostic Scale, indicating that there was no difference between groups 1&2, at the $\alpha = 0.05$ level.

For consultation 2, the null hypothesis was accepted for the Myofascial Diagnostic Scale, indicating that there was no difference between groups 1&2, at the $\alpha = 0.05$ level.

For consultation 4, the null hypothesis was rejected for the Myofascial Diagnostic Scale, indicating that there was a statistically significant difference between groups 1&2, at the $\alpha = 0.05$ level.

4.4.2 Tables of the statistical results of inter-group comparison for groups 1 & 2, with regards to subjective findings

Table 8 : Inter-group comparison between groups 1&2, using the Mann Whitney U-test to analyze results obtained from the Short-form McGill Pain Questionnaire, at consultations 1, 2 & 4.

Short-form McGill Pain Questionnaire							
	Group 1 (placebo)				Group 2 (treatment)		
	mean	S.D	S.E	P-value	mean	S.D	S.E
Cons.1	12.600	8.0541	1.4705	**0.657**	13.500	7.8158	1.4270
Cons.2	8.3000	7.4748	1.3647	**0.393**	7.3000	6.9389	1.2669
Cons.4	5.6333	5.4740	0.9994	**0.093**	3.6667	3.7996	0.6937

For consultation 1, the null hypothesis was accepted for the Short-form McGill Pain Questionnaire, indicating that there was no difference between groups 1&2, at the $\alpha = 0.05$ level.

For consultation 2, the null hypothesis was accepted for the Short-form McGill Pain Questionnaire, indicating that there was no difference between groups 1& 2, at the $\alpha = 0.05$ level.

For consultation 4, the null hypothesis was also accepted, indicating that there was no difference between groups 1&2, at the $\alpha = 0.05$ level.

Table 9 : Inter-group comparison between groups 1&2, using the Unpaired t-test to analyze results obtained from the NRS 101 questionnaire, at consultations 1, 2 & 4.

NRS 101							
	Group 1 (placebo)				Group 2 (treatment)		
	mean	S.D	S.E	P-value	mean	S.D	S.E
Cons. 1	56.100	16.263	2.9692	**0.363**	52.883	10.222	1.8663
Cons. 2	45.950	17.310	3.1604	**0.050**	36.700	18.519	3.3810
Cons. 4	39.267	18.399	3.3593	**0.000**	20.700	19.067	3.4812

For consultation 1, the null hypothesis was accepted for the NRS 101 questionnaire, indicating that there was no difference between groups 1&2, 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 1&2, at the $\alpha = 0.05$ level.

For consultation 4, the null hypothesis was rejected for the NRS 101 questionnaire, indicating that there was a statistically significant difference between groups 1&2, at the $\alpha = 0.05$ level.

4.4.3 Tables of the statistical results of intra-group comparison for groups 1 & 2, with regards to objective findings

Table 10: Intra-group comparison for groups 1&2, using Friedman's test to analyze results obtained from the Myofascial Diagnostic Scale, at consultations 1, 2 and 4.

Myofascial Diagnostic Scale						
	Group 1 (placebo)			Group 2 (treatment)		
	Cons. 1	Cons. 2	Cons. 4	Cons. 1	Cons. 2	Cons. 4
Mean	12.3667	11.6767	9.5000	12.2750	10.7950	8.0233
S.D	0.8899	2.1103	2.6482	1.1302	1.9236	3.0911
S.E	0.1625	0.3853	0.4835	0.2063	0.3512	0.5644
P- value	**0.000**			**0.000**		

For group 1, the null hypothesis was rejected for the Myofascial Diagnostic Scale, indicating that there was a statistically significant difference between consultations, at the $\alpha = 0.05$ level of significance.

For group 2, the null hypothesis was rejected for the Myofascial Diagnostic Scale, indicating that there was also a statistically significant difference between consultations for this group, at the $\alpha = 0.05$ level of significance.

Since the null hypothesis was rejected for the Myofascial Diagnostic Scale, the Dunn's procedure (multiple comparison test) was performed to determine which of the treatments were significantly different, for both groups 1&2.

Table 11: Treatment ranks and rank totals for the Myofascial Diagnostic Scale, group 1, at consultations 1,2 & 4.

Myofascial Diagnostic Scale			
Blocks	Consultation 1	Consultation 2	Consultation 4
1	10 (2.5)	10 (2.5)	6.25 (1)
2	11 (2)	11 (2)	11 (2)
3	12 (2)	13 (3)	10 (1)
4	13 (3)	12 (2)	11 (1)
5	13 (2.5)	13 (2.5)	9.5 (1)
6	13 (2.5)	8 (1)	13 (2.5)
7	13 (3)	9.3 (2)	8 (1)
8	13 (3)	8 (1)	12 (2)
9	11 (2.5)	11 (2.5)	8 (1)
10	10 (1)	16 (3)	11 (2)
11	12 (2.5)	12 (2.5)	10 (1)
12	13 (2.5)	13 (2.5)	7 (1)
13	13 (2)	13 (2)	13 (2)
14	13 (2.5)	13 (2.5)	8 (1)
15	13 (3)	7 (1.5)	7 (1.5)
16	12 (2)	13 (3)	4 (1)
17	13 (2.5)	13 (2.5)	12 (1)
18	12 (1.5)	13 (3)	12 (1.5)
19	13 (2)	13 (2)	13 (2)
20	12 (2)	13 (3)	9.5 (1)
21	13 (2)	13 (2)	13 (2)
22	13 (3)	8 (1)	12 (2)
23	12 (2.5)	12 (2.5)	6 (1)
24	13 (2.5)	13 (2.5)	12 (1)
25	13 (2.5)	13 (2.5)	12 (1)
26	13 (2.5)	13 (2.5)	5 (1)
27	13 (3)	12 (2)	8 (1)
28	12 (3)	8 (1.5)	8 (1.5)
29	12 (2.5)	12 (2.5)	7 (1)
30	12 (2.5)	12 (2.5)	7 (1)
Sum of ranks	**72.5**	**67.5**	**40**

$R_1 = 72.5$ $R_2 = 67.5$ $R_3 = 40$

b = 30 (no. of blocks) k = 3 (no.of treatments) z = 2.12

If $|R_j - R_{j'}| \geq z \sqrt{\frac{bk(k+1)}{6}}$

$\geq 2.12 \sqrt{\frac{30x3(3+1)}{6}}$

$\geq 2.12 \sqrt{60}$

$\geq 2.12 \times 7.746$

≥ 16.42, then R_j and $R_{j'}$ are declared significant.

