

**THE RELATIVE EFFECTIVENESS OF SPRAY AND
STRETCH COMPARED TO ICE AND STRECTH IN
THE TREATMENT OF MYOFASCIAL TRIGGER
POINTS.**

By

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representative of my own work.

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DEDICATION

To all my friends.

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To Dr R Mathews for his patience, effort and his support, not only to me, but to my family as well.

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ABSTRACT

Pain arising from myofascial trigger points is common and is often so disabling that the need for fast effective treatment is urgent. Of the many documented treatments for trigger points, there is little evidence to support one treatment over another. It is thus the purpose of this study to determine the relative effectiveness of stretch and ice to stretch and spray in the treatment of myofascial trigger points found in the upper trapezius muscle.

This comparative clinical study involved the participation of thirty patients presenting with myofascial trigger points of the upper trapezius muscle.

By means of consecutive sampling, patients complaining of neck pain, and/or headaches, and/or shoulder pain or a combination thereof, and who were between the ages of sixteen and sixty-five, underwent a screening processes to determine if they had active myofascial trigger points in the upper trapezius. Those that were eligible for the study were randomly assigned to either the stretch and ice group or the stretch and spray group.

The subjective primary data consisted of three pain questionnaires, namely the Short Form McGill Pain Questionnaire, CMCC Neck Disability Index, and Numerical Rating Scale-101. The objective data was supplied by readings taken from an algometer. The patients underwent three consultations in the first week, two consultations in the second week and a final consultation one-month after the fifth treatment. All the primary data was collected at four occasions. These were at the first, third, fifth and one month follow-up consultations.

Intra-group analysis using the Wilcoxon Sign-Rank Test determined if each group improved significantly with respect to the data collected. The Mann-Whitney U test was used to determine which group was statistically better than the other. The results, including the standard deviation, standard error, mean and power

results were displayed in the form of tables. The level of significance for all the tests were set at $\alpha = 0.05$.

Overall the results showed that both groups improved significantly over the treatment period but not over the one-month period following the last treatment. These results allowed the acceptance of hypothesis one and two which stated that there will be an improvement within each respective group. When comparing the two groups it was found that neither was significantly better than the other. The Mann Whitney U test thus provided the results needed to reject the third hypothesis which stated that there would be a significant improvement between the two treatment groups.

In conclusion the results show that both stretch and ice and stretch and spray are effective in treating trigger points and that neither groups are statistically better than the other. Thus when considering which treatment protocol to administer, the practitioner must take into account other factors such as cost, safety, comfort, and treatment time. All of which vary for each individual practice.

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DEFINITION OF TERMS

Active Range of Motion: -

The movement caused only by voluntary effort to move the body part being tested. (Travell and Simons 1992:1).

Active Myofascial Trigger Point: -

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 on motion that is specific for that muscle. An active trigger point is always tender, prevents full lengthening of the muscle, weakens the muscle, usually refers pain on direct compression, mediates a local twitch response of muscle fibers when adequately stimulated, and is often associated with referred autonomic phenomena, generally in its pain reference zone. (Travell and Simons 1992:1).

Ethyl Chloride Spray : -

This is a colorless vapocoolant which is applied to the skin to produce an intense cold and local anesthesia.

Fibromyalgia: -

Fibromyalgia is identified by widespread pain of at least 3 months duration in combination with tenderness at 11 or more of 18 specified tender point sites. (Travell and Simons 1992:2).

Jump Sign: -

A general involuntary pain response of the patient, who winces, may cry out, and may withdraw in response to the pressure applied on a trigger point. (Travell and Simons 1992: 3).

Myofascial Pain Syndrome: -

Pain and/or autonomic phenomena referred from active myofascial trigger points with associated dysfunction. The specific muscle or muscle group that causes the symptoms should be identified. (Travell and Simons 1983:3).

Myofascial Trigger Point: -

A hyperirritable spot, usually within a taut band of skeletal muscle or in its fascia. The spot is painful on compression and can give rise to characteristic referred pain, tenderness, and autonomic phenomena. A myofascial trigger point is to be distinguished from cutaneous, ligamentous, periosteal, and nonmuscular fascial trigger points. Types include active, latent, primary, associated, satellite and secondary. (Travell and Simons 1992: 4).

Palpable Taut Band: -

Collection of taut muscle fibers that are associated with the myofascial trigger point and are identifiable by tactile palpation of the muscle. (Travell and Simons 1992:5).

Passive Range of Motion: -

The extent of movement (usually tested within a given plane) of an anatomical part at a joint when movement is produced by an outside force without voluntary assistance or resistance by the subject. (Travell and Simons 1983:3).

Referred Pain: -

This is pain that arises in a trigger point, but is felt at a distance, often entirely remote from its source. The pattern of which is reproducibly related to its site of origin. (Travell and Simons 1983:3).

Subjective Clinical Findings: -

A diagnostic procedure completed by the patient, which subjectively assesses the condition of the same patient. Usually gathered by use of questionnaires. This study made use of the CMCC Neck Disability Index, Short Form McGill Pain Questionnaire and the Numerical Rating Scale-101 to determine the subjective clinical findings.

CHAPTER ONE

INTRODUCTION

CHAPTER 1

INTRODUCTION

Myofascial trigger points are one of the most common causes of acute and chronic musculoskeletal pains (Nielson 1981). With skeletal muscle making up 43% of a persons body weight (Moore 1985: 37), its not surprising that trigger points are extremely common and that they would effect everyone's life at some stage (Travell and Simons 1983 :5). Han and Harrison (1997) found that the incidence of myofascial pain syndrome varied between thirty and eighty-five percent of the people attending pain clinics, with the condition being more prevalent in women than in men. Goldenberg's (1987) conservative estimate of people in the United States effected with myofascial trigger points is around three to six million.

