

The relative effectiveness of Myofascial Trigger Point Manipulation as compared to Proprioceptive Neuromuscular Facilitative Stretching in the treatment of active myofascial trigger points a pilot clinical investigation.

By

Jason Berry

A dissertation submitted to the Department of Chiropractic in partial compliance with the requirements for the Master's Degree in Technology: Chiropractic.

I, Jason Berry, do hereby declare that this dissertation represents my own work in both concept and execution.

Jason Douglas Berry

Date

Approved for Final Submission

Dr. Tarryn Mac Dougall, M.Deg.Chiropractic

Date

Dedication

This work is dedicated to my parents, **Mike** and **Ally** whom I love very much.

Without your love, support and patience through all my years of study, some rather frustrating and trying times, none of this would have been possible.

To **Carrin**, while this experience has been a testing one, without your love and support, I don't know if I would have got through it all. It is your patience and love that make you who you are. I love you.

Acknowledgements

Thanks go to the following people for their help in finally reaching my goal:

Dr. Tarryn Mac Dougall, my supervisor, for your continuous support and for your patience. It has been a long journey.

The staff at Durban Institute of Technology, Pat, Linda, and Mrs. Ireland for all your assistance in the clinic.

Dr. Charmaine Korporaal, without your guidance, support and down right pushing this study might not have happened. A very heart felt thank you.

Thanks to all the clinicians who gave of their own free time to help supervise me at SARS, I appreciate it more than you know.

To all the patients who participated in my study, your contribution has made this possible. A special thanks to Deborah Needham without your help my study would have been a lot more difficult. Thanks to Rupert Britz who helped co-ordinate my study so efficiently.

To all the people that I am able to call my friends a big thank you. A special thanks to Dr. Norm, Dom and Andrew for always being there for advice and never giving up on me.

Abstract

Myofascial pain syndrome (MPS) is defined as the sensory, motor and autonomic symptoms caused by myofascial trigger points (MFTPs), or hyperirritable spots within skeletal muscles that are associated with palpable nodules in a taut band.

The fact that MFTPs have been described in the literature for acupuncturists, anaesthesiologists, chronic pain managers, dentists, family practitioners, gynaecologists, neurologists, nurses, orthopaedic surgeons, paediatricians, physical therapists, physiologists, rheumatologists and veterinarians is evidence of the syndrome's clinical importance.

As a result of a large amount of research, a large number of different treatments have been shown to be clinically effective in the treatment of MFTP. These treatments include amongst others:

- Ischaemic compression.
- Myofascial manipulation.
- Spray and stretch.
- Ultrasound.
- Transcutaneous electrical nerve stimulation.
- Dry needling.

As can be seen from the above, it is important to be able to treat MPS effectively because it is such a common disorder. According to Schneider an effective treatment is needed for MPS, despite the array of treatments available to a clinician. Han and Harrison agree that more studies are required to determine the efficacy of these treatments.

The aim of this study is to evaluate the relative effectiveness of Myofascial Trigger point Manipulation (MFTPM) as compared to Proprioceptive Neuromuscular Facilitative (PNF) stretching in the treatment of active Myofascial Trigger Points (MFTPs) in the trapezius muscle (TP 1 and/or TP 2) in terms of subjective and objective clinical findings.

The study required a total of 60 patients, which following acceptance were then randomly divided into two groups of 30, with an equal number of male patients in Group one (MFTPM) and two (PNF), and female patients in Group one and Group two. Each patient had four consultations (three treatments and one follow up visit) in a two week period. Subjective and Objective Data was recorded at each consultation prior to the treatment.

Subjective measurements (Numerical Pain Rating Scale and Short Form McGill Pain Questionnaire) were taken prior to the treatment at all four visits. Objective measurements (Cervical Range of Motion Meter and Algometer) were also taken prior to the treatment at all four visits, except for Algometer readings which were taken at the initial consultation and the fourth treatment only.

SPSS version 11.5 was used for analysis of data (SPSS Inc, Chicago, Ill, USA). Baseline comparisons were done between treatment groups using Pearson's chi square tests or Fisher's exact tests as appropriate for categorical variables, and student's t-tests for quantitative normally distributed variables. Treatment effect was assessed with repeated measures ANOVA. A significant time by group interaction indicated a significant differential treatment effect. A p value <0.05 designated statistical significance. The direction of the treatment effect was assessed with profile plots.

Evaluation of data collected from both groups showed a significant improvement

in terms of objective and subjective clinical findings to a value of $p < 0.001$. There was no statistical difference between the two groups in terms of objective and subjective clinical findings, although a trend was shown when looking at the objective findings that suggest that MFTPM was more effective than PNF stretching.

The sample population was drawn from a very homogenous group of people (i.e. SARS call centre), in order to achieve greatest emphasis on clinical outcomes. This process however limits the clinical applicability of the results and thus will not always be applicable to all patients within the population.

It is therefore the researcher's conclusion that there is no statistical difference between MFTPM and PNF stretching in terms of objective and subjective clinical findings. Both treatment modalities have been shown to be equally effective in the treatment of subacute active TPs in the upper trapezius.

There is a definite trend when looking at the objective data that may support the hypothesis that MFTPM is as effective as, if not more effective than PNF stretching. It is of the opinion of the author that a larger sample size is needed to make it clinically significant.

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Chapter 1

Introduction

1. 1 The problem and its setting

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

According to Han and Harrison (1997:98), American studies based at pain clinics indicate that the incidence of MPS is as high as 85%. He further states that the condition is more prevalent in women although it is clearly found in both sexes. The incidence of MPS in the South African setting is unknown, but it can be seen from the above that this is a common disorder.

The fact that MFTPs have been described in the literature for acupuncturists, anaesthesiologists, chronic pain managers, dentists, family practitioners, gynaecologists, neurologists, nurses, orthopaedic surgeons, paediatricians, physical therapists, physiologists, rheumatologists and veterinarians is evidence of the syndrome's clinical importance (Travell, Simons and Simons, (1999 1:13).

As a result of a large amount of research, a large number of different treatments have been shown to be clinically effective in the treatment of MFTPs. These treatments include amongst others:

- Ischaemic compression (Mance, 1986 and Hanten, 2000).
- Myofascial manipulation (Walker, 2002).
- Spray and stretch (Han and Harrison, 1997: 97).
- Ultrasound (Gam et al., 1998:73).

- Transcutaneous electrical nerve stimulation (Han and Harrison, 1997:97).
- Dry needling (Lewit, 1979:90; Hong, 1994:256 and Alvarez, 2002:657).

Each of these treatment modalities has thus been classified according to its invasive or non-invasive nature (as cited by Shacksnovis, 2005).

As can be seen from the above that it is important to be able to treat MPS effectively because it is such a common disorder. According to Schneider (1995) an effective treatment is needed for MPS, despite the array of treatments available to a clinician. Han and Harrison (1997) agree that more studies are required to determine the efficacy of these treatments.

Therefore this research will compare Myofascial Trigger Point Manipulation (MFTPM) compared to Proprioceptive Neuromuscular Facilitative (PNF) Stretching in the treatment of active upper trapezius trigger points (TPs), in order to generate a greater amount of knowledge with regard to the treatment of MPS as mention above by Schneider (1995) and Han and Harrison (1997).

1. 2 Aim of the study

The aim of this study is to evaluate the relative effectiveness of MFTPM as compared to PNF stretching in the treatment of active MFTPs in the trapezius muscle (TP 1 and/or TP 2) in terms of subjective and objective clinical findings.

Objective 1:

The first objective is to evaluate the relative effectiveness of MFTPM as compared to PNF stretching in terms of objective clinical findings, in the treatment of active myofascial trigger points (MTPs).

The first hypothesis was that MFTPM was more effective than PNF stretching in terms of objective clinical findings.

Objective 2:

The second objective is to evaluate the relative effectiveness of MFTPM as compared to PNF stretching in terms of subjective clinical findings, in the treatment of active myofascial trigger points (MTP's).

The second hypothesis was that MFTPM was more effective than PNF stretching in terms of subjective clinical findings.

1. 3 Need for a solution to the problem

In a comparable study, MacDougall (1999) stated that PNF stretching therapy may be a more effective treatment when compared to static stretching in the treatment of active MFTPs. This is evident from the statistically significant difference noted when comparing the algometer readings and subjective pain perception levels from the fifth consultation of patients from the PNF stretching group.

In a study by Shacksnovis (2005), he found there to be no statistical difference between the myofascial manipulation and the ischaemic compression groups in terms of subjective and objective findings although both treatments showed a statistical improvement in terms of subjective and objective clinical findings. In light of these findings the chiropractor might find it better to use myofascial manipulation as an effective treatment to the benefit of the patient as the treatment is faster in application and subjects the patient to less overall pain over a shorter period of time.

With MPS being so prevalent it is therefore important to find the most effective way of treating the condition. Comparing PNF stretching which has been proven effective in treating MFTPs and MFTPM which is also effective in treating the same condition we will be able to recommend the more effective treatment protocol.

1. 4 Benefits of the study

It is hoped that this study will generate much needed information about MFTPM as a treatment protocol as very little literature exists about the treatment, and help to streamline the treatment of MPS in order to provide future patients with the most effective form of treatment for MPS.

1. 5 Summary

In summary it can be seen that MPS is a common disorder that will affect a large proportion of the population. It is so common that other professionals not primarily involved with treating skeletal conditions are made aware of the prevalence in the population.

The aim of this research is to compare Myofascial Trigger Point Manipulation (MFTPM) compared to Proprioceptive Neuromuscular Facilitative (PNF) Stretching in the treatment of active upper trapezius trigger points (TPs), in terms of objective and subjective clinical findings. As both treatments have been shown to be effective it is therefore important to find the most effective way of treating the condition.

By completing this study it is hoped that more clinical information will be generated to further aid the clinician in effectively treating MPS.

Chapter 2

Literature Review

2.1 Introduction

Myofascial pain syndrome may be defined as the sensory, motor and autonomic symptoms caused by myofascial trigger points (MFTPs), or hyperirritable spots within skeletal muscles that are associated with palpable nodules in a taut band. These trigger points (TPs) are extremely common and become a distressing part of nearly everyone's life at one time or another (Travell, Simons and Simons, 1999 1:5).

MFTPs can also be responsible for the weakness of the involved muscles as well as autonomic dysfunction such as salivation, sweating, localized vasoconstriction and lacrimation (Travell, Simons and Simons, 1999 1:5 and Chaitow and Delany, 2002:18).

Muscular pain is the most common work-related injury and the second most common cause of visits by patients to physicians (Hubbard, 1998:16).

2.2 Prevalence

A study conducted by Skootsky et al. (1989) found that of 172 consecutive patients presenting to a university primary care general internal medicine practice, thirty percent of the 54 patients whose reason for the visit was pain, were diagnosed with myofascial pain. This showed myofascial pain to be the single most common reason for a patient with pain to visit a physician. This is an indication of the prevalence of this condition.

Han and Harrison (1997:90) also claim that American studies done at pain clinics indicate that the incidence of Myofascial Pain Syndrome varies between 30 and 85%. Chaiamnuay et al. (1998:1382) found similar results in their study conducted in villages in rural Thailand where 2463 subjects were examined. Of these, 36.2% had musculoskeletal pain, and MPS was the most common diagnosis. In a similar manner, Fishbain et al. (1986:197) found MFTP's to be the primary cause of pain in 85% of 283 consecutive admissions to a pain centre programme.