$|R_1 - R_2| = |72.5 - 67.5|$

$= 5$

Since $5 < 16.42$, R_1 and R_2 were not declared significantly different.

Thus, there was no significant difference between treatments 1&2.

$|R_2 - R_3| = |67.5 - 40|$

$= 27.5$

Since $27.5 > 16.42$, R_2 and R_3 were declared significantly different.

Thus, there was a significant difference between treatments 2&4.

$|R_1 - R_3| = |72.5 - 40|$

$= 32.5$

Since $32.5 > 16.42$, R_1 and R_3 were declared significantly different.

Thus, there was a significant difference between treatments 1&4.

Table12: Treatment ranks and rank totals for the Myofascial Diagnostic Scale, group 2, at consultations 1,2 & 4.

Myofascial Diagnostic Scale			
Blocks	Consultation 1	Consultation 2	Consultation 4
1	13 (3)	12 (1.5)	12 (1.5)
2	13.5 (3)	12 (2)	6 (1)
3	12 (2.5)	12 (2.5)	5 (1)
4	13 (2.5)	13 (2.5)	5 (1)
5	12 (3)	8 (2)	5 (1)
6	12 (3)	11 (2)	5 (1)
7	11 (3)	8.5 (1.5)	8.5 (1.5)
8	13 (2)	13 (2)	13 (2)
9	12 (3)	8 (1)	10 (2)
10	13 (3	8 (1.5)	8 (1.5)
11	11 (3)	8 (2)	5 (1)
12	12.5(3)	11 (2)	9 (1)
13	12 (3)	10 (2)	7.5 (1)
14	12 (2)	13 (3)	5 (1)
15	13 (2.5)	13 (2.5)	12 (1)
16	13 (3)	8 (2)	5.75 (1)
17	13 (3)	12 (2)	5 (1)
18	12 (3)	8.6 (2)	5 (1)
19	12 (1.5)	12.5 (3)	12 (1.5)
20	12 (2)	12 (2)	12 (2)
21	10.75 (2.5)	10.75 (2.5)	6.25 (1)
22	16.5 (3)	12 (2)	11 (1)
23	11 (3)	10 (2)	9 (1)
24	11 (2)	9 (1)	12 (3)
25	12 (2.5)	12 (2.5)	6.2 (1)
26	13 (2)	14 (3)	12 (1)
27	11 (3)	8.5 (2)	2 (1)
28	11 (2.5)	11 (2.5)	7.5 (1)
29	13 (2.5)	13 (2.5)	7 (1)
30	12 (2.5)	10 (1)	12 (2.5)
Sum of ranks	**79.5**	**62**	**38.5**

$R_1 = 79.5$ $R_2 = 62$ $R_3 = 38.5$

b = 30 (no. of blocks) k = 3 (no.of treatments) z = 2.12

If $|R_j - R_{j'}| \geq z \sqrt{\frac{bk(k+1)}{6}}$

$\geq 2.12 \sqrt{\frac{30x3(3+1)}{6}}$

$\geq 2.12 \sqrt{60}$

$\geq 2.12 \times 7.746$

≥ 16.42, then R_j and $R_{j'}$ are declared significant.

$|R_1 - R_2| = |79.5 - 62|$

$= 17.5$

Since $17.5 > 16.42$, R_1 and R_2 were declared significantly different.

Thus, there was a significant difference between treatments 1&2.

$|R_2 - R_3| = |62 - 38.5|$

$= 23.5$

Since $23.5 > 16.42$, R_2 and R_3 were declared significantly different.

Thus, there was a significant difference between treatments 2&4.

$|R_1 - R_3| = |79.5 - 38.5|$

$= 41$

Since $41 > 16.42$, R_1 and R_3 were declared significantly different.

Thus, there was a significant difference between treatments 1&4.

Table 13 : Intra-group comparison for groups 1&2, using the Paired-t test to analyze results obtained from the Algometer readings, between consultations 1&2.

Algometer readings				
	Group 1 (placebo)		Group 2 (treatment)	
	Cons. 1	Cons. 2	Cons. 1	Cons. 2
Mean	2.2947	2.3687	2.6258	2.9145
S.D	0.7247	0.7087	0.8970	0.9221
S.E	0.1323	0.1294	0.1638	0.1684
P-val/2	0.286/2 = 0.143		0.027/2 = 0.0135	
P- value	**0.143**		**0.0135**	

For group 1, the null hypothesis was accepted for the Algometer readings, indicating that there was no improvement between consultations 1&2, at the $\alpha = 0.05$ level of significance.

For group 2, the null hypothesis was rejected for the Algometer readings, indicating that there was a statistically significant improvement between consultations 1&2 for this group, at the $\alpha = 0.05$ level of significance.

Table 14 : Intra-group comparison for groups 1&2, using the Paired-t test to analyze results obtained from the Algometer readings, between consultations 2&4.

Algometer readings				
	Group 1 (placebo)		Group 2 (treatment)	
	Cons. 2	Cons. 4	Cons. 2	Cons. 4
Mean	2.3687	2.5287	2.9145	3.5673
S.D	0.7087	0.7161	0.9221	0.1684
S.E	0.1294	0.1307	0.1684	0.2124
P-val/2	0.015/2 = 0.0075			
P- value	**0.0075**		**0.000**	

For group 1, the null hypothesis was rejected for the Algometer readings, indicating that there was a statistically significant improvement between consultations 2&4, at the $\alpha = 0.05$ level of significance.

For group 2, the null hypothesis was rejected for the Algometer readings, indicating that there was also a statistically significant improvement between consultations 2&4 for this group, at the $\alpha = 0.05$ level of significance.

Table 15 : Intra-group comparison for groups 1&2, using the Paired-t test to analyze results obtained from the Algometer readings, between consultations 1&4.

Algometer readings				
	Group 1 (placebo)		Group 2 (treatment)	
	Cons. 1	Cons. 4	Cons. 1	Cons. 4
Mean	2.2947	2.5287	2.6258	3.5673
S.D	0.7247	0.7161	0.8970	1.1636
S.E	0.1323	0.1307	0.1638	0.2124
P-val/2	0.021/2 = 0.0105			
P- value	**0.0105**		**0.000**	

For group 1, the null hypothesis was rejected for the Algometer readings, indicating that there was a statistically significant improvement between consultations 1&4, at the $\alpha = 0.05$ level of significance.