Gatterman (1990:285) and Travel and Simons (1983 :13) both state that active trigger points are most likely to occur in the postural muscles of the neck. Sola (1981) found that the trapezius, levator scapulae and the infraspinatus muscles were the most common muscles in which active trigger points occurred. Travell and Simons (1983:183) state further that the muscle most often affected by myofascial trigger points is the trapezius.

Myofascial pain has in the past been a cause of much confusion and controversy with regards to musculoskeletal pain (Nielson 1981). Past nomenclature for this syndrome included fibrositis, myositis, myalgia, and non-articular rheumatism (Nielson 1981). The lack of consistent nomenclature and the lack of a unified theory to explain myofasciitis, coupled with there being no obvious characteristic pathological changes, all contribute to the confusion surrounding this syndrome (Fricton 1990).

An active trigger point is located in an area of hyperirritability within a taut muscle band. When palpated the active trigger point refers pain and/or autonomic phenomena to a specific referral zone. (Graaf-Radford et al. 1987). The referred pain, which is often described as deep, dull, and aching (Travell and Simons 1983:5-13), is characteristic for each trigger point and does not usually follow the distribution of sclerotomes, dermatomes or peripheral nerves (Nielson 1981).

Myofascial triggers points are aggravated by factors that affect or stress the muscle. These factors include certain physical stresses such as poor posture or body mechanics. Systemic disorders such as chronic infections, arthritis, and visceral disease, and psychological factors such as depression and mental stress, to name but few, also contribute to trigger point activation and perpetuation. Nutritional, metabolic and endocrine anomalies have also been implicated in the perpetuation of trigger points. (Graaf-Radford et al. 1987.)

Once the aetiology of the trigger point has been established, treatment of the trigger point is not difficult (Rubin 1981). In his review article, Simons (1976) states that there are 35 recommended treatments for myofascial pain syndrome. These could then be sub-divided into six broader categories: physical therapy, injection, vapocoolant spray, medical management, drugs and surgery. He goes on to say that of these treatments, massage, procaine injection, and ethyl chloride spray were reported to provide marked pain relief.

Han and Harrison (1997) state that a multidisciplinary approach to the treatment of trigger points appears to be the most beneficial and may include such modalities as hypodermic injection, dry needling, stretch and spray, and transcutaneous electrical nerve stimulation (TENS). In a study by Lewit and Simons (1984), stretching was used to relieve increased muscle tension associated with trigger points. They believed that the stretching not only abolished trigger points in muscles but also those found in painful ligaments and in the periosteum in the region of muscle attachment. Broome (1996) found that

dry needling of trigger points produced a significant improvement when used in conjunction with an appropriate stretch of the affected muscle. He recommends the use of dry needling as an alternative to hypodermic injection as it is easier to use and more cost effective. Graaf-Radford's et al. (1989) study on the effect of TENS on myofascial pain and trigger point sensitivity found that although effective in reducing myofascial pain, there was however no significant changes in trigger point sensitivity. On this basis they suggest that TENS alone may be insufficient for the long term treatment of myofascial pain.

Travell and Simons (1992:63-64) felt that stretch and spray was the workhorse of myofascial therapy. Ellis (1961) found that many of his patients suffering from myofasciitis had had complete relief after a single application of ethyl chloride spray. However there are problems associate with the use of ethyl chloride. It is flammable and potentially explosive when the vapor is mixed with air and is therefore not safe for home use. Excessive application can also cause local tissue damage through hypothermia i.e. frostbite/chilblains. (Ellis 1961)

According to Travell and Simons (1992:8-10) the sensory and reflex effects of ethyl chloride spray can be obtained to a certain degree by stroking with ice. The advantages of stretch and ice over stretch and spray are that the former is safe and can be given to the patient for home use. Till (1969 55:461-466) states that ice therapy provides good results, has a high patient compliance, requires no elaborate equipment, is inexpensive, and provides marked symptom relief on the first treatment.

Although both methods are effective in the treatment of myofascial trigger points, it is not know if one is considerably more effective than the other. It is the aim of this study to compare the stretch and ice treatment to stretch and spray in order to determine which is the more effective treatment of myofascial trigger points.. The first objective is to evaluate the effectiveness of the stretch and spray technique and stretch and ice technique in terms of subjective clinical findings in

the treatment of active myofascial trigger points. The second objective is to evaluate the effectiveness of the stretch and spray technique and stretch and ice technique in terms of objective clinical findings in the treatment of active myofascial trigger points. The third objective is to integrate the data of the first two objectives in order to determine which treatment is more effective in the treatment of active myofascial trigger points.

The algometer is used to collect data needed for the objective clinical findings, whereas three pain questionnaires, namely the Short Form McGill Pain Questionnaire, CMCC neck disability index, and numerical rating scale-101, will be used to determine the subjective clinical findings.

The results will in turn assist health care practitioners in choosing the most effective and cost affective form of treatment, resulting in a quicker recovery time and greater long term effect.

CHAPTER TWO

REVIEW OF THE RELATED LITERATURE

CHAPTER 2

REVIEW OF THE RELATED LITERATURE

2.1 INTRODUCTION

Painful musculoskeletal conditions such as strains, myositis, fibrositis, arthritis, and bursitis are the presenting diagnoses of a large percentage of patients seen in any general medical practice (Grant 1964: 233). The Nuprin report (Taylor 1985) found that fifty-three percent of the American population suffers with muscle pain. Thirty-three percent of these report pains lasting greater than eleven days, while ten percent report pain lasting greater than one hundred days. Two years later Goldenberg (1987) concluded with a conservative estimate that around three to six million Americans suffer from myofascial pain.