In a review by Han and Harrison (1997:90), it was stated that of the 200 adults presenting for a particular study, 54% of women and 45% of men had latent myofascial trigger points in the shoulder girdle.

2.3 Aetiology

According to Travell, Simons and Simons, (1999) acute injuries may cause immediate symptoms, while chronic stresses are more likely to cause a gradual onset of symptoms. The latter has a tendency to perpetuate the activation of trigger points.

The mechanical stresses that tend to activate MFTPs acutely include stresses such as automobile accidents, falls, fractures, joint sprains, dislocations, a direct blow to the muscle, or an episode of excessive, unusual exercise. Sustained postural overload, prolonged immobilization and poor work ergonomics may lead to TP formation by way of gradual onset or chronic stress aetiologies. TPs in the upper trapezius may become active due to an activity in which the trapezius helps to carry the weight of the arm for a prolonged period. These activities include telephoning or sitting without armrest support, high typewriter or keyboard, elevation of the scapula as an expression of anxiety or emotional distress (Travell, and Simons, 1983).

The following is an overview of muscle structure, function and the formation of TrPs. This is a summary from Travell, Simons and Simons, (1999 1:45-60).

“A muscle consists of a bundle of fascicles, each of which is made up of muscle fibres. These fibres each contain numerous myofibrils surrounded by a sac-like structure called the sarcoplasmic reticulum. The sarcoplasmic reticulum is the source of the contractile force of muscle. Calcium is released from the sarcoplasmic reticulum thereby stimulating the actin and myosin of the myofibrils to contract in the presence of ATP (adenosine triphosphate). Action potentials are responsible for this release of calcium and the contraction is maintained until the ATP is depleted or until the free calcium is returned to the sarcoplasmic reticulum.”

“A motor unit consists of the cell body, its axon and multiple motor endplates of an alpha motorneuron in the anterior horn of the spinal cord. The action potential begins in the cell body, travels along the axon and is then transmitted chemically across the synaptic cleft of the motor endplate thereby causing a muscle contraction.”

Travell, Simons and Simons, (1999) suggest that “a TrP is a cluster of minute loci of intense abnormality found throughout the trigger point and that this abnormality is a neuromuscular dysfunction of the motor endplate. Events such as trauma or prolonged mechanical stress may result in an excessive release of acetylcholine from the nerve terminal. This causes a sustained release of calcium from the sarcoplasmic reticulum resulting in maximal contracture of the muscle fibre. This sustained contraction produces a local ischaemia, which prevents oxygen and ATP from entering the area and therefore the calcium pump is unable to return calcium to the sarcoplasmic reticulum. The continuous contact with calcium causes further contraction and a vicious cycle is set up. This process is known as the “energy crisis theory”. Histologically these areas of contraction are visible as contraction knots. A group of these contraction knots

within a taut band of muscle constitutes a TrP and gives it its nodular feel” (Travell, Simons and Simons, 1999).

“The energy crisis resulting in these areas may stimulate the production of vasoreactive substances that can sensitise local nociceptors known as sensitive loci. It is believed that these sensory nociceptors or sensitive loci elicit pain, referred pain and latent twitch responses. These sensitive loci are found throughout the entire muscle but are in higher concentrations within the TrP region. When a sensitive locus and an active locus are in close proximity, a myofascial TrP locus develops. When the input from the sensitive loci persists, central sensitisation in the spinal cord may develop, resulting in referred pain corresponding to the receptive field of the original dorsal horn neuron” (Travell, Simons and Simons 1999). As cited by Webb (2003).

Micro-trauma and muscle overload may result in MFTP formation through the release of calcium from the sarcoplasmic reticulum. High levels of calcium cause continued contraction of the sarcomeres and increased demand for ATP resulting in local hypoxia. The disabled calcium pump sustains this contraction cycle (Auleciems, 1995).

Rosen (1993) states that tissue breakdown occurs secondary to improper use or abnormal loads imposed upon muscles and joints incapable of withstanding these critical loads. Dysfunction occurs when critical load capacity is exceeded, resulting in fatigue and subsequent tissue breakdown. This occurs as a result of localised changes in the metabolism of specific sarcomeres that are overloaded, injured or stressed – as a result of local hypoxia. Through a thermistor study, it was revealed that temperature increases occurred at these dysfunction sites and electron microscope studies showed fibres bunching up within a taut band region which is palpable clinically as a myofascial trigger point.

Han and Harrison (1997) found that in muscle tissue biopsies of tender points, there were various biochemical abnormalities. These included reduced contents of adenosine triphosphate and diphosphate, phosphocreatine, and glycogen, and increased levels of adenosine monophosphate and creatine. Abnormally low subcutaneous oxygen tension in TPs has implied an increase in metabolism. Accumulation in water and fat, as well as mucopolysaccharides, platelets, and degranulating mast cells, has also been shown in fibrositic nodules. Platelets and mast cells release serotonin and histamine, which stimulate peripheral nerve endings, thereby contributing to a hyperirritable state.

According to Hong and Simons (1998) the proposed hypothetical mechanism of taut band formation in a MFTP region is as follows. Intracellular calcium in certain muscle fibres may be excessively released in response to trauma or abnormal stress. The abnormally increased calcium may cause uncontrolled shortening activity and increased metabolism. The muscle fibre shortening also impairs local circulation, which causes a loss of oxygen and nutrients supplied to the region. This completes a vicious cycle; thus, an energy crisis occurs and taut bands form. This hypothesis is supported by Han and Harrison (1997) who showed a low oxygen tension in a MFTP region and a significant decrease in high energy phosphates coupled with an increase in low energy phosphates and creatine in a tender muscle site.

According to Gay et al. (1994) the currently accepted aetiology of MFPS is that of muscle hyperactivity, which leads to muscle spasm, pain and finally constant chronic muscle fatigue.

Through the spinal cord mechanism of TP activation as proposed by Hong and Simons (1998), input from nociceptors in an original receptive field persists (pain from an active TP). Central sensitisation in the spinal cord may develop and the receptive field corresponding to the original dorsal horn neuron may be expanded

(referred pain). Through this mechanism, new TPs, or satellite TPs, may develop in the referred zone of the original TP.

2.4 Clinical features

2.4.1 Symptoms

Patients with myofascial pain syndrome have pain ranging from a mild ache to an excruciating pain, it is either sharp or dull, and is often associated with general fatigue, a decreased range of motion and loss of muscle strength. Patients tend to complain of regional persistent pain, most frequently located in the head, neck, shoulders, upper and the lower extremities and the back (Han and Harrison 1997).

In terms of this research only referred pain patterns of TPs in the upper trapezius are of concern. These are from TP 1 and TP 2. Their referral patterns are as follows.

MFTP 1 – TPs in this area consistently refer pain unilaterally upward along the posterolateral aspect of the neck to the mastoid process. The referred pain when intense, extends to the side of the head, centering in the temple and back of the orbit, and may also include the angle of the jaw, pain may also extend to the occiput (Travell and Simons, 1983 1: 184).

MFTP 2 – The referred pain pattern of this TP lies slightly posterior to the essential cervical reference zone of TP 1, blending with its distribution behind the ear (Travell and Simons, 1983 1: 184).

Travell and Simons (1983: 13-14) list the symptoms of active MFTPs as the following:

- Muscle stiffness and weakness may be the result of the activity of the TPs.
- Clinical features of TP activity usually outlast the precipitating event.

- Active MFTPs vary in intensity at any given time.
- Phenomena other than pain, such as localised sweating, vasoconstriction, lacrimation, salivation, pilomotor activity and proprioceptive disturbances may also be caused by active MFTPs.

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

2.4.2 Signs

Upon examination of a patient suffering with Myofascial Pain Syndrome, certain physical findings are necessary before a correct diagnosis can be made. The most characteristic physical sign in MPS is the presence of trigger points (Travell, Simons and Simons, 1999).

Travell and Simons (1983:13-17) and Gatterman (1990:295) list the signs characteristic of active MFTP's on patient examination.

- Increased pain by passive/active stretching of the muscle in which the TP is present.
- Decreased stretch range of motion.
- Restricted isometric contraction of the affected muscle with increased pain.
- There may be a weakened maximal contractile force within the muscle.
- Deep tenderness and dysaesthesia are commonly referred by active MFTPs to the zone of referred pain.
- Disturbances of non-sensory function are sometimes induced in the referral zone. These include increased vasomotor activity (pallor during stimulation of the TP, rebound hyperemia following its activation), lacrimation, coryza, sudomotor activity and pilomotor activation (goose-flesh).

- Muscles adjacent to active MFTPs may also feel tense to palpation.
- Palpable bands that contain TPs may have an area of well defined intense tenderness.
- A jump sign is usually elicited.
- Snapping palpation of an active MFTP often induces a local twitch response.
- Pressure on an active TP can cause an increase in pain in the pain referral zone of the TP.
- Patients may suffer from Dermographia or Panniculosis in the area overlying the active TP.

2.5 Diagnosis

Schneider (1995) outlines a set of recommended diagnostic criteria for Myofascial Pain Syndrome (Active MFTPs).

Major Criteria

- Regional pain complaint.
- Pain pattern in the expected distribution of muscular referred pain.
- Palpable taut band in accessible muscles.
- Exquisite spot tenderness at one point or nodule within a taut band.
- Some degree of restricted range of motion or slight muscle weakness.

Minor Criteria

- Manual pressure on the TP nodule reproduces the clinical pain complaint.
- Local twitch response caused by either snapping palpation or injection of the tender spot.
- Pain is diminished or eliminated by muscular therapy e.g. therapeutic stretch, ischaemic compression or needle injection of the TP.

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

Travel, Simons and Simons (1999), suggest that the minimum acceptable criteria for identifying a TP are a combination of the spot tenderness in a palpable band and patient recognition of the pain.

These criteria are principally assessed by palpation of the affected muscles. The application of a sustained deep pressure is the method used most frequently in the diagnosis of MFTPs. When MFTPs are palpated, the pain is either concentrated in the trigger point area or along that muscle's distinct referral pattern, which is constant, reproducible, and does not follow a dermatomal or nerve distribution (Han and Harrison 1997).

2.6 Confirmatory diagnosis

The reliability and validity of the palpatory diagnosis has been confirmed by various techniques and according to Han and Harrison (1997) there has been confirmation with the technique of thermography. This is a non-invasive imaging technique, which detects the temperature distribution of the bodies' surface. Heat is detected and converted into a visual image. In MPS it has been used to objectively detect active and latent trigger points, which appear as discoid shapes, 1.5 degrees Celsius higher in active, and 1 degree Celsius higher in latent trigger points compared to the corresponding areas on the opposite side of the body.

Thus for the purposes of this research, the palpatory diagnosis has been utilised as the above techniques have validated the palpatory diagnosis as a reliable and valid method of patient assessment in respect of myofascial pain syndrome (Hsieh et al. 2000).

2.7 Treatment

There is a large amount of research that has been produced on MPS, and as a result there are many different forms of treatment available. They are divided into Invasive (Those which penetrate the skin or body cavities which require and depend on a high level of skill from the practitioner) and Non-Invasive (as cited by Shacksnovis 2005).