For group 2, the null hypothesis was rejected for the Algometer readings, indicating that there was also a statistically significant improvement between consultations 1&4 for this group, at the $\alpha = 0.05$ level of significance.

4.4.4 Tables of the statistical results of intra-group comparison for groups 1 & 2, with regards to subjective findings

Table16 : Intra-group comparison for groups 1&2, using Friedman's test to analyze results obtained from the Short-form McGill Pain Questionnaire at consultations 1, 2 and 4.

Short-form McGill Pain Questionnaire						
	Group 1 (placebo)			Group 2 (treatment)		
	Cons. 1	Cons. 2	Cons. 4	Cons. 1	Cons. 2	Cons. 4
Mean	12.6000	8.3000	5.6333	13.5000	7.3000	3.6667
S.D	8.0541	7.4748	5.4740	7.8158	6.9389	3.7996
S.E	1.4705	1.3647	0.9994	1.4270	1.2669	0.6937
P- value	**0.000**			**0.000**		

For group 1, the null hypothesis is rejected for the Short-form McGill Pain Questionnaire at the $\alpha = 0.05$ level of significance, indicating that there was a statistically significant difference between consultations.

For group 2 the null hypothesis was rejected for the Short-form McGill Pain Questionnaire at the $\alpha = 0.05$ level, indicating that there was also a statistically significant difference between consultations within this group.

Since the null hypothesis was rejected for the Short-form McGill Pain Questionnaire, the Dunn's procedure (multiple comparison test) was performed to determine which of the treatments were significantly different, for both groups 1&2.

Table 17: Treatment ranks and rank totals for the Short-form McGill Pain Questionnaire, group 1, at consultations 1,2 & 4.

Short-form McGill Pain Questionnaire			
Blocks	Consultation 1	Consultation 2	Consultation 4
1	11 (3)	2 (1)	6 (2)
2	31 (3)	28 (2)	19 (1)
3	22 (3)	14 (2)	5 (1)
4	5 (3)	4 (2)	3 (1)
5	18 (3)	11 (2)	3 (1)
6	8 (2)	1 (1)	10 (3)
7	15 (3)	2 (1.5)	2 (1.5)
8	15 (3)	10 (2)	3 (1)
9	2 (2)	2 (2)	2 (2)
10	7 (3)	5 (2)	2 (1)
11	11 (3)	7 (2)	5 (1)
12	4 (3)	3 (1.5)	3 (1.5)
13	8 (2)	10 (3)	2 (1)
14	10 (3)	8 (2)	7 (1)
15	7 (3)	6 (2)	5 (1)
16	4 (3)	3 (2)	0 (1)
17	27 (3)	25 (25)	22 (1)
18	16 (3)	13 (2)	4 (1)
19	18 (3)	10 (1)	13 (2)
20	33 (3)	30 (2)	11 (1)
21	18 (3)	10 (2)	4 (1)
22	17 (3)	7 (1)	15 (2)
23	8 (3)	5 (2)	0 (1)
24	11 (3)	6 (2)	4 (1)
25	13 (3)	4 (1.5)	4 (1.5)
26	6 (3)	2 (2)	0 (1)
27	9 (3)	4 (1.5)	4 (1.5)
28	3 (2.5)	3 (2.5)	1 (1)
29	4 (2.5)	4 (2.5)	2 (1)
30	17 (3)	10 (2)	8 (1)
Sum of ranks	**86**	**56**	**38**

$R_1 = 86$ $R_2 = 56$ $R_3 = 38$

b = 30 (no. of blocks) k = 3 (no.of treatments) z = 2.12

If $|R_j - R_{j'}| \geq z \sqrt{\frac{bk(k+1)}{6}}$

$\geq 2.12 \sqrt{\frac{30x3(3+1)}{6}}$

$\geq 2.12 \sqrt{60}$

$\geq 2.12 \times 7.746$

≥ 16.42, then R_j and $R_{j'}$ are declared significant.

$|R_1 - R_2| = |86 - 56|$

$= 30$

Since $30 > 16.42$, R_1 and R_2 were declared significantly different.

Thus, there was a significant difference between treatments 1&2.

$|R_2 - R_3| = |56 - 38|$

$= 18$

Since $18 > 16.42$, R_2 and R_3 were declared significantly different.

Thus, there was a significant difference between treatments 2&4.

$|R_1 - R_3| = |86 - 38|$

$= 48$

Since $48 > 16.42$, R_1 and R_3 were declared significantly different.

Thus, there was a significant difference between treatments 1&4.

Table 18: Treatment ranks and rank totals for the Short-form McGill Pain Questionnaire, group 2, at consultations 1,2 & 4.

Short-form McGill Pain Questionnaire			
Blocks	Consultation 1	Consultation 2	Consultation 4
1	12 (3)	7 (2)	3 (1)
2	7 (3)	4 (2)	1 (1)
3	5 (3)	2 (2)	0 (1)
4	15 (3)	8 (2)	4 (1)
5	13 (3)	3 (2)	0 (1)
6	14 (3)	1 (2)	0 (1)
7	24 (3)	23 (2)	8 (1)
8	17 (3)	6 (1.5)	6 (1.5)
9	10 (2)	13 (3)	9 (1)
10	10 (3)	5 (2)	3 (1)
11	8 (3)	1 (2)	0 (1)
12	6 (3)	3 (2)	1 (1)
13	8 (2)	5 (1)	14 (3)
14	6 (2)	10 (3)	1 (1)
15	9 (3)	7 (1.5)	7 (1.5)
16	25 (3)	16 (2)	12 (1)
17	31 (3)	20 (2)	0 (1)
18	12 (3)	3 (1.5)	3 (1.5)
19	14 (3)	4 (2)	3 (1)
20	21 (3)	5 (2)	2 (1)
21	5 (3)	2 (2)	0 (1)
22	16 (3)	3 (2)	2 (1)
23	15 (3)	3 (1)	7 (2)
24	10 (3)	6 (1)	9 (2)
25	26 (3)	19 (2)	6 (1)
26	34 (3)	27 (2)	2 (1)
27	8 (3)	3 (2)	1 (1)
28	6 (2.5)	6 (2.5)	1 (1)
29	12 (3)	3 (2)	1 (1)
30	6 (3)	1 (1)	4 (2)
Sum of ranks	**86.5**	**57**	**36.5**

$R_1 = 86.5$ $R_2 = 57$ $R_3 = 36.5$

b = 30 (no. of blocks) k = 3 (no.of treatments) z = 2.12

If $|R_j - R_{j'}| \geq z\sqrt{\frac{bk(k+1)}{6}}$

$\geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$

$\geq 2.12\sqrt{60}$

$\geq 2.12 \times 7.746$

≥ 16.42, then R_j and $R_{j'}$ are declared significant.