In their review article, Han and Harrison (1997) found that the incidence of myofascial pain syndrome varied between thirty and eighty-five percent of people attending pain clinics, with the condition being more prevalent in females than in males. In Sola *et al.*'s (1955) survey of 200 young asymptomatic adults, around forty-nine percent were found to have one or more trigger points. The survey also showed that fifty-four percent of females and forty-five percent of males presented with latent trigger points in the muscles of the shoulder girdle. This is supported by Yunus *et al.* (1981) who state that females are more commonly affected than males and that they range between the ages of twenty-five and forty years of age. Friction *et al.* (1985) found that the decrease in prevalence of trigger points after the age of forty-nine was probably due to a decrease in muscle activity and a decrease in muscle stress.

2.2 CONFUSION AND CONTROVERSY SURROUNDING MYOFASCIAL PAIN

Myofascial pain has in the past been a cause of much confusion and controversy with regards to musculoskeletal pain (Nielson 1981). Parallel meanings, overlapping meanings and multiple names have all contributed to blocking the general understanding of myofascial pain syndrome (Travell and Simons 1983:8).

Myofascial pain has been described as fibrositis, myositis, myalgia, myofasciitis, non-articular rheumatism and muscular strain (Nielson 1981). Travell and Simons (1983:9) list several reasons why authors keep introducing new terms and names for myofascial pain syndromes: -

- Many physicians are unfamiliar with myofascial pain disorders.
- Authors are often unaware that a myofascial pain disorders comprise a large family of single-muscle and muscle group syndromes.
- Authors are often frustrated with ambiguous terms such as "fibrositis".

A large area of confusion lies in the ability to differentiate myofascial pain syndrome from that of primary fibromyalgia syndrome (PFS)- commonly known as fibrositis. Travell and Simons (1983: 11) list four criteria with which PFS can be diagnosed: -

1. A widespread aching lasting three months.
2. Tenderness at 12 of 14 specific locations.
3. Tenderness during skin rolling of the upper scapulae region.
4. Disturbance of sleep accompanied with morning fatigue and stiffness

In order to develop criteria for PFS, Wolfe et al. (1990) studied 558 patients. With a control group of 265 and a group of 283 patients diagnosed with fibromyalgia,

he managed to draw up new criteria for the classification of this disorder. These where: -

- widespread pain in combination with,
- Tenderness at eleven or more of eighteen specific tender point spots.

In their review article, Han and Harrison (1997) mention the above criteria as well as generalized pain involving three or more anatomic sites for a duration of greater than three months, and the exclusion of similar conditions as main diagnostic criteria for PFS.

In contrast to myofascial pain syndrome, which are characterized by hypersensitive trigger points which refer pain in a consistent pattern, PFS patients present with multiple tender points without the characteristic pain referral (Gatterman 1990:286). In addition to this, patients diagnosed with myofascial pain syndrome report few, if any, systemic symptoms whereas PFS patients often experience fatigue, sleep disturbances, morning stiffness, paresthesia, headaches or irritable bowel syndrome (Yunus et al. 1981).

In the acute form, the differentiation between PFS and myofascial pain syndrome is relatively easy, but when myofascial pain syndrome becomes chronic then there are often overlapping symptoms. Both myofascial pain syndrome and PFS have similar characteristics and may represent two ends of a continuous spectrum. (Han and Harrison 1997.) Due to the confusion and controversy surrounding PFS and myofascial pain syndrome, Yunus et al. (1981) advocate for further studies on myofascial pain involving many independent investigators working in a collaborative manner.

2.3 THE ACTIVATION OF TRIGGER POINTS

The causes for activation of myofascial trigger points must be identified and eliminated to prevent the same stresses from reactivating and perpetuating them after the treatment (Travell and Simons 1983:45).

Sola (1981) found that the main initiating factors in trigger point development were emotional stress and physical stress. Gatterman (1990:286-287) stated that the patient often reported a history of muscle strain in a traumatic accident prior to them reporting trigger point symptoms. Both Sola (1981) and Gatterman (1990:286-287) agree in an inherent predisposition of the patient to developing trigger points. Gatterman (1990:286-287) includes inadequate nutrition, poor fitness, joint laxity, job frustrations, physical, sexual, and psychological abuses, allergies and metabolic abnormalities as factors that may predispose a patient to trigger points.

Travell and Simons (1983:55-56) separate the causes of trigger point activation in two groups according to the nature of the onset, namely sudden onset and gradual onset. This approach is similar to that of Yunes et al. (1987) who state that activation is either due to acute stresses or chronic stresses.

2.3.1 Sudden onset/Acute Stresses

Under this heading Travell and Simons (1983: 55-56) list the following mechanical stresses: -

- Wrenching movements
- Falls
- Automobile accidents
- Fractures (including chip fractures)
- Joint sprains

- Dislocation
- Direct blow to the muscle

Of these Murphy (1989) highlights trauma to the muscle or indirect injury such as whiplash as important factors in trigger point formation.

One-time gross traumas, usually due to excessive or unaccustomed exercise, often lead to trigger point formation. These are easily inactivated the moment the associated injury has healed. (Travell and Simons 1983: 55.)

Intra-muscular injection of medicinal substances in the location of a latent trigger point and other physical factors such as fatigued muscles, cold drafts and atherosclerosis may all contribute to trigger point activation (Travell and Simons 1983:55).

2.3.2 Gradual onset/chronic stresses

Biomechanical stresses such as sustained postural overload, poor work ergonomics, and prolonged immobilization may all lead to the gradual formation of trigger points (Travell and Simons 1983:56). This is supported by Friction (1994) who state that trigger points often result from muscles weakened through immobilization and use cervical collars and prolonged bed rest as examples.

Compression of peripheral nerves due to conditions such as radiculopathy may lead to trigger point activation in the muscles supplied by the compromised nerve root. This is known as post-disc Syndrome. (Travell and Simons (1983:56.)