<u>Invasive</u>	<u>Non-Invasive</u>
Dry needling (Lewit, 1979:90, Hong, 1994:256, Alvarez, 2002:657).	Ischaemic compression (Mance, 1986 and Hanten, 2000).
Injection with anaesthetic (Travell, Simons and Simons, 1999).	Myofascial manipulation(Walker, 2002).
Injection with non-steroidal anti-inflammatory (Travell, Simons and Simons, 1999).	Spray and stretch (Han and Harrison, 1997: 97).
Injection with steroidal anti-inflammatory (Travell, Simons and Simons, 1999).	Transcutaneous electrical nerve stimulation (Han and Harrison, 1997:97).
	Ultrasound (Gam et al., 1998:73).
	Static Stretching and Proprioceptive Neuromuscular Facilitative Stretching (McAtee, 1993).

As can be seen from the above table, both MFTPM and PNF stretching are non invasive, and therefore classified as conservative forms of therapy.

However even though they have been classed into the non-invasive category, there are differences in respect of the two interventions, which include:

- Pain and discomfort felt by the patient during the treatment application.

- The mechanism of application (viz. Duration of treatment application and manner).
- The proposed changes at the muscular level with respect to how the intervention is applied, (Schneider, 1996, Walker, 2002).

The two different techniques used have different mechanisms of actions which will be discussed below.

- *PNF* (contract-relax-antagonist-contract technique) stretching is based on a neurophysiological phenomenon involving the stretch reflex. Every muscle in the body contains various types of receptors (Golgi tendon organs and muscle spindles) that when stimulated inform the central nervous system (CNS) about what is happening with that muscle. When a muscle is stretched, the muscle spindles are also stretched, sending a volley of sensory impulses to the spinal cord. These impulses inform the CNS that the muscle is being stretched. Impulses return to the muscle from the spinal cord, which causes the muscle to reflexively contract, thus resisting the stretch. If the stretch persists for an extended period of time (at least six seconds), the Golgi tendon organs respond to the change in length and the increase in tension by firing off sensory impulses of their own to the spinal cord. The impulses from the Golgi tendon organs have the ability to override the impulses coming from the muscle spindles, allowing the muscle to reflexively relax after the initial reflex resistance to the change in length (Arnheim and Prentice, 1993).
- *MFTPM* may be used to restore mechanical function of soft tissue, especially its elasticity and mobility, relative to other tissue to exert a therapeutic effect on the autonomic nervous system by decreasing reflexive holding patterns (Hertling and Kessler 1996). MFTPM may be based on the stretch separating the actin / myosin filaments in the muscle fibre which will also give a sudden barrage of nerve impulses to CNS (central nervous system) that will force the muscle to relax by toning down the impulses from the gamma nerves. Secondly, the Golgi tendon organs

would be stimulated by forced stretch of the skeletal muscle causing both gamma and alpha motoneuron inhibition which will result in muscles relaxation (Korr, 1975 as cited in Leach, 1994).

The stretch in the muscle caused by both forms of treatment causes a separation of actin and myosin filaments as well as a stretch to the Golgi tendon organs. This leads to a toning down of impulses from the gamma nerves which causes a relaxation of the affected muscle (as mentioned above). The relaxation in the muscle will also lead to a decrease in hyperirritable spots within skeletal muscles that are associated with palpable nodules in a taut band, which results in the resolution of the TP.

Very little is known about the mechanism of action of MFTPM and it is very much a hypothesis. In a study done by Walker (2002), MFTPM was found to be more effective than placebo and therefore an effective treatment of MPS. In another study done by Shacksnovis (2005), there was found to be no statistical difference between the myofascial manipulation and the ischaemic compression groups in terms of objective and subjective findings. He further states that myofascial manipulation may be more effective than ischaemic compression as it is faster in application and subjects the patient to less overall pain over a shorter period of time.

PNF stretching was developed as a treatment modality in the late 1940s and early 1950s. By the late 1970s physical therapists and athletic trainers had begun using PNF techniques to facilitate flexibility and range of motion in healthy people. The rapid growth in sports medicine in the 1980s has fuelled the search by practitioners for effective, efficient techniques for improving sport performance. The adaptation of PNF stretching techniques for use with athletes opened the door for its current popularity amongst sport health practitioners. The use of PNF will continue to expand as therapists and athletes realise the gains in flexibility it makes possible (McAtee, 1993). In a study done by MacDougall

(1999), it was noted that clinically, but not statistically, PNF stretching therapy may be a more effective treatment when compared to static stretching in the treatment of active MFTP.

It is therefore the aim of this study to determine which of the two treatment protocols, MFTPM and PNF stretching are more effective in the clinical setting in terms of objective and subjective clinical findings.

Chapter 3

Research Design and Methods

3.1 Study Design:

This study was a prospective, randomised, comparative, clinical trial.

The aim was to compare and evaluate the effectiveness of MFTPM, in terms of subjective and objective clinical findings, for the treatment of MPS.

3.2 Sampling:

3.2.1 Sample Selection

Non-probability, convenience sampling was used for patients from the South African Revenue Service (SARS) Call Centre.

3.2.2 Sample Size:

The study required a total of 60 patients, which were then randomly divided into two groups of 30, with an equal number of male patients in Group one and two, and female patients in Group one and Group two.

3.2.3 Sample Allocation:

Patients, once accepted into the study were randomly assigned to a treatment group, either Group one MFTPM or Group two PNF stretching. Thirty pieces of paper with MFTPM inscribed on them and thirty pieces of paper with PNF inscribed on them were placed into a hat. Patients that qualified for the study, were allocated by randomly drawing a piece of paper out of a hat themselves and

were so either placed in Group one or Group two. Each patient therefore had an equal chance of being in either group.

3. 3 Research - Patient Procedure

Patients from the SARS Call Centre voluntarily agreed, after reading the advertisements that had been placed on notice boards in the office. The patients then had to read the letter of information (APPENDIX D) and sign the letter of consent (APPENDIX E) before they were allowed to participate. Any interested parties could have contacted the researcher to find out any further information regarding their participation in the study.

3. 3. 1 Research - Patient Assessment

Prospective patients were initially screened for compliance with the Inclusion and Exclusion criteria by means of completing a patient history (APPENDIX A), physical examination (APPENDIX B), and cervical regional examination, (APPENDIX C) in order to determine if they met the studies inclusion criteria. They met the criteria if a positive diagnosis of myofascial pain syndrome of the upper trapezius muscles was made by the researcher.

3.4 Inclusion and Exclusion criteria

3.4.1 Inclusion Criteria:

- All applicants were between the ages of 20 and 45 so as to reduce chronicity;

In Respect of Age.

Travell, Simons and Simons (1999) indicate that individuals in their mature years (31-50) are more likely to suffer from MPS. However, the condition does occur in younger individuals. Chettiar (2001) found that of the 60 patients treated for myofascial pain, 52% were of the age group 32-55, and 43% were between 20-31. This shows the greatest number of sufferers being between 20-50 years. These statistics would support the current age group limits set for this study.

- All applicants must be exclusively office workers so as to ensure the homogeneity of the study.

In Respect of Occupation.

Alvarez (2002), states that the following may precipitate the activation of TPs: holding a telephone receiver between the shoulder and ear, prolonged bending over a table, sitting with poor back support, improper height of arm rest supports and moving heavy boxes. This is supported by Travell, Simons and Simons (1999) and lends support to the selection of secretaries, personal assistants and receptionists for this study, as the factors mentioned above are similar in all the occupational groupings. Furthermore the fact that all participants work in the same environment improves the sample homogeneity (Mouton, 1996).

- All patients were diagnosed with active trigger points one and/or two in the trapezius muscle. To diagnose an active MFTP, one looks for the following, (Travell and Simons 1983 1: 18-19).

- A history of sudden onset during or shortly following acute overload stress, or a history of gradual onset with chronic overload to the affected muscle.
 - Characteristic patterns of pain that are referred from myofascial TPs patterns that are specific to individual muscles.
 - Weakness and restrictions in the stretch range of motion of the affected muscle.
 - A taut palpable band in the affected muscle.
 - Exquisite, focal tenderness to digital pressure (the TP), in the band of taut muscle fibres.
 - A local twitch response elicited through snapping palpation or needling of the tender spot.
 - The reproduction of the patient's pain complaints by pressure on, or needling of, the tender spot.
- There must be a positive diagnosis of sub-acute myofascial pain syndrome of the upper trapezius.
- Myofascial pain syndrome from onset to three to four days is considered as acute and myofascial pain syndrome of longer than three months is considered as chronic. Therefore this was the range for the treatment of neck pain (Schneider, 1995). This time range was to avoid the potential co-existence of myofascial pain dysfunction and fibromyalgia, which is diagnosable after a three month period. Therefore any time between one week and two to three months was considered sub-acute for this research (Schneider, 1996).

3.4.2 Exclusion Criteria:

- Those patients who exhibited any of the contra-indications to myofascial adhesion manipulation, advised by Nook (1998), were excluded from this study. These include:
 - Vascular compromise
 - Anticoagulant use and Hemophiliacs
 - Severe diabetes (with peripheral neuropathy)
 - Sensory deficit
 - Infection (local and systemic)

- Also patients who exhibit any of the contra-indications to massage and massage type therapies which include (Basmajian, 1985):
 - Infection due to bacterial action
 - Rheumatoid, infective or gouty arthritis
 - Bursitis and calcification in soft tissue structures
 - Patients on anti-coagulant therapy
 - Patients using analgesics and anti-inflammatory drugs
 - Fractures, dislocations or bone tumours

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

- Patients were not allowed to receive any other form of treatment for MPS or related musculoskeletal conditions for the duration of their involvement in the study. This included allopathic, homeopathic or other forms of medication and any form of manual or electrotherapeutic therapy.

- Any patient who was on any oral non-steroidal anti-inflammatory drug would be required to participate in a three day wash out period prior to entering the study (Poul et al. 1993).
- Any patients suffering from neck or shoulder pain caused by trigger points other than those included in the study were excluded.

3.5 Location and Diagnosis of the MFTP's of the Upper Trapezius Muscle

Travell, Simons and Simons (1999 1: 278) discuss two main regions for the presence of MFTPs, as found in the upper trapezius muscle fibres, namely MFTP 1 and MFTP 2.

MFTP 1 is located by pincer palpation of the free margin of the upper trapezius muscle, approximately midway between the spinous processes and the acromion, in the anterior fibres.

Referred pain from this MFTP 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. It may include the angle of the jaw. It is a common cause of tension neck ache and temporal headaches (Travell, Simons and Simons, 1999 1: 278).