$|R_1 - R_2| = |86.5 - 57|$

$= 29.5$

Since $29.5 > 16.42$, R_1 and R_2 were declared significantly different.

Thus, there was a significant difference between treatments 1&2.

$|R_2 - R_3| = |57 - 36.5|$

$= 20.5$

Since $20.5 > 16.42$, R_2 and R_3 were declared significantly different.

Thus, there was a significant difference between treatments 2&4.

$|R_1 - R_3| = |86.5 - 36.5|$

$= 50$

Since $50 > 16.42$, R_1 and R_3 were declared significantly different.

Thus, there was a significant difference between treatments 1&4.

Table 19 : Intra-group comparison for groups 1&2, using the Paired-t test to analyze results obtained from the NRS 101 Questionnaire, between consultations 1&2.

NRS 101				
	Group 1 (placebo)		Group 2 (treatment)	
	Cons. 1	Cons. 2	Cons. 1	Cons. 2
Mean	56.1000	45.9500	52.8833	36.7000
S.D*	16.2613	17.3102	10.2223	18.5187
S.E*	2.9692	3.1604	1.8663	3.3810
P- value	**0.000**		**0.000**	

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

Table 20 : Intra-group comparison for groups 1&2, using the Paired-t test to analyze results obtained from the NRS 101 Questionnaire, between consultations 2&4.

NRS 101				
	Group 1 (placebo)		Group 2 (treatment)	
	Cons. 2	Cons. 4	Cons. 2	Cons. 4
Mean	45.9500	39.2667	36.7000	20.7000
S.D*	17.3102	18.3997	18.5187	19.0673
S.E*	3.1604	3.3593	3.3810	3.4812
P-val/2	0.009/2 = 0.0045			
P- value	**0.0045**		**0.000**	

For group 1, the null hypothesis was rejected for the NRS 101 questionnaire, indicating that there was a statistically significant difference between consultations 2&4, at the $\alpha = 0.05$ level.

For group 2, the null hypothesis was rejected for the NRS 101 questionnaire, indicating that there was also a statistically significant difference between consultations 2&4 for this group, at the $\alpha = 0.05$ level.

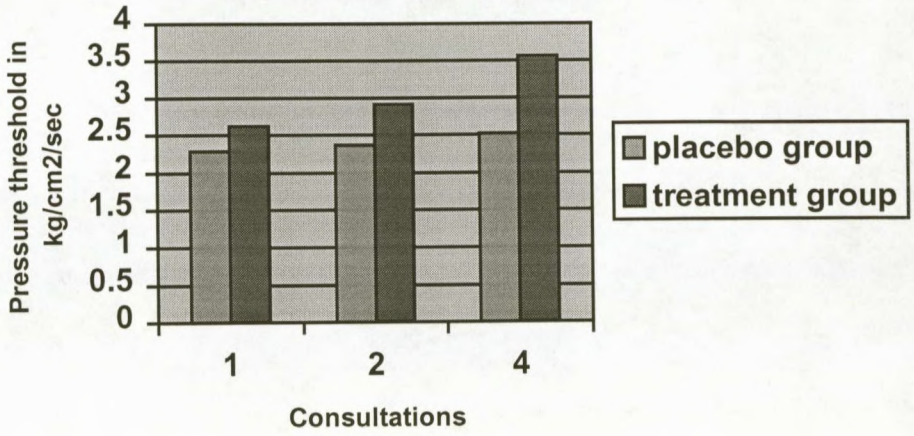
Table 21 : Intra-group comparison for groups 1&2, using the Paired-t test to analyze results obtained from the NRS 101 Questionnaire, between consultations 1&4.

NRS 101				
	Group 1 (placebo)		Group 2 (treatment)	
	Cons. 1	Cons. 4	Cons. 1	Cons. 4
Mean	56.1000	39.2667	52.8833	20.7000
S.D*	16.2613	18.3997	10.2223	19.0673
S.E*	2.9692	3.3593	1.8663	3.4812
P- value	**0.000**		**0.000**	

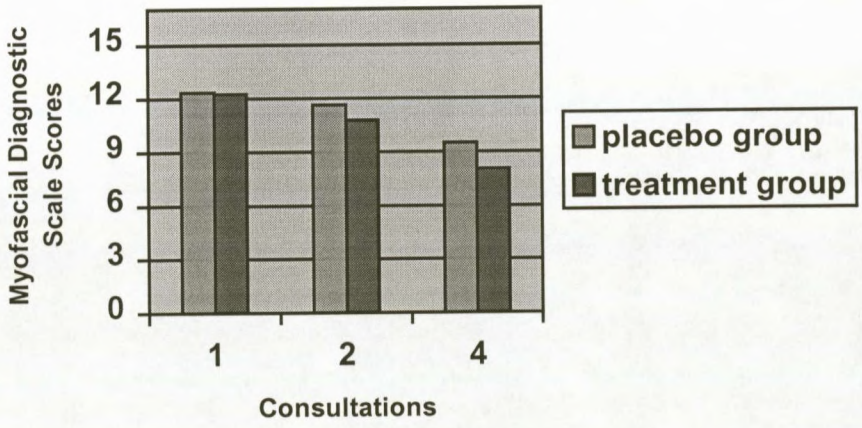
For group 1, the null hypothesis was rejected for the NRS 101 questionnaire, indicating that there was a statistically significant difference between consultations 1&4, at the $\alpha = 0.05$ level.

For group 2, the null hypothesis was rejected for the NRS 101 questionnaire, indicating that there was also a statistically significant difference between consultations 1&4 for this group, at the $\alpha = 0.05$ level.