Travell and Simons (1983:56), Friction (1994), and Sandman and Backstrom (1984) believe that emotional stress or psychological tension produces sustained muscular contraction that can in turn develop into an active trigger point. In a study by Fishbain et al. (1986) on 286 chronic pain patients 85% had myofascial pain. An on analysis of the myofascial patients who presented with an diagnosis

due to psychiatric nature showed that depression was a common factor, but that the psychogenic pain disorder was rare. Yunus et al. (1991) analysis of 103 primary fibromyalgia syndrome patients, concluded that the clinical features of PFM were independent of the psychological status of the patient and were more likely related directly to the PFM itself. They did however state that pain severity might be influenced by psychological factors.

2.4 RELEVANT PHYSIOLOGY

2.4.1 Anatomy of a skeletal muscle fiber.

Externally a muscle is surrounded by a connective tissue called the epimysium. The epimysium is continuous with projections of connective tissue, the perimysium, which in turn surround and encase bundles of muscle fibers known as fascicles. The perimysium continues further into the muscle interior and becomes known as the endomysium. This endomysium surrounds each individual muscle fiber. (Guyton 1987:57-61.)

The plasma membrane of a muscle fiber is called the sarcolemma and the cytoplasm is referred to as the sarcoplasm. The sarcoplasmic reticulum is composed of many membrane-lined sarcotubules that form a complex network around individual myofibrils. (Guyton 1987: 57-61.)

Each myofibril is composed of myofilaments, which in turn consist of actin and myosin molecules (Krause 1986:134-135). A myosin molecule consists of two free heads at one end and a tail at the opposite end. The tails form the body of the filament and the heads form the cross bridges. The heads act as an ATPase enzyme to convert ATP to ADP in order to release energy for the contraction process. Thus it is the cross bridges which are responsible for the contraction of the myofibrils and therefore of the muscle fiber as a whole. (Guyton 1987: 60-61.)

Each actin filament is composed of three components namely, actin, tropomyosin and troponin. Each strand of the double actin helix is composed of around thirteen G-actin molecules. Attached to each G-actin molecule is one single ADP. These ADP molecules are the active sites on the actin filaments with which the cross-bridges of the myosin filament interacts to cause muscle contraction. (Guyton 1987: 60-61.) Along each tropomyosin molecule, at multiple points, is a complex of three proteins: troponin I, troponin T, and troponin C. The affinity of the troponin C for calcium ions is believed to initiate muscle contraction. (Guyton 1987:60-61.)

2.4.2 Skeletal muscle contraction.

Muscle contraction occurs via a sliding mechanism whereby the actin filaments slide inward amongst the myosin filaments. It is almost certain that this sliding is caused by mechanical, chemical, or electrostatic forces generated by the interaction of the cross-bridges of the myosin filaments with the actin filament. Interaction between the actin filaments and the myosin cross-bridges is known as the "*Walk-along*" theory of muscle contraction. As soon as the actin filaments become activated by the calcium ions, it is believed that the heads of the cross-bridges become attracted to the active sites on the actin filament, and thus cause muscle contraction. (Guyton 1987 61-62).

The source of energy required for muscle contraction is supplied by ATP. The sequence events leading to contraction as set out by Guyton (1987:62) are as follows:

- Prior to contraction, the ATPase cleaves ATP leaving ADP bound to the myosin head. At this point the head is extended perpendicular toward the actin filament.
- When the inhibitory effect of the troponin-tropomyosin complex is itself inhibited by calcium ions, active sites are uncovered and the myosin head binds with these.

- A change in the myosin head causes the head to tilt toward the arm of the cross-bridge. This is known as the power stroke.
- Tilting of the myosin head allows the release of ADP and exposes a site on which new ATP can bind. This in turn causes detachment of the head from the actin filament.
- The new ATP is cleaved and the energy again tilts the head back to its perpendicular position, thus initiating another power stroke.
- The accumulation of power strokes leads to shortening of the muscle and therefore a muscle contraction.

2.4.3 Pathophysiology of trigger points

Myofascial trigger points may originate by acute trauma or repetitive micro-trauma to the sarcoplasmic reticulum surrounding a muscle fiber (Sandman 1981). A damaged sarcoplasmic reticulum would result in its impaired ability to remove calcium from the site if muscle strain (Gatterman 1990:291). The exposed sarcolemas would sustain contractile activity provided there is sufficient adenosine triphosphate (ATP) energy supplied. Thus the muscle spasm, which would persist despite the absence of nerve stimulation, would be maintained as long as both calcium and ATP remained. The tension produced from this physiological process would result in the **palpable taut band** commonly associated with trigger points. Local vasoconstriction of the area would result in the local metabolism being unstable. (Gatterman 1990:291.)

The unstable metabolism can result in the accumulation of certain waste products such as lactic acid, prostaglandins, serotonin, kinins, and histamine and the depletion of available ATP stores (Travell and Simons 1983:35). These metabolic wastes cause the local tissue acidity to increase and stimulate the muscles nociceptors causing apparent and **local referred pain**. Sensitization of these nerve endings may be primarily responsible for the **twitch response** and

the classic jump sign often associated with active myofascial trigger points (Han and Harrison 1997).

The decrease in blood flow to the damaged area, as a result of the vasoconstriction, would result in a local tissue ischemia and in pain. A self generating cycle, also known as the pain-spasm-pain cycle (Gatterman 1990:285), is perpetuated through a lack of proper treatment, incorrect body biomechanics, and other contributing factors such as inactivity and/or sleep disturbance.

If the muscle is stretched to cause the sarcomeres to elongate enough to allow the myosin heads to separate from the reactive actin filaments then this unstable metabolism will be terminated. This is physiological rationale used to explain the successful role of spray and stretch in the inactivation of myofascial trigger points. (Travell and Simons 1983: 32-37.)

2.5 TREATMENT

For the complete treatment of trigger points, the physician needs to consider the chronic nature of the disorder, as well as the physiological and psychosocial stresses that are involved in its development and perpetuation (Han and Harrison 1997). Rubin (1981) believed that trigger point treatment is an easy task provided that the physician has identified the exact aetiology.