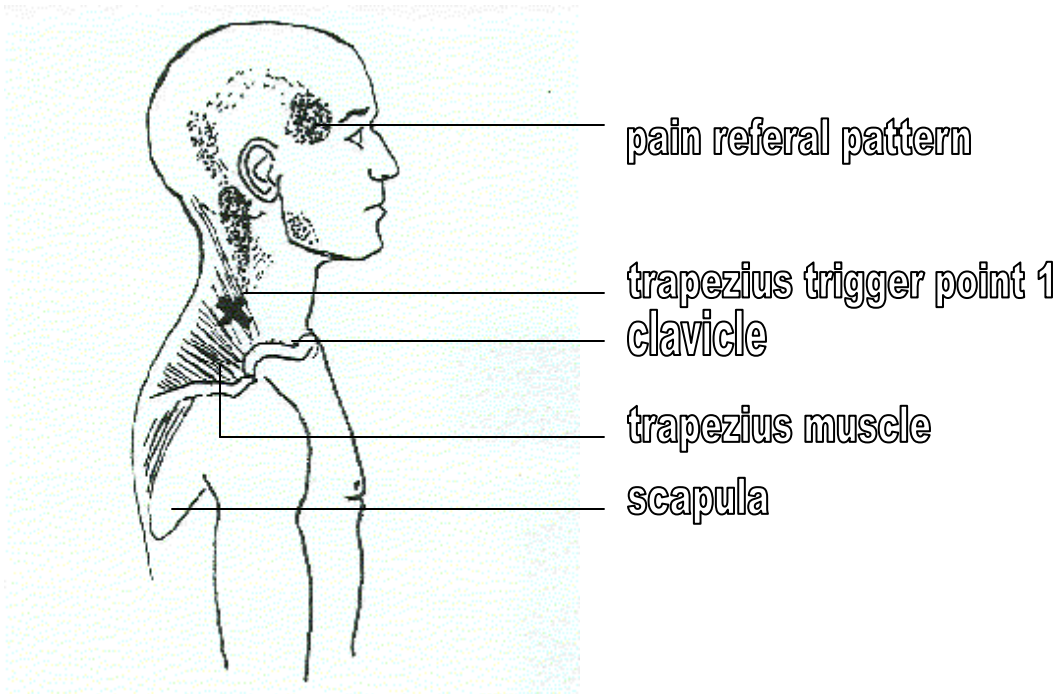


Diagram showing the pain referral patterns from trapezius TP 1 (Travell, Simons and Simons 1999 1: 278).

MFTP 2 is located close to MFTP1, but is slightly posterior and inferior, just caudal to the free border of the upper trapezius.

Palpation of this trigger point is performed in a similar manner as for MFTP1, but larger patients may require flat palpation. Referred pain from this MFTP also lies posterior to that of MFTP1, blending with its distribution behind the ear (Travell, Simons and Simons 1999 1: 278).

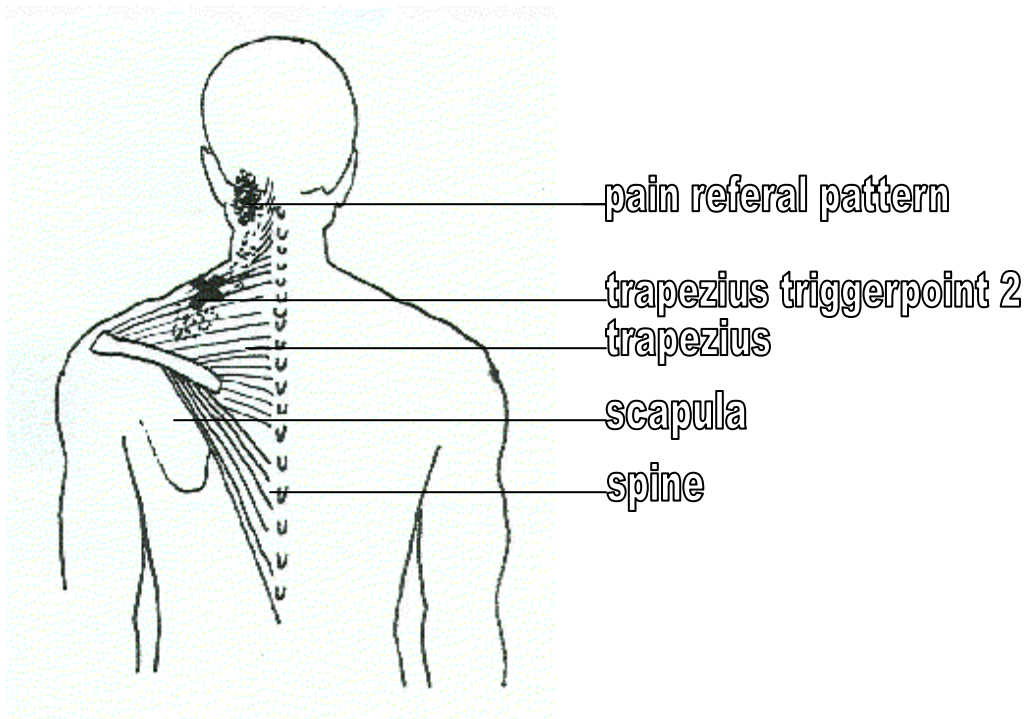


Diagram showing the pain referral patterns from trapezius TP 2 (Travell, Simons and Simons 1999 1: 278).

In addition to the location and the referred pain pattern, the following criteria were utilised in order to determine the presence of the above MFTPs, with the requirement that the patient had all five of the major criteria and at least one of the minor criteria according to the classification by Schneider (1995).

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 muscle weakness (when measurable).

Minor criteria:

1. Manual pressure on the MFTP nodule reproduces the chief pain complaint.
2. Snapping palpation of the taut band at the MFTP 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 MFTP.

3. 6 Interventions

Group 1 received MFTPM as prescribed by Walker (2002):

The technique may be performed with the patient in the seated or prone position (Nook, 2001 as cited by Walker, 2002). For the purpose of this study, all patients were treated in a seated position.

The location of the MFTP was determined by flat or pincer palpation as described by Travell, Simons and Simons, (1999). Once located, the researcher used a firm reinforced index contact over the MFTP. Tissue slack was removed from the muscle by exerting pressure to the MFTP in the long axis direction of the muscle fibres. Once this was done, a high velocity, low amplitude thrust was given to the MFTP in the same direction. The treatment was repeated for each of the involved TPs at every consultation.

Group 2 received treatment in the form of PNF stretching (contract-relax-antagonist-contract technique) of the trapezius muscle on the same side of the active TPs. The treatment was done in the seated position. It was performed as follows (Nook, 1997).

- Stretch Position – The patient actively laterally flexes the head as far as is comfortable. The researcher crosses arms and places one hand on the shoulder and the other over the ear on the same side as that being stretched.

- Contract Phase – The patient then pushes against the researcher’s hand cupping the ear. This push will be held for a count of eight seconds.
- Relaxation Phase – The patient then relaxes the muscle briefly.
- Antagonist Contraction Phase – The patient then again laterally flexes the head until a stretch is felt.
- Stretch Phase – The researcher then holds the head as in step one, where the stretch was felt by the patient.

The patient then contracted against the researcher’s hand again and then begins the next set of PNF stretches. The stretch was repeated a total of three times.

3.7 Intervention frequency

Patients in both groups received a series of three treatments and a follow up consultation over a maximum period of two weeks, this is similar to Walker (2002).

At the first three consultations (including the initial consultation) the readings were taken first, followed by the treatment. At the fourth consultation a final set of readings were taken for subjective and objective clinical findings, and a treatment given.

3.8 Measurement tools:

Subjective measurements:

1. A short form McGill pain questionnaire (SFMQ) (APPENDIX F) was used, as this is easy to understand and quick to use and it provides information on the sensory, affective and overall intensity of pain according to Melzack (1987:191). It consists of 15 descriptors of pain, rated on an intensity scale of 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 measurement for this study as it is sensitive, quick to administer and easy to understand by patients. On completion of the questionnaire, the points are added up to form a final maximum points out of 45 for each consultation.

2. A Numerical pain rating scale, (NRS) (APPENDIX G) was also used which asks the patient to rate their pain intensity on a numerical scale of 0 – 100. In a study of by Jenson et al. (1986), comparing six methods on 75 chronic pain patients, the NRS was deemed the most practical index to use for its simplicity and ease of administration. The NRS is a scale that asks the patient to rate their pain intensity out of 100, where 0= the least amount of pain and 100= the most amount of pain. This is a practical index to use, as it is easy to administer and score (Jenson et al. 1986). On completion of the scale, the mean score of the least and the worst was found by adding them together.

Objective Measurements

1. Algometer readings (APPENDIX H) were taken to measure changes in pressure pain threshold for each patient. Algometer readings were taken at the initial and at the fourth consultation. This form of measurement has been proven to be useful for the assessment of treatment results (Fischer, 1987:207).

The procedure according to Fischer (1986), is as follows.

- The dial on the gauge was set to zero.
- The disc was placed on the point of maximum sensitivity.
- Pressure was increased at 1kg/cm²/sec.
- The patient was asked to indicate by saying “yes” at the point where the pain was first perceived.
- The pressure was stopped at this point and a reading was taken.

According to Reeves et al. (1986), as quoted by Han and Harrison (1997), pressure algometry is a diagnostic tool used to quantify the pressure pain threshold for each patient over the course of each treatment. This is the measurement of minimum pressure that induces pain, which is useful in the assessment of the results and is a reliable tool for quantifying MFTP sensitivity (Reeves et al. 1986, Fischer 1987 and Han and Harrison 1997).

Algometer readings were taken to measure changes in pressure pain threshold for each patient over the course of research treatments. This form of measurement has been proven to be useful for the assessment of treatment results (Fischer 1987).

1. A CROM device (APPENDIX I), is a cervical range of motion device with a magnetic yoke and gravity goniometers which measure the cervical range of motion in the frontal and sagittal planes. Research by Youdas et al. (1992) concluded, after testing 337 subjects, that inter tester and intra tester reliability using the CROM device were accurate to an intra class coefficient of greater than 0.80. In this research, due to the nature of the muscle to be tested the upper trapezius (a lateral flexor of the cervical spine) only values for active range of motion were recorded before the start of each of the three treatments given and then a fourth recording was taken at the fourth consultation.

3.9 Measurement Frequency

Subjective measurements were taken prior to the treatment at all four visits. Objective measurements were also taken prior to the treatment at all four visits, except for Algometer readings which were taken at the initial consultation and the fourth treatment only.

3.10 Statistical Analysis

SPSS version 11.5 was used for analysis of data (SPSS Inc, Chicago, Ill, USA). Baseline comparisons were done between treatment groups using Pearson's chi square tests or Fisher's exact tests as appropriate for categorical variables, and student's t-tests for quantitative normally distributed variables. Treatment effect was assessed with repeated measures ANOVA. A significant time by group interaction indicated a significant differential treatment effect. A p value <0.05 designated statistical significance. The direction of the treatment effect was assessed with profile plots.

Chapter 4

Statistical analysis

4. 1 Introduction.

This chapter presents statistics gathered during the course of the study, and the interpretation and explanation of the results in terms of the literature discussed in Chapter two.

The information gathered was either subjective; Numerical pain rating scale (NRS) and The Short Form McGill Pain Questionnaire (SFMQ), or objective; Pressure Threshold Algometry (ALG), and Cervical Range of Motion apparatus (CROM).

4. 2 Criteria Governing the Admissibility of Data.

Data was collected only from those patients who met the inclusion criteria and who participated for the duration of the study. The researcher collected only objective data (ALG and CROM), while the patients' recorded subjective data (NRS and SFMQ) under the supervision of the researcher.