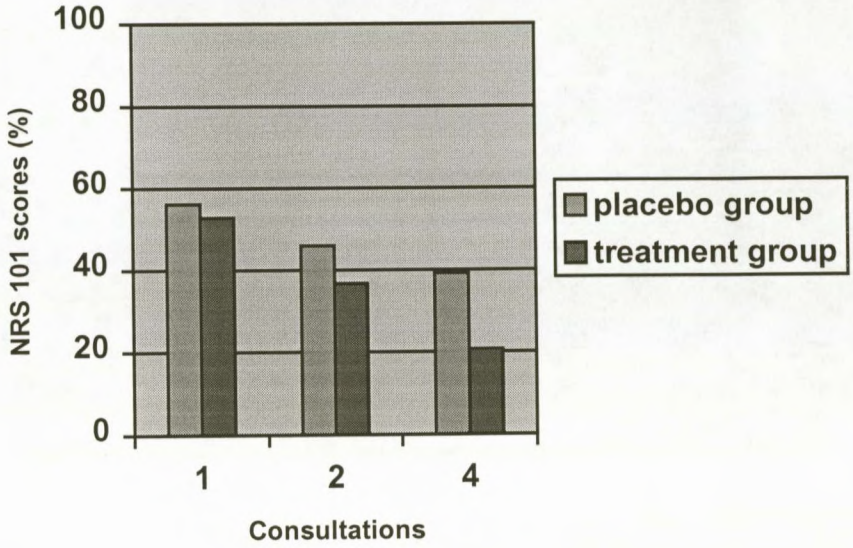
Graph 1: Mean values for groups 1 & 2, Algometer readings, at consultations 1,2 & 4.



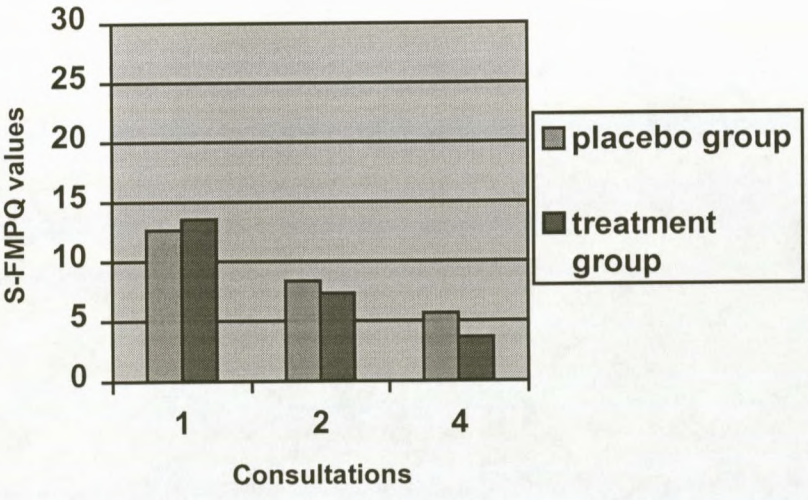
Graph 2: Mean values for groups 1 & 2, Myofascial Diagnostic Scale, at consultations 1, 2 & 4.



Graph 3: Mean values for groups 1 & 2, NRS 101 scores, at consultations 1,2 & 4.



Graph 4: Mean values for groups 1 & 2, S-FMPQ, at consultations 1, 2 & 4.



CHAPTER FIVE: DISCUSSION OF THE RESULTS

5.1 INTRODUCTION

This chapter involves the discussion of the demographic data and the results of the statistical analysis of the objective and subjective data. It also includes a discussion of the problems encountered throughout the research program, including problems with study design and data obtained.

The results of statistical analysis are discussed in two parts, namely, objective and subjective results. These are further evaluated in terms of intra- and inter-group comparisons.

Evaluation of the intra-group results between the first and fourth consultations (overall measurement interval) gives an indication of the overall effectiveness of the treatment regime. Evaluation of the results between first and second consultations (first measurement interval) gives an indication of the initial effectiveness of the treatment regime, whilst evaluation of the results between consultations two and four, give an indication of the progression of the treatment regime.

Evaluation of the inter-group results of the first consultation reveal any variance in the subjective and objective findings between the two groups presenting at the start of the study. Similar evaluation at consultations two and

four reveal any difference in the overall improvement as well as the rate of improvement between the two groups.

5.2 DISCUSSION OF THE DEMOGRAPHIC DATA

Of the 60 patients that participated in the research program, 17 were male and 43 were female (Table 1). Both Sola, Rodenberger and Gettys (1955:587) and Han and Harrison (1997:90) state that Myofascial Pain Syndrome is more common in females, thus, this study shows a high degree of correlation with literature regarding the sex distribution of the above condition.

The age group chosen as an inclusion criterion for this study was between 16 and 55 years. Although Travell, Simons and Simons (1999 1:13) state that individuals in their mature years (between 31-50 years) are most likely to suffer from the condition, the age group of greatest prevalence in this study was 16 –30 years, and of those patients, most fell between the ages of 21 and 25 (20%) (Table 2). It is the opinion of the author that this was the age group of greatest prevalence because the study was carried out at a tertiary education institution and students had the widest exposure to advertisements and to the day clinic.

Evaluation of the race groups represented by this study show the majority of patients to be of Caucasian (56.7%) and Indian (30%) races respectively

(Table 3). Black patients made up 8.3% of the sample, whilst only 5% were of mixed race. This does not give a true representation of the race distribution of the general South African population. The Chiropractic profession is largely unknown by most black South Africans and this is the most likely explanation for the above results. Advertisements for the study were also posted in the area surrounding the Technikon, which is populated more by the white and Indian communities.

Of those patients that were accepted into the study, 38.3% were students, 15% were businessmen/women and 13.3% worked as secretaries or receptionists. These were the most common occupations recorded (Table 4) and they correlate with the high percentage (56.7%) of the patients who reported that working at a desk or in front of a computer was the activity most commonly associated with aggravating their condition (Table 5). Poor posture associated with prolonged sitting at a desk may explain the high prevalence of the condition with these patients (Han and Harrison 1997: 92).

5.3 DISCUSSION OF THE OBJECTIVE RESULTS

5.3.1 Algometer readings

Intra-group comparison

Evaluation of the results of the Paired t-test on algometric measurements taken at the first, second and fourth consultations revealed a statistically

significant improvement between consultations 1&2, 2&4 and 1&4 for the treatment group (Tables 13, 14 and 15).

Similar evaluation for the placebo group revealed a statistically significant improvement between consultations 2&4 and 1&4, but no improvement between consultations 1&2 (Tables 13, 14 and 15).