At present the choice of treatment has been one of personal choice due to the lack of clinical evidence to support a specific treatment (Anderson 1997). In his review article, Simons (1976) mentions 35 recommended treatments that are recommended for myofascial trigger points. These, when sub-divided, form six broad categories: physical therapy, injection, vapocoolant, medical management, drugs and surgery. He goes on to say that of these massage, procaine injection, and ethyl chloride were reported to provide marked pain relief. In comparison,

both Auclesiums (1997) and Han and Harrison (1997) advocate a multi-disciplinary approach to trigger point treatment and include modalities such as hypodermic injection, dry needling, stretch and spray, and TENS.

Regardless of the treatment protocol chosen, the attention of each seem to be directed toward the disruption of the reverberating neural circuit which is thought to be responsible for the self-perpetuation of the pain-spasm-pain cycle mentioned earlier in the chapter (Gatterman 1990: 296). She goes on to say that needling, vapocoolant spray and stretch, saline injection, acupuncture, ultrasound and ischemic compression are useful in trigger point deactivation.

2.5.1 Massage

Massage, as defined by Basmajian and Nyberg (1993:207), is the systemic, therapeutic and functional stroking and kneading of the body. This form of treatment has shown to effect circulation, blood flow, capillary dilation, cutaneous temperature, and the morphology of blood vessels Basmajian and Nyberg (1993: 207). Auclesiums (1995) states that a deep massage would break up the fibrous bands within a trigger point, but this may also cause a considerable amount of pain for the patient. According to Travell and Simons (1983: 87) massaging too vigorously may cause an adverse reaction with an increase in pain. They recommend light stroking of the area follow by a gradual increase in tactile pressure. This form of massage, similar to cross-friction massage, results in movement of the superficial tissues over the underlying structures, resulting in an increase in tissue mobility (Travell and Simons (1983: 87).

2.5.2 Ischemic compression

This form of treatment, which has been used by chiropractors for decades, consists of the application of a sustained pressure for a duration of time sufficient

to cause trigger point pain relief (Gatterman 1991:296). The term ischemic compression is so named due to the blanching effect observed when the physician releases pressure (Travell and Simons 1983:86).

This procedure can be performed as follows (Travell and Simons 1983:86):-

1. The relaxed muscle is passively stretched to the point of discomfort.
2. Depending on the tissue thickness, a thumb, finger, knuckle or elbow is applied directly to the trigger point to create tolerable pain.
3. Pressure is then gradually increased up to a minute in duration and with as much pressure as 20 to 30 pounds pressure.
4. Application of a hot pack to the area and active movement of the muscle complete this treatment.
5. The entire procedure can be repeated until tenderness is eliminated.

This type of treatment may be repeated every 2-3 days for several weeks depending on the aetiology and chronicity (Gatterman 1990:296). Authors such as Travell and Simons (1983: 87) believe that an acute condition can be treated with one treatment. Ischemic compression is especially useful for muscles not suitable for spray and stretch and in muscles closest to the skin such as the infraspinatus muscle (Travell and Simons 1983:87).

2.5.3 Transcutaneous electrical nerve stimulation

Transcutaneous electrical nerve stimulation (TENS) is often used to treat acute and chronic pain conditions. Although TENS is not mentioned in Travell and Simons (1983) trigger point manual as a recommended therapy, it has been successfully used to decrease pain over trigger points. (Graaf-Radford et al. 1988).

Although the double-blind study by Graaf-Radford et al. (1988), in which they compared four modes TENS and a control, showed that TENS does reduce trigger point pain, these pain reductions did not reflect changes in trigger point

sensitivity. They concluded that TENS alone may be insufficient for long term trigger point treatment and suggest coupling this treatment with spray and stretch.

TENS does not inactivate trigger points directly but rather affects the nervous system to control the pain associated with myofascial pain syndrome (Hutchings 1998). This is achieved by increasing the circulating endogenous opiates or by modulating autonomic responses (Graaf-Radford et al. 1988). Other theories are that the electrical stimulation results in muscle contractions that will squeeze any oedema increase blood flow and also relax muscles (Auclesimus 1995).

2.5.4 Trigger point injection

Many authors advocate injecting the trigger point with either saline or a local anesthetic (Simons 1976). The postulated mechanism for the reported success of this treatment is as follows (Han and Harrison 1997): -

- Mechanical disruption of the muscle fiber and nerve endings by the needle.
- Mechanical disruption of the muscle fibers causing an increase in extra-cellular potassium which results in depolarization of never fibers.
- Interruption of the positive feedback mechanism that perpetuates pain (pain-spasm-pain cycle discussed earlier).
- Vasodilation caused by the local anesthetic may result in an increase in metabolite removal.

In 1955, Sola and Kuitert's study on 100 cases of myofascial syndrome occurring in the neck and shoulder girdle found an equal response by patients when comparing injected saline to a local a anesthetic. Taking this one step further, Broome's (1996) study on 30 patients with myofascial syndrome where he compared the injection of saline to dry needling, found that there was no

significant difference between the two. However he did state that he preferred dry needling as it caused less patient discomfort. Han and Harrison (1997) review on myofascial trigger points found that injection of local anesthetic was a preferred treatment to dry needling because of the analgesic effect that the local anesthetic agents offered to the surrounding tissues. They recommend the use of the following local anesthetics: -

1. 3% Chlorpromazine and 0.5% procaine, or
2. 1.0% Lidocaine with vasoconstrictors, or
3. 2ml Diclofenal.