4. 3 Demographics

Table 1: Gender by treatment group (n=60)

			Group		Total
			MFTPM	PNF	
Gender	male	Count	6	5	11
		Column %	20.0%	16.7%	18.3%
	female	Count	24	25	49
		Column %	80.0%	83.3%	81.7%
Total		Count	30	30	60
		Column %	100.0%	100.0%	100.0%

Sixty participants were randomized into two equal treatment groups. There were similar proportions of males and females in each group. The MFTPM group was 20% male and the PNF group consisted of 17% males, the slight difference being non significant ($p=0.739$). Breakdown of gender per group is shown in Table 1.

According to Han and Harrison (1997) the incidence of TPs appear to be higher in women although they are clearly found in both sexes. It was also stated that of the 200 adults presenting for a particular study, 54% of women and 45% of men had latent MFTPs in the shoulder girdle. The study does not reflect the demographic stated by Han and Harrison, in that 81.7% of patients were female and only 18.3% of patients were male. The study was conducted at the SARS call centre where the employees are predominately female.

Table 2: Racial group by treatment group (n=60)

			Group		Total
			MFTPM	PNF	
Race	White	Count	3	8	11
		Column %	10.0%	26.7%	18.3%
	Black	Count	14	12	26
		Column %	46.7%	40.0%	43.3%
	Indian	Count	8	6	14
		Column %	26.7%	20.0%	23.3%
	Coloured	Count	5	4	9
		Column %	16.7%	13.3%	15.0%
Total		Count	30	30	60
		Column %	100.0%	100.0%	100.0%

Similarly there was not a statistically significant difference between the groups in terms of the proportions in each racial group ($p=0.420$). Table 2 shows that there was a slightly higher proportion of Whites in the PNF group than in the MFTPM group but this was not statistically significant.

A Factor that could have affected the study was that patients that come from different cultures and first languages, could have had a different perception of pain than the perception of the researcher, which leads to a difference in their perception of the treatment given (Melzack, 1975).

Table 3: Comparison of age by treatment group (n=60)

	Group	N	Mean	Std. Deviation	Std. Error Mean	p value
AGE	MFTPM	30	28.53	5.077	.927	0.534
	PNF	30	29.40	5.642	1.030	

The mean age of the MFTPM group was 28.5 years while the mean age of the PNF group was slightly higher at 29.4 years. However, this difference was not statistically significant ($p=0.534$, see Table 3).

In an epidemiological study, MPS occurred in 30% of women aged 20-40, and patients between the ages of 30 and 49 years old appeared to have the highest prevalence of TPs, which then decreases with age (Han and Harrison, 1997). This is supported by the study in that the mean age is between 28 and 30 years.

Table 4: Comparison of Chronicity (years) by treatment group (n=60)

	Group	N	Mean	Std. Deviation	Std. Error Mean	p value
Chronicity (years)	MFTPM	30	2.524	2.5894	.4728	0.747
	PNF	30	2.328	2.0677	.3775	

The mean number of years that the two groups had been affected by their condition was very similar. Table 4 shows no significant difference between the two means ($p=0.747$).

This was an important statistic in this study because chronicity may affect the response to the treatment. This claim is supported by Schneider (1994), where he states that the development of a chronic pain syndrome where the muscle tissue becomes infiltrated with scar tissue or undergoes fibrosis, means that it becomes much more difficult or impossible to restore normal function.

4. 4 Baseline comparison

Table 5: Comparison of baseline measurements by treatment group (n=60)

	Group	N	Mean	Std. Deviation	Std. Error Mean	p value
Algometer	MFTPM	30	2.3867	.60954	.11129	0.865
	PNF	30	2.4133	.60443	.11035	
NRS	MFTPM	30	62.067	17.3616	3.1698	0.079
	PNF	30	54.517	15.2646	2.7869	
McGill	MFTPM	30	18.87	9.031	1.649	0.207
	PNF	30	15.93	8.769	1.601	
CROM left	MFTPM	30	48.40	4.643	.848	0.857
	PNF	30	48.12	7.208	1.316	
CROM right	MFTPM	30	45.70	6.137	1.120	0.674
	PNF	30	46.40	6.662	1.216	

In order to ensure that any differences found between the treatment groups at the end of treatment could be attributed to the treatment alone, baseline group differences in outcome measures had to be ruled out. Table 5 shows that there were no statistically significant differences between the groups at baseline. However, NRS showed borderline significance, with the MFTPM group showing slightly higher mean readings than the PNF group ($p=0.079$).

4. 5 Treatment effects

4. 5. 1 Objective pain measurements

Table 6: Between and within subjects effects for algometer

Effect	Statistic	p value
Time	Wilk's lambda =0.416	<0.001
Group	F=0.140	0.710
Time*group	Wilk's lambda =0.981	0.297

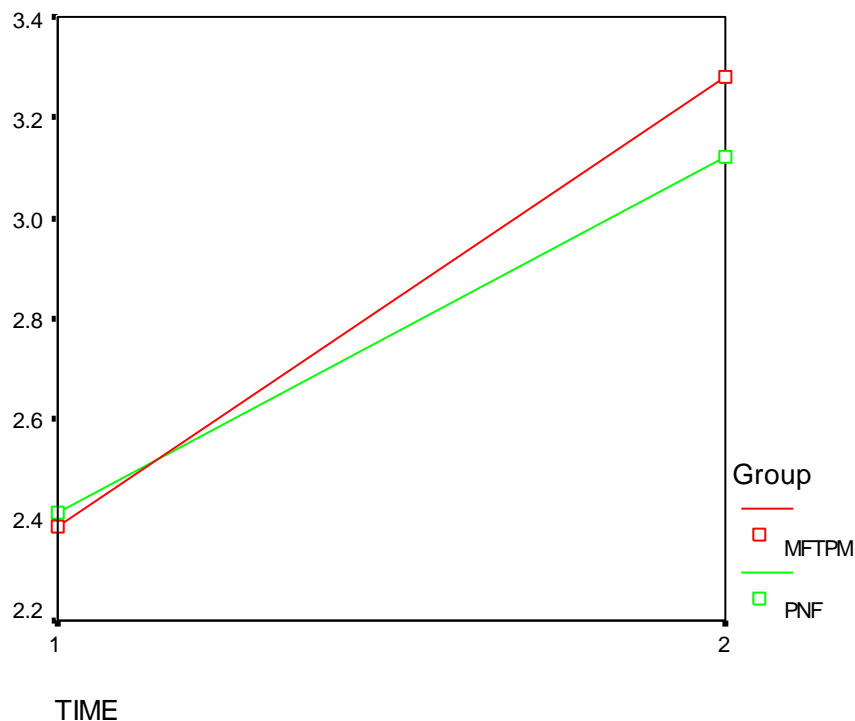


Figure 1: Profile plot of mean algometer measurements over time by group (n=60)

ALG measurements were only taken on two occasions (treatment one and treatment four). There was a highly statistically significant time effect, thus both groups showed a significant increase in mean ALG measurement over time. However, the time by group interaction was not statistically significant ($p=0.297$) meaning that the increase over time was not dependant on which group the

participants were in, thus there was no significant effect of the treatment over and above the control group. However, if one examines Figure 1, which shows the ALG profiles of the two groups over time, it is evident that the profiles are not exact and group one (MFTPM group) showed a steeper rate of increase than the other. This shows clinically that patients in the MFTPM group showed a greater response to the treatment in terms of pain over the areas treated.

The main reason for taking readings at the initial and final treatments only, was to remove any post treatment soreness that may occur in the MFTPM group and how it would affect the data. This was supported by Walker (2002), where she states that some patients reported feeling worse after the initial treatment, with palpatory tenderness over the area treated.

While there may be no statistical difference between the two groups the MFTPM group showed a steeper rate of increase indicating a trend, that there was a greater reduction in palpatory tenderness over the area treated and therefore a quicker resolution of the TPs.

This trend is hypothesized by Walker (2002), where she states MFTPM may have the added advantage in chronic Myofascial Pain cases, where resultant scar tissue formation can be broken down and normal muscle movement restored. Shacksnovis (2005) supports this theory. With MFTPM there is a breaking of adhesions, and as a result reactive inflammation develops. With this initial inflammation there is still an improvement in the overall types of pain reported as functional activity improves between treatments 1 and 2.

Readings were not taken at treatments 2 and 3 because often there is some reactive inflammation and skin tenderness that subsides over the course of the treatments. This trauma would inevitably cause edema leading to the degranulation of mast cells and the release of heparin and histamine both of which encourage mucopolysaccharide deposits and fibroblastic activity

respectively, (Chaitow and Delany, 2002 1:86) .Taking readings at these treatments would have negatively influenced the results of the MFTPM group.

The response of both treatment groups may be attributed to stretching Golgi tendon organs which respond to the change in length and the increase in tension by firing off sensory impulses of their own to the spinal cord. The impulses from

the Golgi tendon organs have the ability to override the impulses coming from the muscle spindles, allowing the muscle to reflexively relax after the initial reflex resistance to the change in length (Arnheim and Prentice, 1993), as well as separating the actin / myosin filaments in the muscle fibre which will also give a sudden barrage of nerve impulses to CNS (central nervous system) that will force the muscle to relax by toning down the impulses by the gamma nerves (Korr, 1975 as cited in Leach, 1994).

Table 7: Between and within subjects effects for CROM (left)

Effect	Statistic	p value
Time	Wilk's lambda =0.377	<0.001
Group	F=0.405	0.527
Time*group	Wilk's lambda =0.894	0.096

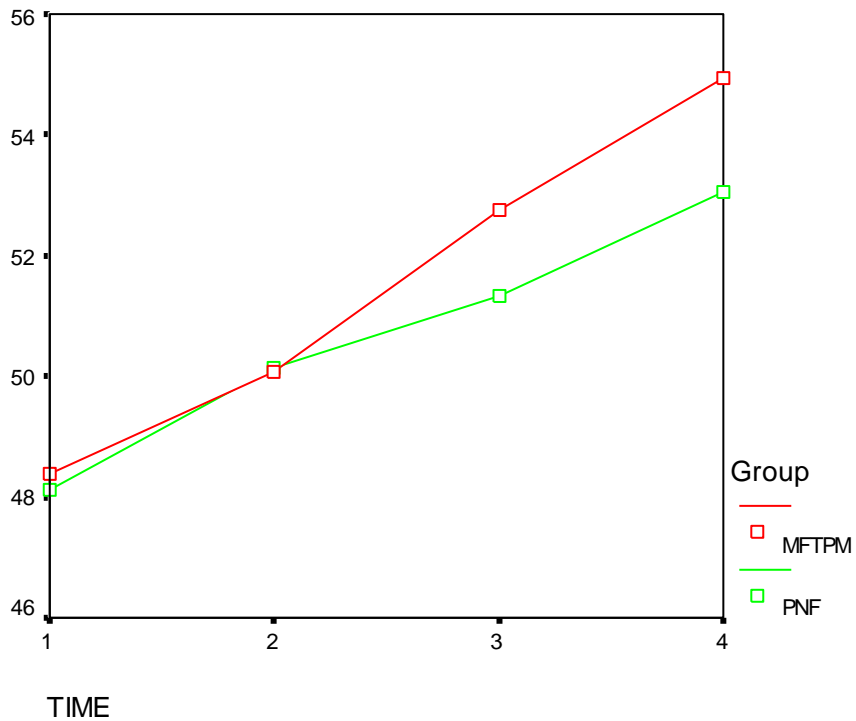


Figure 2: Profile plot of mean CROM (Left) over time by group (n=60)

CROM measurements (lateral flexion) were taken on all four visits on each side. For the left side, there was a highly statistically significant increase over time ($p < 0.001$) irrespective of treatment group ($p = 0.096$). Figure 2 shows a trend of a treatment effect in the MFTPM group compared with the PNF group, since the mean increased at a faster rate in the former group.