These findings suggest that both groups showed an increase in pressure threshold levels over the research program, but the treatment group showed a more rapid response, with improvement after only one treatment, which continued over the following consultations. A significant improvement within the placebo group was not expected, but possible reasons for this improvement are discussed in the summary on page 82.

Inter-group comparison

Statistical comparison of groups 1&2 using the Unpaired t-test at consultation one revealed no significant difference between the groups, which implied that there was minimal variance between groups with regards to this particular data collected at the initial consultation (Table 6).

Similar comparison at consultations 2 and 4 revealed a statistically significant difference between treatment and placebo groups at both consultations. By evaluating the mean values for each group, it was evident that the treatment

group showed a greater improvement in pressure threshold levels, confirming that this group performed more favourably than the placebo group (Table 6).

5.3.2 Myofascial Diagnostic Scale

Intra-group comparison

Evaluation of the statistical results of the Friedman's and Dunn's Post tests for the treatment group revealed a statistically significant improvement between consultations1&2, 2&4 and 1&4 with regards to the Myofascial Diagnostic Scale. The placebo group yielded the same results. (Tables 10, 11 and 12).

These findings suggest that both treatment and placebo groups showed a reduction in the clinical signs outlined in the Myofascial Diagnostic Scale, over the research program. The positive placebo effect may have occurred as a result of the inadequacy of the form of placebo used, but may also give an indication that the Myofascial Diagnostic Scale is somewhat subjective and its validity as a measurement tool needs to be determined. Problems encountered with the scale are discussed on p85.

Inter-group comparison

The Mann Whitney U-test for inter-group comparison of the Myofascial Diagnostic Scale data showed no difference between groups at consultation one, showing that there was minimal variance between groups with regard to the data collected at the initial consultation (Table 7).

Evaluation of the statistical results between groups at consultation two revealed no statistically significant difference between the treatment and placebo groups (Table 7).

Similar evaluation for consultation four revealed that there was a statistically significant difference between groups and the mean values showed that it was the treatment group that performed more favourably than the placebo group (Table 7). However, the p-value at consultation four was $p=0.049$, which lies very close to the $p=0.05$ level of significance. The statistical result shows a tendency towards significance and may have yielded different results if a larger sample size had been used.

The above results suggest that the treatment group showed a greater reduction in clinical signs than the placebo group, but only at the completion of the treatment regime. A follow-up period over 2-4 weeks would have been of interest to determine if the reduction in clinical signs continued or remained the same.

Of particular interest to the researcher are the mean values for both groups at consultation four. The placebo group has a mean value of 9.5, whereas the treatment group has a mean value of 8.02. According to the Myofascial Diagnostic Scale, a score of 9 or more indicates an active TrP, whilst scores of

less than 9 indicate latency. Thus, the treatment group showed a tendency for active TrPs to become latent over as few as four consultations, in 2-3 weeks.

5.4 DISCUSSION OF THE SUBJECTIVE RESULTS

5.4.1 Numerical Pain Rating Scale 101

Intra-group comparison

Evaluation of the results of intra-group comparison using the Unpaired t-test for the NRS 101 scores revealed a statistically significant improvement between consultations 1&2, 2&4 and 1&4 for both the treatment and placebo groups (Tables 19, 20 and 21).

These findings suggest that both the treatment and placebo groups showed a significant reduction in pain intensity over the research program.

Inter-group comparison

Comparison between the treatment and placebo group, using the Unpaired t-test at consultation one, revealed no significant difference between groups, indicating minimal variance with regards to NRS 101 data collected at the initial consultation (Table 9).

At consultation two, the same statistical test for NRS 101 data revealed no statistically significant difference between treatment and placebo groups,

whilst at consultation four, there was a statistically significant difference between groups. By analyzing the mean values for consultation four, it was evident that the treatment group responded more favourably than the placebo group. (Table 9).

These findings suggest that the treatment group showed a greater reduction in perceived pain intensity than the placebo group over the research program.

5.4.2 Short-Form McGill Pain Questionnaire

Intra-group comparison

Friedman's test and Dunn's Post test for intra-group comparison of S-FMPQ data revealed a statistically significant improvement between consultations 1&2, 2&4 and 1&4 for both the treatment and placebo groups (Tables 16,17 and 18).

These findings suggest that both the treatment and placebo groups showed a reduction in the quality and intensity of pain over the research program.

Inter-group comparison

Evaluation of the results obtained from the Mann Whitney U-test for inter-group comparison of S-FMPQ data revealed no difference between the treatment and placebo groups at consultations 1, 2 or 4 (Table 8). This result suggests that both groups responded equally to the respective treatment

regimes, with regards to the S-FMPQ. Since analysis of all other data collected showed differences between the two groups at the end of the treatment program, the use of the S-FMPQ for further studies using the same treatment technique is questionable. Observations made regarding Myofascial Adhesion Manipulation are discussed on p86 and these may explain the high S-FMPQ scores for the placebo group.

5.5 SUMMARY OF CLINICAL FINDINGS

The hypotheses that Myofascial Adhesion Manipulation would be an effective form of treatment for patients with Myofascial Pain Syndrome (hypothesis 1) and that it would be more effective than placebo (hypothesis 2) are both supported by this study.

Intra-group analysis of data obtained from the treatment group revealed significant improvements between consultations 1&2, 2&4 and 1&4 in terms of subjective and objective data. These results suggest that not only was the treatment regime effective over the research program, but it was effective after only one treatment and the improvement continued throughout the research program.

However, similar results were obtained for the placebo group, in terms of both subjective and objective data. This indicates that a positive placebo effect was

obtained. It is the opinion of the author that the choice of placebo treatment used in the study contributed to these results. The cooling effect of the ultrasound transmission gel and the metallic ultrasound head may have caused a physiological effect that resulted in favourable objective results. Han and Harrison (1997: 97) state that a sudden drop in skin temperature (by icing for example) may produce temporary anesthesia by blocking the sensation of pain at high centres. It is proposed that had a different placebo treatment been used, more accurate results would have been obtained.

Inter-group analysis of data obtained from treatment and placebo groups revealed significant differences between the groups at the end of the research program, in terms of algometric measurements, Myofascial Diagnostic Scale scores and the NRS 101 questionnaire. Only the Short-Form McGill Pain Questionnaire data analysis showed no difference between groups. These results suggest that the treatment group responded more favourably than the placebo group, even though there was a positive placebo effect. This is supported by two major findings. Firstly, the treatment group showed a tendency for active TrPs to become latent, as shown by Myofascial Diagnostic Scale scores, whereas the placebo group did not. Secondly, the algometric analysis showed a significant improvement between consultations 1&2 for the treatment group, but not for the placebo group, indicating that the treatment group responded more rapidly than the placebo group.