Hammerhof et al.'s (1981) randomized double-blind-crossover study on the comparison of Bupivacaine, Lidocaine and saline in the treatment of myofascial trigger points, concluded that the local anesthetic provided more relief than the saline. However it must be added that bupivacaine has serious side effects such as muscle necrosis and severe inflammation and appears to be considerably toxic (Han and Harrison (1997). This proposes serious ethical questions when considering the use such an anesthetic. In view of this, Frost et al.'s (1980) double-blinded study on the comparison of mepivacaine to injected saline in trigger points found that the saline group did far better. In fact 80% reported relief with saline as compared to only 52% relief with mepivacaine.

In considering injection as a treatment, the physician must be aware of the possible side effects and contra-indications. Complications such as skin depigmentation, and more seriously tendon atrophy, depression of plasma cortisol levels and the response to insulin induced hypoglycemia have been reported (Han and Harrison 1997). Local bleeding due to the cutting edge of the hollow syringe, may also cause an increase in local muscle irritation, and may lead to post injection soreness (Baldry 1989:36-37). Since 1964 there have been a recorded 561 adverse reactions to commonly used local anesthetics; these include syncope, palpitations, apnea, cardiac arrest and convulsions (Baldry 1989:37).

2.5.5 Dry needling

The deactivation of trigger points can easily be achieved by using an acupuncture needle. This technique is called dry needle stimulation (Baldry 1989:50).

Morgan (1997) describes the process of dry needling as follows: -

1. Locate the taut band by palpation.
2. Swab the skin with alcohol.
3. Insert the needle at 30 degrees to the skin and so that it enters the maximum area of tenderness.
4. Fan the area with the needle so produce hyper-stimulation [Lewit (1979) also advocates this.]

It is a well documented fact that dry needling often results in prolonged relief of myofascial pain (Melzack 1981) and is regarded by authors such as Baldry (1989) and Simons (1976) as the most effective treatment for trigger points.

In a prospective randomized double blind study by Garvey et al. (1989), four types of therapy were performed on patients with low back pain. These were 1%Lidocaine, 1% Lidocaine with triamcinolone , dry needling and vapocoolant with acupressure. Dry needling resulted in a 63% improvement rate while the local anesthetics resulted in a 42% improvement rate. In support of this, the success of dry needling was shown in Lewit's (1979) study on the needle effect in myofascial pain. With 241 patients and 312 active sites, 86,8% reported immediate relief form their pain. This led the researcher to conclude that dry needling was a highly effective treatment for myofascial pain.

Provided the physician uses a needle that has been adequately sterilized, and has a good knowledge of human anatomy, the procedure of dry needling is relatively safe. There are certainly far less harmful effects from dry needling than from many of commercially prescribed drugs for pain relief. Complications such as syncope, convulsions, drowsiness and visceral damage have been documented but are relatively rare. (Baldry 1989:52).

2.5.6 Stretch and spray

In 1954 Travell described the use of ethyl chloride spray in the treatment of painful muscular conditions and pleaded for a wider trial of this simple form of treatment. Since then further studies on the effectiveness of this modality have been made and will be discussed further on.

Stretch and spray is an effective treatment for trigger points and simply involves passive stretching of the affected muscle while applying a vapocoolant. Two types of vapocoolant can be used, namely fluori-methane and ethyl chloride. Although fluori-methane is non-toxic, non-flammable and generally safer, the vapocoolant ethyl chloride acts as a general anesthetic and has a greater cooling effect, and as a result of this, make it the more commonly used vapocoolant (Han and Harrison 1997).

A review of the literature regarding this technique shows that there is very little variation with regards to method of application. Travell and Simons (1983:67-72), Mennel (1976: 876) and Nielsen (1981) all apply the vapocoolant in a similar manner: -

1. The therapist sprays the skin in sweeps parallel to the muscle fibers and over the pain referral area.
2. Sweeps are usually around 7-13mm apart with the spray at 30 degrees to the skin and bottle about 45cm away.

3. The spray sweeps at a rate of about 10cm/sec.

However spray alone is insufficient to cause deactivation. In stretch and spray, spray is the distraction whereas the stretch is the action (Travell and Simons 1983: 64). Thus in order to fully deactivate trigger points, the muscle must be extended to its full length. This causes pain and results in a reflex spasm of the muscle. It's at this point that the application of a vapocoolant acts on the central pain receptor areas bombarding them with an overwhelming barrage of cold impulses, ultimately obliterating the pain impulses. This barrage of impulses acts as if the sensory input from the skin turns off the body's central nervous system feedback mechanism. Therefor the sudden cold and touch stimuli of the vapocoolant would inhibit pain and reflex spasm that would normally prevent passive stretching of the muscle. (Travell and Simons 1983: 64-73.)

Using experimental design and a quantitative joint measuring technique, Halkovich et al. (1981) set out to test the validity of the of the clinical application associated with vapocoolants. This controlled trial showed that the experimental group, which received stretch and spray, had a significant increase in joint range of motion over that of the control group which only received passive stretching. Although Halkovich et al. (1981) used a small sample group, the trial does provide some useful information regarding the effectiveness of vapocoolants.

In her 1954 article on the use of ethyl chloride for painful muscle spasm, Travell reported on the treatment of 150 patients with muscle spasm. She found that of 40 patients with acute "stiff neck" on whom the spray was applied, 70% had complete permanent relief of pain and stiffness. In about 25% of the cases, a step like improvement in painful motion was noted after several applications, with return to normal within two days. Only 5% reported a negligible improvement.

Jaeger and Reeves (1986) assessed the effectiveness of stretch and spray on 20 subjects experiencing unilateral or bilateral head and neck pain. The results

showed a decrease in myofascial trigger point sensitivity as recorded by a pressure algometer.

The explanation for failing to obtain a satisfactory result by means of stretch and spray are as follows (Travell 1954: 297): -

- Incorrect site of application (pain referenced zone)
- Errors in technique of application. Theses include excessive cooling and hurried procedure
- A lack of attention to both passive stretching and to active motion of the affected muscle
- Inability to achieve normal range of motion due to mechanical deformities or structural defects
- The chronicity of the syndrome and a change in the cause of pain
- Continuous remote source of noxious impulses which may reactivate the trigger point
- When the primary etiology is due to a psychogenic nature.