Table 8: Between and within subjects effects for CROM (right)

Effect	Statistic	p value
Time	Wilk's lambda =0.389	<0.001
Group	F=0.025	0.875
Time*group	Wilk's lambda =0.976	0.715

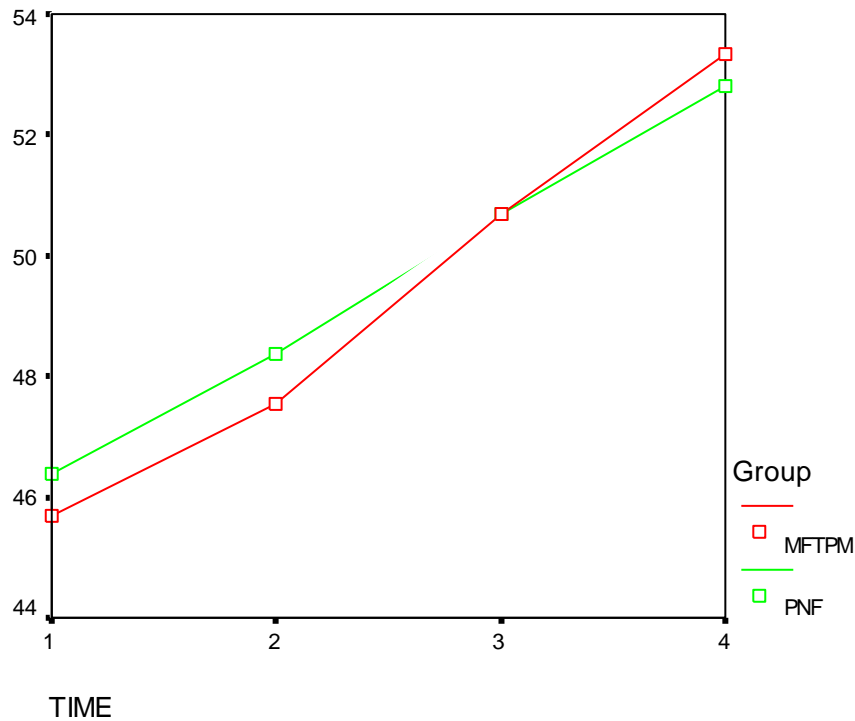


Figure 3: Profile plot of mean CROM (Right) over time by group (n=60)

CROM measurements on the right side showed that there was also a highly statistically significant increase over time ($p < 0.001$) but this was not dependent on the treatment group ($p = 0.715$). Again there was a trend showing that the rate of increase may have been steeper in the MFTPM group than in the PNF group (Figure 3).

Specific to the study and the type of patient being treated, TPs in the upper trapezius may become active due to an activity in which the trapezius helps to carry the weight of the arm for a prolonged period. These activities include telephoning or sitting without armrest support, high typewriter or keyboard, elevation of the scapula as an expression of anxiety or emotional distress (Travell and Simons, 1983). All patients treated were from the SARS call centre

and so the above factors would affect every patient treated, as they all did a similar type of job.

Analysis of both left and right lateral flexion in terms of the CROM findings showed a statistically significant improvement in terms of range of motion (lateral flexion). This improvement may in large be due to lengthening of the muscle during the stretch and a reduction of the TP activity as discussed above and in Chapter 2.

There is a slower but consistent improvement in the PNF group. This may be largely due to the slower more consistent stretch. While actin and myosin filaments and Golgi tendon organs are being stretched, the stretch was done at a slower rate when compared to MFTPM. This is supported by Travell, Simons and Simons (1999) where they state the high velocity thrust applied to the affected muscle induces a localized stretch to the contracted actin and myosin filaments, thereby breaking the cycle of contractile activity within the TP.

Initially the response of the MFTPM group was slower (between treatments 1 and 2), thereafter there is a much sharper increase in the range of motion largely due to the decrease in the reactive inflammation and tenderness following the initial treatments.

4. 5. 2 Subjective measurements

Table 9: Between and within subjects effects for NRS

Effect	Statistic	p value
Time	Wilk's lambda =0.274	<0.001
Group	F=1.347	0.250
Time*group	Wilk's lambda =0.967	0.594

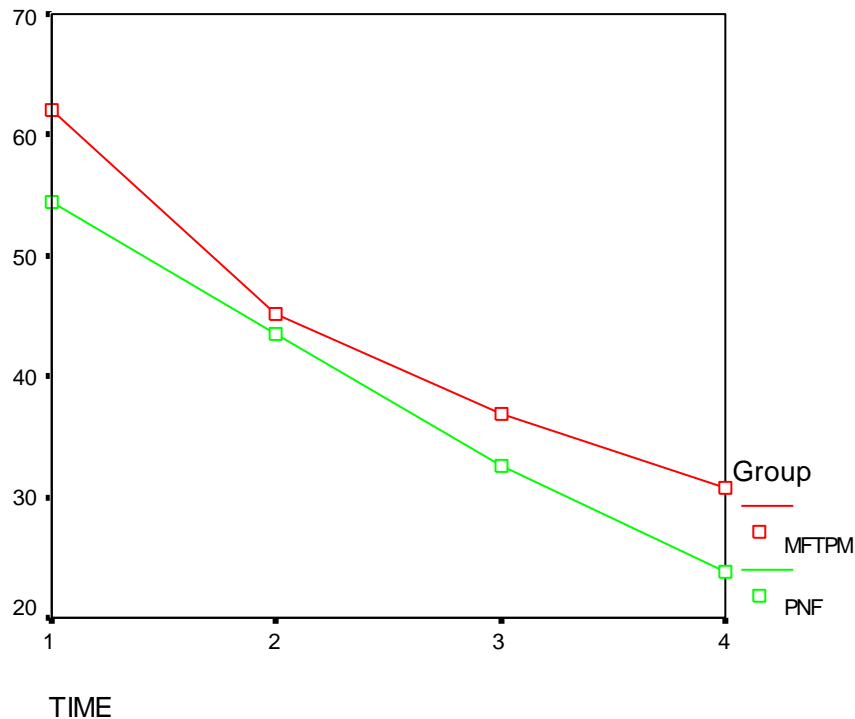


Figure 4: Profile plot of mean NRS over time by group (n=60)

Table 9 shows that there was evidence of both groups showing a statistically significant decrease in pain measured by the NRS over the four time points ($p < 0.001$), but no evidence of a difference between the treatment groups over time ($p = 0.594$). This is supported by Figure 4 which shows almost parallel profiles of the two groups over time.

Both treatment groups showed almost a parallel improvement over time, this is reflected by a decrease in the activity of TPs in the upper trapezius. This same improvement is reflected in the ALG and CROM readings. With a decrease in the activity of TPs there will be a decrease in the amount of pain and an increase in range of motion.

There was an initial sharp decrease in pain perception between treatment one and two in the MFTPM group. This could be attributed to breaking of superficial adhesions, breaking the cycle of contractile activity, and causing a fresh wash of

blood to the area removing any breakdown products of inflammation, thereby allowing the muscle to reflexively relax. The mechanism whereby the cycle of contractility is broken is discussed in greater detail in Chapter two. The flattening out of the response of the MFTPM group between treatments two and four may be due to patients being treated on consecutive days due to time constraints. The reactive inflammation associated with MFTPM did not have time to subside before the next treatment. This is also reflected in the SFMQ below.

Table 10: Between and within subjects effects for McGill pain score

Effect	Statistic	p value
Time	Wilk's lambda =0.362	<0.001
Group	F=2.193	0.144
Time*group	Wilk's lambda =0.960	0.509

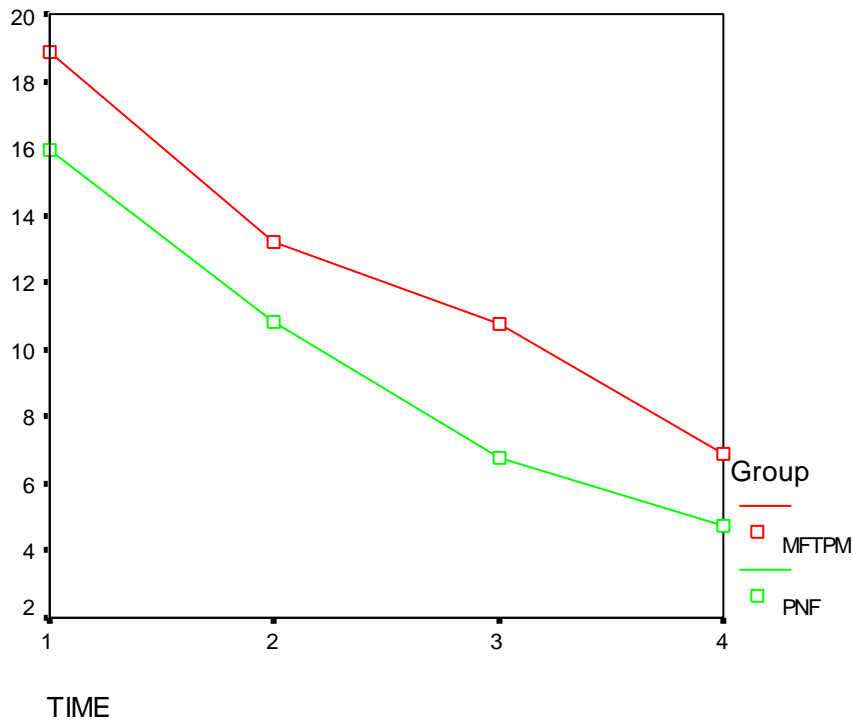


Figure 5: Profile plot of mean McGill pain score over time by group (n=60)

Pain score measured with the Short Form McGill Pain Questionnaire showed a highly statistically significant decrease over time in both groups ($p < 0.001$), but no evidence of a differential treatment effect ($p = 0.509$). Figure 5 shows both groups decreasing at similar rates over time.

Carrying on from the trend discussed for the NRS there is significant improvement in both groups. Overall the PNF group shows a slightly steeper decrease in pain. This may be due to the lack of an inflammatory response discussed for the MFTPM group above. The flattening out of the decrease in pain perception between treatments two and four may be due to the fact that only superficial adhesions were broken. The researcher could not break the deeper adhesions due to tenderness over the area or to tenderness within the muscle itself.