5.6 PROBLEMS ENCOUNTERED WITH THE DATA

5.6.1 Subjective data

The only problem encountered with subjective data within this study was a lack of understanding of the questionnaires by those patients whose home language was not English. Most of the black patients were unfamiliar with some of the descriptive terms used in the S-FMPQ and the researcher had to explain these terms to the best of her ability. It was still uncertain after explaining the terms whether or not those patients had a clear understanding. This may have had an effect on the statistical results. The NRS 101 questionnaire was easier to explain and it is the opinion of the author that all patients had a good understanding of how to complete the form.

5.6.2 Objective data

No problems were encountered with the use of the Algometer. The researcher found it to be an easy to use and reliable tool.

With regards to the Myofascial Diagnostic Scale, the author felt that it may have been moderately subjective. There was no way of determining whether the degree of pressure used to elicit tenderness over the TrP area was the same for each patient and this could have lead to researcher bias in favour of a particular treatment regime. Inter-examiner reliability testing would have to be done in an independent study in order to determine the validity of this statement.

The author also feels that the Myofascial Diagnostic Scale would not be reliable for testing all muscles. Chettiar (2001) reports that he had difficulty re-evaluating and re-finding TrPs found in the Gluteus Medius muscle, which may have resulted in inaccurate recording of diagnostic scores. This problem was not encountered in this study, but the author feels that studies using this scale to evaluate muscles that are not well exposed may show inaccurate results, especially where taut bands and local twitch response are difficult to locate or elicit. More research into the reliability of this scale is therefore required.

5.7 OBSERVATIONS: MYOFASCIAL ADHESION MANIPULATION

Owing to the fact that no studies prior to this have been conducted on Myofascial Adhesion Manipulation and very little written information exists on its application and mechanism of action, it is hoped that the following observations made throughout the research program may provide a basis for further studies and contribute to the literature currently available on this technique. These observations did not form part of the data collected and analyzed in the study, but are merely observations made by the author and would certainly require further study to determine their validity.

The first observation made was that most patients who received Myofascial Adhesion Manipulation were surprised by how much improvement they felt after the first treatment. At least 5 of the patients reported that they slept better following their first treatment, which was unusual for them since their sleep had continuously been interrupted due to pain prior to the treatment. It was the very short time it took to administer the treatment (roughly 30 seconds to treat all TrPs) that made the patients wary of its effectiveness, hence their surprise when an improvement was felt after one treatment.

There was a general opinion amongst the patients that responded to the treatment that their shoulders felt "looser" and they had less stiffness following the treatments. One patient reported that she felt as though "a weight had been lifted off her shoulders". It was, however, also observed that some patients reported feeling worse after the first treatment, with palpatory tenderness over the area that was treated. The author believes that this tenderness was largely surface/skin tenderness, which mostly likely influenced the patients subjective pain intensity recorded in NRS 101 and S-FMPQ data. Some of those patients that reported an increased tenderness following the treatment also showed a reduction in pressure threshold levels. It was noted that once the tenderness subsided, algometer readings increased to greater than those at the initial consultation, thus showing an improvement in TrP sensitivity.

Those patients who received treatments on consecutive days showed a tendency to worsen or experience higher levels of tenderness. Due to the fairly aggressive nature of the treatment, it is advised to separate treatments by at least 1-2 days, to allow for reduction of any inflammatory process that may occur due to micro-trauma to the area.

Although there was no specific data collected to compare the rate of improvement between men and women, the men in the group seemed to report a more rapid rate of improvement than the women. This cannot be confirmed statistically, but at least 5 of the 11 men treated reported an 80% (or more) reduction in their pain levels and/or symptoms after the first treatment. None of the women showed as significant a reduction after one treatment. The author suggests that this difference may be due to the larger muscle bulk in men, but this is merely speculative and requires further research and review.

CHAPTER SIX: CONCLUSION & RECOMMENDATIONS

6.1 CONCLUSION

This study consisted of 60 patients, divided into two groups of 30 each, all of whom were diagnosed with active TrPs of the Trapezius and/or Levator Scapulae muscles. After undergoing a full case history, general physical examination and regional examination, the patients were randomly allocated to either the treatment group or the placebo group. Those patients in the treatment group received Myofascial Adhesion Manipulation (grip and rip) of the affected muscles, whilst those in the placebo group received sham ultrasound treatment. Each patient received 4 treatments over a maximum of 3 weeks and data was collected at the initial, second and final consultations.

Evaluation of the statistical results showed that the treatment group responded favourably in terms of subjective and objective clinical findings. The statistical results also showed that the treatment group responded more favourably than the placebo group in terms of objective findings and the subjective NRS 101 questionnaire. The placebo group also showed a statistically significant improvement in terms of subjective and objective clinical findings, indicating a positive placebo effect. Despite the positive placebo effect, the treatment group was still found to be more effective and it is concluded that Myofascial Adhesion Manipulation is an effective form of

treatment for patients suffering with the active TrPs of Myofascial Pain Syndrome.

Schneider (1995) states that Chiropractors who use only osseous manipulative techniques will have great difficulty when attempting to treat patients with Myofascial Pain Syndrome, for the TrPs found in this condition require specific treatment, applied directly to muscle tissue. This study provides the Chiropractor with a simple, effective, non-invasive and time saving technique to add to the choice of myofascial treatments currently available for use in the clinical environment, as an adjunct to conventional Chiropractic manipulation.

6.2 RECOMMENDATIONS FOR FUTURE STUDIES

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 and is recommended.

It is suggested that further studies in this field use stratified sampling as a form of randomization, so as to have an even distribution of patients with concomitant cervical facet syndrome throughout the study groups.

A more accurate representation of the South African population may be obtained by advertising to a broader community and perhaps using

advertisements in African languages. The black races are a vast majority in South Africa and more information is needed regarding the epidemiology, aetiology and treatment regimes effective for such conditions within these races, which can only be obtained by further research.

Stricter inclusion criteria should be used when researching Myofascial Adhesion Manipulation in future studies. The effect of Myofascial Adhesion Manipulation on patients with varying chronicity of pain, patients of different sex, a history of cervical pain and/or a history of cervical trauma are just a few factors which could be researched separately so as to obtain more information on the correct clinical setting in which to apply the technique, for optimum treatment results.