2.5.7 STRETCH AND ICE

Ice is a physical modality that has been used to relieve both chronic and acute musculoskeletal pains, however the scientific basis for its action is poorly established (Ernst et al. 1994). There are numerous theories on how the use of cryotherapy may bring about the relief of pain: -

1. Ice applied to the body surface causes alternating vasoconstriction and vasodilatation of peripheral blood vessels. This sequence of events may reduce edema and result in the removal of chemical irritants. (Ernst et al. 1994).
2. Reduction of peripheral nerve temperature causes a decrease in the rate of nerve conduction (Forster and Palastanga 1985: 200-207).

According to Ernst et al. (1994) this theory is unlikely to play a major role in pain control. This is due to the fact that pain transmitted in C fibers would be only slightly affected by moderate cooling. The pain in C fibers is usually the one that requires treatment. (Ernst et al. 1994).

3. Use of cooling agents may stimulate the sensation of cold by stimulating the thermal receptors in the skin. This counter-irritant effect may block the pain felt. (Travel 1954 and Ernst et al. 1994).
4. Cold might stimulate the release of endorphins, which would in turn influence opioid receptors in the central nervous system causing a temporary relief in pain (Ernst et al. 1994).

The physiological effect of ice stroking (ice massage), iced towels, and ethyl chloride are very similar. Ethyl chloride spray causes the largest reduction in skin temperature, up to 28 degrees Celsius, whilst ice stroking causes the least, approximately 18 degrees Celsius. Ice stroking does however have a major advantage over ethyl chloride, and that is that there is no danger of frostbite because the skin temperature will not fall below 14 degrees Celsius, whereas ethyl chloride may reduce skin temperature to minus 4 degrees Celsius. (Olson and Stravinio 1974).

Landon (1967) performed a comparative study on the effect of ice stroking versus the use of hot packs. Of the 59 patients treated with ice stroking, 64% reported some degree of improvement after the first treatment and 88% reported an overall decrease in pain at the time of discharge. In comparison 64% of the 58 patients treated with heat packs reported improvement after the first treatment and 85% reported a decrease in pain at the time of discharge. The strength of this study lies in its large sample of patients, and the weakness in the fact that he didn't use a control group.

Travell and Simons (1993: 8) believe that the effect of the vapocoolant can be obtained to some degree by stroking with ice. The reason for this is that both

spray and ice would act as a counter-irritant. Thus they believe that both would provide the same sensory and reflex effects discussed previously in this chapter. (Travell and Simons 1993:9). Han and Harrison (1997) however believe that vapocoolant is the better option because it is easier to use and does not wet the skin. Anderson (1998) found stretch and ice less time consuming, easier to use and less messy when compared to the use of moist heat with passive stretching.

Although there are numerous studies on the effectiveness of stretch and spray, there appears to be a lack of studies involving the use of ice combined with stretching. Anderson (1998) compared the relative effectiveness of stretch and ice versus moist heat and stretch in the treatment of myofascial trigger points. This randomized trial of 30 subjects found that both groups were effective forms of treatment and that there was little statistical difference between the two groups. His study however didn't include a control group and the sample size was too small. Due to this the results of this trial can not be considered as conclusive with regards to stretch and ice effectiveness.

Although stretch and ice has been advocated by numerous authors for the treatment of myofascial trigger points (Travell and Simons 1993: 8 and Han and Harrison 1997), it seems that it is only assumed to be as effective as stretch and spray on the basis that both ethyl chloride and ice stroking act as counter-irritants. The effect of ice stroking has been established as effective, but studies involving ice stroking in conjunction with passive stretching appears to be poor.

2.6 SUMMARY

Certain points can be highlighted from the review: -

1. Myofascial pain syndrome an extremely common condition that will effect most of the population at some time in their life (Travell and Simons 1983: 5).
2. There is confusion and controversy surrounding this syndrome, especially with regards to nomenclature and the ability to distinguish myofascial pain syndrome from primary fibromialgia (Nielson 1981).
3. There are many forms of treatment available for trigger points, of which stretch and spray is considered the "workhorse" of myofascial therapies (Travell and Simons 1992: 63-64).
4. The effectiveness of ice stroking combined with passive stretching in the treatment of trigger points is poorly documented and researched (Travell and Simons 1992:9-10).

This investigation was aimed at comparing the relative effectiveness of stretch and spray to stretch and ice in the treatment of myofascial trigger points. The results of which will aid practitioners in choosing the most effective and cost affective form of treatment for myofascial pain.

CHAPTER THREE

MATERIALS AND METHODS

3.1 STUDY DESIGN

This aim of this study was to compare the relative effectiveness of stretch and spray technique to stretch and ice technique in the treatment of active myofascial trigger points. The study was designed so that an intra-group comparison could be made between the group receiving stretch and spray and the group receiving stretch and ice. By statistically analyzing the subjective and objective data collected during the course of the treatment, an inter-group comparison could be made to determine if one treatment was more effective than the other. The results would aid the practitioner in determining the best and most cost effective treatment protocol to follow in his treatment of active myofascial trigger points.

3.2 THE SUBJECTS

A sample size of 30 subjects was selected from patients presenting at the Chiropractic Day Clinic at the Technikon Natal. Advertisements were placed in the local newspaper and over the local radio for persons who were complaining of neck and/or shoulder pain. A screening process was used to determine if the patients complied with the entrance requirements set out by this study.

3.2.1 Inclusion and exclusion criteria.

- 1) Subjects had to be within the ages of sixteen and sixty-five.
- 2) Subjects had to be diagnosed as having trigger points within the upper trapezius muscle.
- 3) Any subjects receiving treatment for their neck pain, headaches, or shoulder pain, whether it be medication or manual therapy could not be included.
- 4) Any subjects with systemic disease or pain related to the cervical spine were excluded from the study.