Correlations between changes in outcome measurements

MFTPM Group

Table 11: Correlation matrix between changes in outcome variables in the MFTPM group (n=30)

		change in algometer	change in NRS	change in McGill	change in CROM left	change in CROM right
change in algometer	Pearson Correlation	1	-.499(**)	-.087	.246	.404(*)
	Sig. (2-tailed)	.	.005	.649	.190	.027
	N	30	30	30	30	30
change in NRS	Pearson Correlation	-.499(**)	1	.341	-.280	-.485(**)
	Sig. (2-tailed)	.005	.	.065	.134	.007
	N	30	30	30	30	30
change in McGill	Pearson Correlation	-.087	.341	1	-.338	-.288
	Sig. (2-tailed)	.649	.065	.	.068	.123
	N	30	30	30	30	30
change in CROM left	Pearson Correlation	.246	-.280	-.338	1	.748(**)
	Sig. (2-tailed)	.190	.134	.068	.	.000
	N	30	30	30	30	30
change in CROM right	Pearson Correlation	.404(*)	-.485(**)	-.288	.748(**)	1
	Sig. (2-tailed)	.027	.007	.123	.000	.
	N	30	30	30	30	30

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

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

Within the MFTPM group there was a statistically significant and strong positive correlation between change in CROM right and CROM left ($r = 0.748$, $p < 0.001$). NRS and CROM right were negatively correlated, and algometer and CROM right were positively correlated, although the strength of the correlations was weak. Algometer and NRS were also weakly negatively correlated. Correlation coefficients and p values are shown in Table 11.

PNF Group

Table 12: Correlation matrix between changes in outcome variables in the PNF group (n=30)

		change in algometer	change in NRS	change in McGill	change in CROM left	change in CROM right
change in algometer	Pearson Correlation	1	-.350	-.166	.381(*)	.292
	Sig. (2-tailed)	.	.058	.380	.038	.117
	N	30	30	30	30	30
change in NRS	Pearson Correlation	-.350	1	.519(**)	-.220	-.531(**)
	Sig. (2-tailed)	.058	.	.003	.243	.003
	N	30	30	30	30	30
change in McGill	Pearson Correlation	-.166	.519(**)	1	-.068	-.316
	Sig. (2-tailed)	.380	.003	.	.721	.088
	N	30	30	30	30	30
change in CROM left	Pearson Correlation	.381(*)	-.220	-.068	1	.331
	Sig. (2-tailed)	.038	.243	.721	.	.074
	N	30	30	30	30	30
change in CROM right	Pearson Correlation	.292	-.531(**)	-.316	.331	1
	Sig. (2-tailed)	.117	.003	.088	.074	.
	N	30	30	30	30	30

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

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

The correlations in the PNF group were different to the MFTPM group. CROM left and algometer were weakly positively correlated, NRS and CROM right were moderately negatively correlated, and NRS and McGill score were moderately positively correlated. These are shown in Table 12.

4. 6 Observations

The following observations were made by the researcher and did not form part of the data collected and analyzed as part of the study. They are merely anecdotal and would require further investigation to determine their validity.

4. 6. 1 Myofascial Trigger Point Manipulation

- The first observation noted was that patients seemed disappointed in the treatment they received and were sceptical about the how much they would benefit from the treatments.
- Following on from the first observation was how surprised the patients were after the first two treatments. Patients reported that they slept better at night, that the occurrence of tension type headaches had decreased significantly, that the pain in their necks and trapezius did not bother them at work and that they only thought about it when having to fill out the pain questionnaires.
- Patients treated on consecutive days did experience some post treatment soreness but this had subsided by the following day. This is related to some micro-trauma to the area being treated.
- Patients reported that their necks felt a lot “looser” and some reported that it was as if a weight had been lifted off their shoulders.

4. 6. 2 Proprioceptive Neuromuscular Facilitative Stretching

- Patients seemed disappointed in the treatment they received and were sceptical about the how much they would benefit from the treatments.
- Following on from the first observation was how surprised the patients were after the first two treatments. Patients reported that they slept better at night, and that the occurrence of tension type headaches had decreased significantly.

- Patients reported that their necks felt a lot “looser” and some reported that it was as if a weight had been lifted off their shoulders.
- Patients did not experience any post treatment soreness.
- One patient reported that she felt slightly dizzy immediately following the initial treatment, but this subsided after about a minute. It did not reoccur for the other three treatments. A few patients reported pain in their necks while they were being stretched; this is probably due to an underlying facet syndrome.

4.6.3 Limitations with respect to the study – CONTENTS PAGE

It is noted that the study as a limitation with respect to generalisability of the results. This is based on the fact that in order to achieve maximum sample homogeneity (Mouton, 1996), the sample population was drawn from a very homogenous group of people (i.e. SARS call centre), in order to achieve greatest emphasis on clinical outcomes with minimal variable effects brought in by patients. This process however limits the clinical applicability of the results to patients that resemble the clinical cohort in this study and thus will not always be applicable to all patients within the population.

4.7 Summary

For the objective measurements (ALG and CROM), there was a trend suggesting that the MFTPM group responded more favorably than the PNF group, although this was not shown conclusively. Both treatment groups improved significantly in terms of objective and subjective findings, indicating a treatment effect even though one treatment was not proven to be statistically better than the other.

The reason why statistical significance was not found even though a small treatment effect was visible could be for two reasons. Firstly the treatment effect observed could have been too small to be of clinical significance anyway.

Secondly, if the size of effect was clinically important, the power of the study could have been too low to detect that size of effect due to small sample size. The non significant results suggest that these results could have been observed by chance and that there are no real differences between the groups. The results of this study could be used as justification for a further study in which a larger sample size would serve to either confirm the presence of an effect statistically, or to refute the claim with confidence.

Thus the MFTPM treatment was not superior to or inferior to the PNF treatment although there is a definite trend towards the MFTPM treatment being more effective. This may be due to the fact that imparting a quick stretch to the muscle helps to break the cycle of contractility in the muscle more rapidly, causing some micro-trauma to the area leading to a fresh wash of blood through the area and there by removing the breakdown products of inflammation which have accumulated in the area perpetuating the pain cycle.

Chapter 5

Recommendations and Conclusions

5. 1 Recommendations

5. 1. 1 Objective Data

There were no problems encountered with the use of the ALG and CROM. The researcher found them to be easy to use and reliable tools.

5. 1. 2 Subjective Data

There were no problems encountered with the use of the NRS. It was easy to explain and it is in the opinion of the researcher that the patients had a good understanding of how to complete the form.

There was some difficulty when using the SFMQ with patients whose home language was not English, although all patients spoke English fluently. Most black, Indian, and coloured patients had some difficulty understanding some of the descriptive terms of pain in that they have a different interpretation of the terms. The researcher tried his best to explain the terms, but it was uncertain whether or not those patients had a clear understanding. For future studies it may be beneficial to give the questionnaire in other languages.

Perhaps a brief description of the terms attached to the SFMQ might help alleviate this problem in the future.

5. 1. 3 Researcher Inexperience

Hsieh et al. (2000:263) feel that extensive clinical experience in MFTP examination is important in obtaining examiner reliability. A suggestion for future studies is that a more experienced examiner be present to confirm the location of the TPs.

5. 2 Other Recommendations

Although a sample size of 60 was large enough to use parametric statistical analysis, a larger sample size would have yielded more clinically significant and accurate results.

This study concerns itself mainly with the short term effects of the treatments, perhaps a two week and one month follow up would yield greater insight into the long term effects of the treatments.

For future studies it may be advisable to have a one day break between treatments in order to let any reactive inflammation that follows MFTPM subside.

5. 3 Discussion of hypotheses

Objective 1:

The first objective is to evaluate the relative effectiveness of MFTPM as compared to PNF stretching in terms of objective clinical findings, in the treatment of active myofascial trigger points (MFTPs).

The *first hypothesis* was that MFTPM was more effective than PNF stretching in terms of objective clinical findings.

Objective 2:

The second objective is to evaluate the relative effectiveness of MFTPM as compared to PNF stretching in terms of subjective clinical findings, in the treatment of active myofascial trigger points (MFTPs).

The ***second hypothesis*** was that MFTPM was more effective than PNF stretching in terms of subjective clinical findings.

There is a definite trend when looking at the objective data that may support the hypothesis that MFTPM is as effective as, if not more effective than PNF stretching in terms of objective findings. However, statistically there was no difference between the two groups, therefore the null hypothesis is rejected were a p value of less than 0.05 is significant.

5. 4 Conclusion

This study consisted of 60 patients, randomly divided into two groups of 30, who all underwent a full case history, physical, and cervical regional examination in order to determine whether they met the inclusion and exclusion criteria with respect to sub acute active MFTPs in the upper trapezius.

Patients were randomly allocated into one of two groups by drawing a piece of paper out a hat. Patients in Group one received MFTPM and those in Group two received PNF stretching. All patients received 3 treatments and a follow up within a two week period.

Prior to each treatment subjective (NRS and SFMQ) readings were taken as well as at the follow up. Subjective measurements were also taken prior to each treatment, with ALG readings being taken at the initial consultation and at the

follow up visit. CROM readings were taken prior to each treatment and at the follow up visit.

Statistical evaluation of the results revealed no significant statistical difference between the 2 groups in terms of objective and subjective clinical findings, although there was a definite trend that favored the MFTPM group when looking at the objective findings. However it must be noted that the sample population was drawn from a very homogenous group of people (i.e. SARS call centre), in order to achieve the greatest emphasis on clinical outcomes and results. The study needs to be interpreted in this context, in that it limits the clinical applicability of the results to patients that resemble the clinical cohort in this study, and thus will not always be applicable to all patients within the population.

It is therefore the researcher's conclusion that there is no statistical difference between MFTPM and PNF stretching in terms of objective and subjective clinical findings. Both treatment modalities have been shown to be equally effective in the treatment of subacute active TPs in the upper trapezius.

There is a definite trend when looking at the objective data that may support the hypothesis that MFTPM is as effective as, if not more effective than PNF stretching. It is of the opinion of the author that a larger sample size is needed to make it clinically significant.

The researcher agrees with a statement by Shacksnovis (2005) that the application of MFTPM as a treatment places less stress on the practitioner for a shorter period of time allowing the practitioner to affect more treatments within one treatment session, thus being able to offer more to the patient per treatment session.

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Appendix A.
Demographic Data (Tables).