In order to minimize the placebo effect that occurred within this study, the following suggestions are made for future placebo-controlled studies:

- A double-blinded study wherein the researcher is unaware of which treatment a patient is receiving, is recommended. This can be achieved by having an independent observer assign patients to relevant groups and having another independent observer perform the treatment procedures. The researcher is only responsible for data recording and evaluating. This will also aid in reducing researcher bias towards a favoured treatment protocol.

- The placebo ultrasound treatment is questionable as a useful form of placebo control and it is advised that another form of placebo be used for further studies.

Follow-up consultations were not used in this study. Therefore, conclusions can only be made regarding the short term effects of Myofascial Adhesion Manipulation. One month, three month and /or six month follow-up consultations are recommended for further studies to obtain data on the long term effects of the technique.

It is suggested that the Myofascial Diagnostic Scale is researched further to determine its value as an objective measure. While it does provide a means of standardizing the diagnostic criteria used to include patients in a study, its use as measurement tool is questionable and requires further study. (See chapter 5 for discussion of this scale.)

Finally, since Myofascial Adhesion Manipulation has been shown to be more effective than placebo for the treatment of Myofascial Pain Syndrome, further study suggestions include:

- Comparison of the technique to other forms of treatment for Myofascial Pain (for example; dry needling, injection or anti-inflammatories).
- Using Myofascial Adhesion Manipulation as part of a treatment protocol, including Chiropractic adjustive techniques and education with regards to

home stretching and exercise routines, and comparing this protocol to another.

- Research into the efficacy of Myofascial Adhesion Manipulation for the treatment of conditions where soft tissue adhesions and scar tissue contribute to pain and restricted range of motion (for example, chronic tendonitis, capsulitis etc.).

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APPENDIX A

Letter to the Patient

Dear Patient

Welcome to Technikon Natal Chiropractic Clinic and to this research study. You have been accepted into a study which aims to compare two different treatments for neck and upper back caused by myofascial pain syndrome. This condition includes the presence of active myofascial trigger points in the neck and upper back muscles.

Your participation in this study will entail the following: you will be pre-assigned to one of two groups, A or B, by a third party who will draw out of a hat. Each group will be receiving a different treatment for myofascial pain syndrome over a period of 3 weeks (4 visits).You will receive the same treatment each visit until the course is finished or until you become asymptomatic. Both treatments are entirely safe and pose no health risk to the patient.

It is expected that you carry out the full course of treatments over the 3 week period, as this is vital to the outcome of the study. It is also asked of you not to receive any other treatment for the condition and to advise the researcher of any medication you may be taking.

The treatment is free and overseen by a supervising clinician.

I thank you for your participation and co-operation.

Sincerely

Caileen Walker
(5th year senior intern)

APPENDIX B

INFORMED CONSENT FORM

(To be completed by patient / subject)

Date :

Title of research project : The efficacy of myofascial adhesion manipulation in the treatment of myofascial pain syndrome

---

Name of supervisor : Dr. Andrew Jones

Name of research student : Caileen Walker

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 this study?	Yes	No
8.	Do you understand that you are free to withdraw from this study?	Yes	No
	a) at any time		
	b) without having to give any a reason for withdrawing, and		
	c) 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 C

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC
CASE HISTORY

Patient:_____ Date: _____
file #:_____ X-Ray#:_____
Age:_____ Sex:_____ Occupation:_____
Intern:_____ Signature:_____

FOR CLINICIAN'S USE ONLY
Initial visit clinician:_____Signature:_____

Case History:

Examination:
Previous: Current:

X-Ray Studies:
Previous: Current:

Clinical Path. lab:
Previous: Current:

Case Status:

PTT: Conditional: Signed Off: Final Sign out:

Recommendations:

Intern's Case History

1. Source of History:

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

3. Present Illness:

- Location
- Onset
- Duration
- Frequency
- Pain (Character)
- Progression
- Aggravating Factors
- Relieving Factors
- Associated S & S
- Previous Occurrences
- Past Treatment and Outcome

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
- Environmental Hazards (Home, School, Work)
- Safety Measures (seat belts, condoms)
- Exercise and Leisure
- Sleep Patterns
- Diet
- Current Medication
- 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

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:

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

Patient: _____ File: _____

Date: _____ Intern/Resident: _____

Clinician: _____ Sign: _____

OBSERVATION:

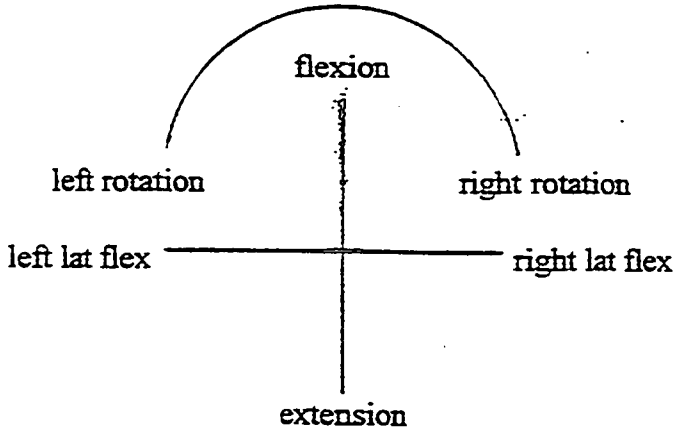
Posture
Swellings
Scars
Discolouration
Hair Line
Bony & Soft Tissue Contours

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

Myofascial Diagnostic Scale

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

Trigger point signs

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

Numerical rating Scale 101

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.

_____

Short-form McGill Pain Questionnaire (SF-MPQ)

Ronald Melzack (1984)

Date:_____ File no.:_____ Visit no:____

Patient name:_____

	NONE 0	MILD 1	MODERATE 2	SEVERE 3
THROBBING				
SHOOTING				
STABBING				
SHARP				
CRAMPING				
GNAWING				
HOT-BURNING				
ACHING				
HEAVY				
TENDER				
SPLITTING				
TIRING-EXHAUSTING				
SICKENING				
FEARFUL				
PUNISHING-CRUEL				

APPENDIX H

ALGOMETER READINGS

Patient Name _____ File No. _____

Date	Treatment Number	Muscle (s) affected	Reading
	1		
	2		
	4		