Table 1: Gender by treatment group (n=60)

			Group		Total
			MFTPM	PNF	
Gender	male	Count	6	5	11
		Column %	20.0%	16.7%	18.3%
	female	Count	24	25	49
		Column %	80.0%	83.3%	81.7%
Total		Count	30	30	60
		Column %	100.0%	100.0%	100.0%

Table 2: Racial group by treatment group (n=60)

			Group		Total
			MFTPM	PNF	
Race	White	Count	3	8	11
		Column %	10.0%	26.7%	18.3%
	Black	Count	14	12	26
		Column %	46.7%	40.0%	43.3%
	Indian	Count	8	6	14
		Column %	26.7%	20.0%	23.3%
	Coloured	Count	5	4	9
		Column %	16.7%	13.3%	15.0%
Total		Count	30	30	60
		Column %	100.0%	100.0%	100.0%

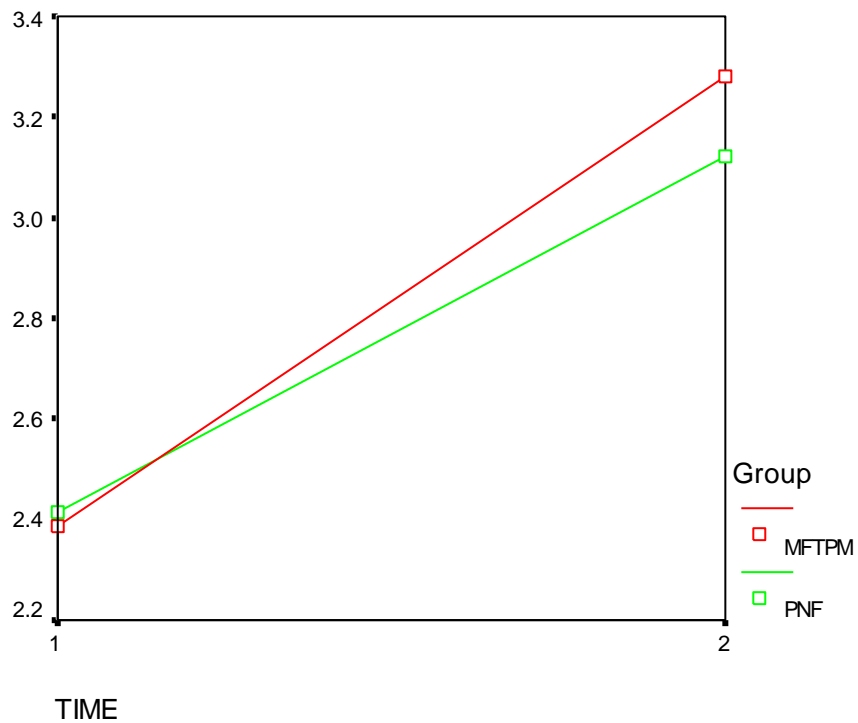
Table 3: Comparison of age by treatment group (n=60)

	Group	N	Mean	Std. Deviation	Std. Error Mean	p value
AGE	MFTPM	30	28.53	5.077	.927	0.534
	PNF	30	29.40	5.642	1.030	

Appendix B Treatment Effect (Tables and Figures).

Table 6: Between and within subjects effects for algometer

Effect	Statistic	p value
Time	Wilk's lambda =0.416	<0.001
Group	F=0.140	0.710
Time*group	Wilk's lambda =0.981	0.297



**Figure 1: Profile plot of mean algometer measurements over time by group
(n=60)**

Table 7: Between and within subjects effects for CROM (left)

Effect	Statistic	p value
Time	Wilk's lambda =0.377	<0.001
Group	F=0.405	0.527
Time*group	Wilk's lambda =0.894	0.096

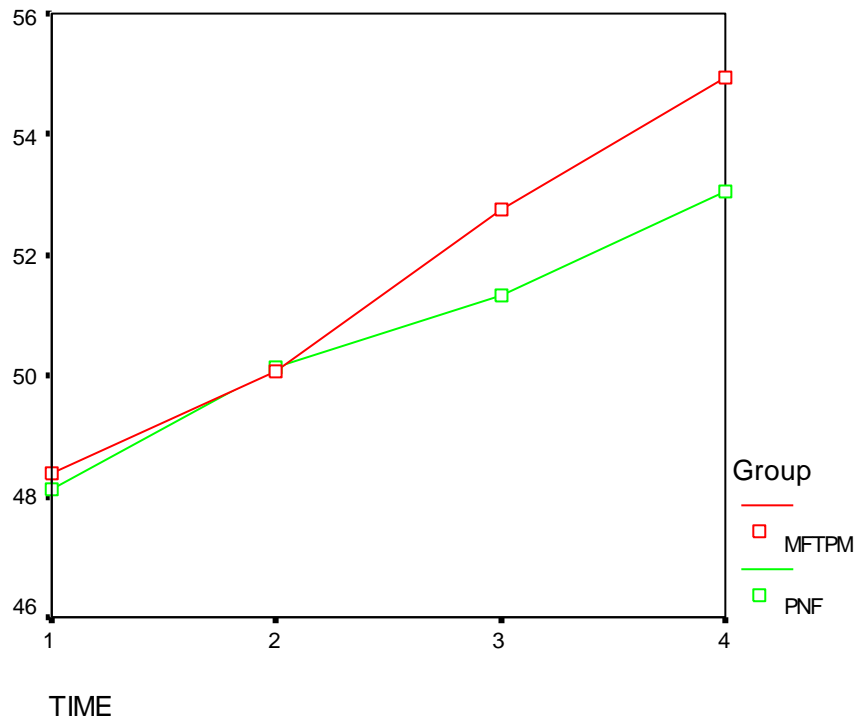


Figure 2: Profile plot of mean CROM (Left) over time by group (n=60)

Table 8: Between and within subjects effects for CROM (right)

Effect	Statistic	p value
Time	Wilk's lambda =0.389	<0.001
Group	F=0.025	0.875
Time*group	Wilk's lambda =0.976	0.715

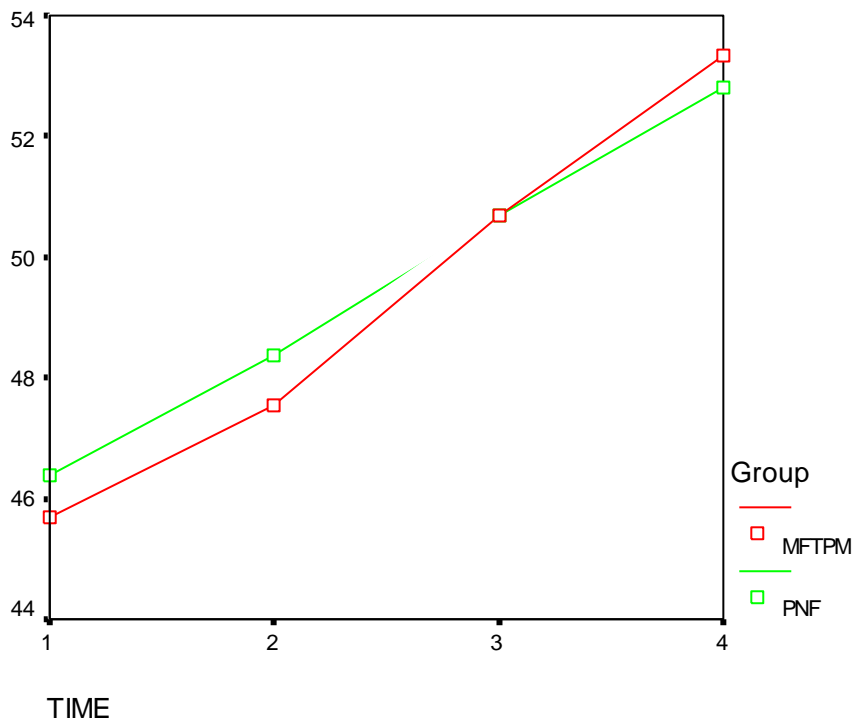


Figure 3: Profile plot of mean CROM (Right) over time by group (n=60)

Table 9: Between and within subjects effects for NRS

Effect	Statistic	p value
Time	Wilk's lambda =0.274	<0.001
Group	F=1.347	0.250
Time*group	Wilk's lambda =0.967	0.594

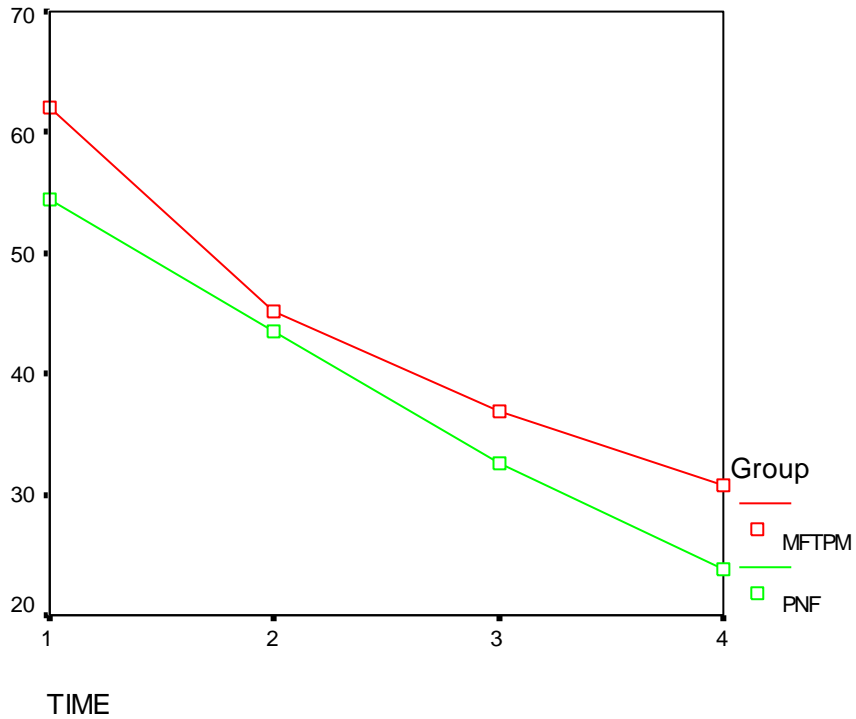


Figure 4: Profile plot of mean NRS over time by group (n=60)

Table 10: Between and within subjects effects for McGill pain score

Effect	Statistic	p value
Time	Wilk's lambda =0.362	<0.001
Group	F=2.193	0.144
Time*group	Wilk's lambda =0.960	0.509

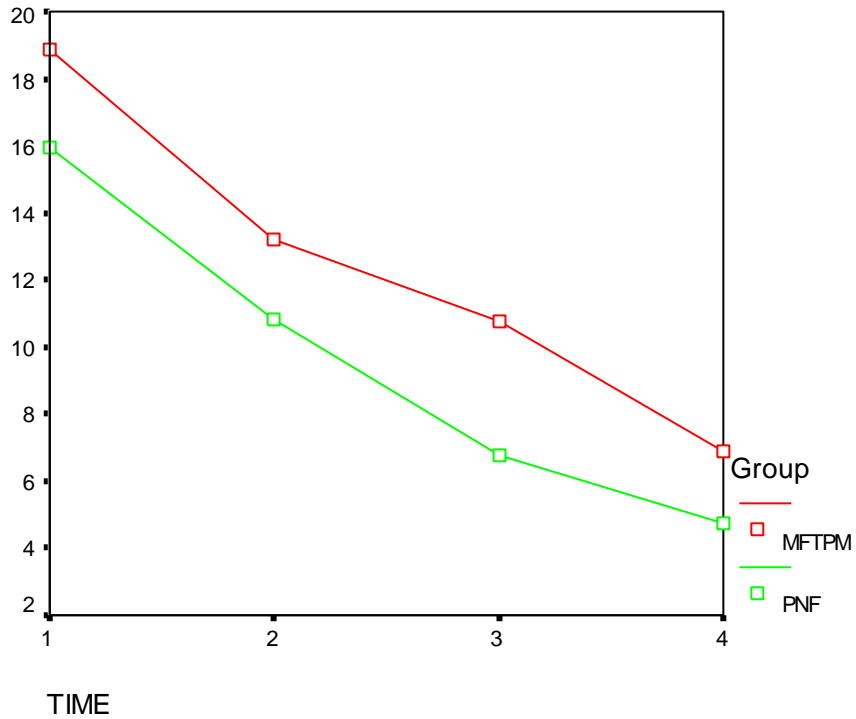


Figure 5: Profile plot of mean McGill pain score over time by group (n=60)