- 5) There were no delimitations with respect to race or gender.
- 6) Any subject for whom cryotherapy was a contraindication were excluded.

These were as follows (Gatterman 1990:336):

- Weakened individuals e.g. Geriatrics , infants, cachexics
- Persons with a psychological aversion to cold
- Hypersensitive subjects secondary to:
 - a) Histamine
 - b) Cold hemolysins and agglutinins
 - c) Cryoglobulins
- Subjects with circulatory disturbances e.g. Raynauds disease, thrombangitis obliterans, peripheral vascular disease, high blood pressure, atherosclerosis, varicose veins, and myocardial weakness.
- Certain rheumatoid conditions
- Hypothermic individuals

The criteria used for the diagnosis of myofascial pain and dysfunction syndrome, as described by Travell and Simons (1983: 18-19) were as follows:

- Sudden onset due to sudden strain or injury by excessive overload or gradual onset when the muscle is subjected to minor stresses or overloads
- A characteristic pain pattern for that muscle
- Weakness and limited range of motion of the affected muscle
- A taut palpable rope-like band
- Exquisite local tenderness in the palpable band due to applied pressure
- A twitch response produced by either needling or snap palpation
- Reproduction of the patients pain pattern due to either needling or palpating the taut band
- Elimination of the patient's symptoms by specific trigger point therapy.

The sample was limited to 15 patients per group. A convenience sampling method was used to determine which 15 patients received the stretch and spray

and which received the stretch and ice. This was achieved by placing 30 pieces of paper in a box. Fifteen pieces contained the word ice, and fifteen contained the word ethyl upon them. After all 30 pieces were folded, to prevent the words being visualized, the box was shaken and each piece of paper was then drawn. The draw number corresponded to the patient number. Each paper drawn was then discarded and not returned to the same box. The patient numbers with the word "ice" ascribed to them received the stretch and ice technique and the patient numbers with the word "ethyl" ascribed to them received the stretch and spray technique.

In order to confirm the diagnosis of myofascial pain syndrome of the upper fibers of the trapezius and to rule out any other conditions, each patient had to undergo a full case history (Appendix A), physical examination (Appendix B) and cervical spine examination (Appendix C).

3.3 ETHICS

After verbally discussing the study with each patient, and prior to any treatment being administered, each patient was required to complete an informed consent form (Appendix D). Any persons failing to sign the informed consent form were not allowed to participate in the study.

3.4 INTERVENTION

All thirty patients received treatment for their active myofascial trigger points. Fifteen patients received the stretch and spray technique, and fifteen received the stretch and ice technique. All patients in the study were treated five times over a period of 2 weeks, and this was followed by a one-month follow up consultation. This was similar to the method set out by Broome (1996) and Anderson (1997). This is supported by Gatterman (1990:296) who stated that

acute cases often respond within three to four treatments. During the month prior the one-month follow up, the patients were instructed not to receive any treatment for their condition and should consult the researcher before using any form of medication. All thirty patients were required to fill in the three questionnaires at the beginning of the first treatment, at the end of the third and fifth treatments and then once more at the one month follow up consultation. Algometer readings were taken at the first, third, and fifth treatments and again at the one month follow up consultation. These measurements will be discussed in detail further on in the chapter.

This study was limited to that of the upper fibers of the trapezius muscle. This was done in order to limit the number of variables by attempting to keep the passive stretch part of the treatment the same for all treatments in both the stretch and ice group and the stretch and spray group.

Anatomically the upper fibers of the trapezius resemble a coat hanger. Superiorly these fibers attach to the medial third of the superior nuchal line, and in the midline, to the external occipital protuberance, ligamentum nuchae and the spinous processes of the first to fifth cervical vertebrae. Inferiorly the fibers converge laterally and forwards to attach to the outer third of the clavicle. (Travell and Simons 1983: 183-188).

Two trigger points are found in the upper trapezius, TP1 and TP2. Of which the most common trigger point of all myofascial trigger points in the body is TP1 (Travell and Simons 1983: 184).

TP1 is located in the upper free border of the muscle. Characteristically it refers pain unilaterally over the postero-lateral neck and head, crossing the mastoid and centering in the ipsilateral temple and orbit. Pain may refer into the lower molar teeth and pinna of the ear. Occasionally it may cause dizziness and/or vertigo.

The second trigger point, TP2, is located slightly inferiorly to TP1 and slightly deeper. This trigger point refers pain along the ipsilateral postero-lateral neck to below the occiput.

The upper fibers of the trapezius cause elevation of the shoulder, lateral head and neck movements and assist in the rotation of the neck and head to the opposite side. Together with the levator scapulae and upper portion of serratus anterior, the upper fibers of the trapezius rotate the scapula glenoid fossa upwards. Bilaterally these fibers may assist in the extension of the head and neck.

For the examination of TP1 the patient is either seated or supine. The muscle is placed in a relaxed position by laterally bending the neck to the involved side. The examiner uses a pincer type grip to lift the upper trapezius away from the body and then using a rolling motion between the fingers, attempts to locate the trigger point. This technique may be repeated for TP2, however patients with firmer tissue should rather lie prone, with the examiner using flat palpation to identify the trigger point. (Travell and Simons 1983: 183-188).

The patients in both groups were seated comfortably with their fingers placed under the chair. This helped to lengthen the fibers of the upper trapezius and also aided in stabilization of the shoulder region. For TP1 the patient's head was passively moved towards the opposite side and slightly forward. At this point those patients in the stretch and spray group received parallel sweeps of the vapocoolant spray. The vapocoolant used was ethyl chloride and was supplied by Adcock Ingram Generics Ltd. (50 Commando Road, Industria, Johannesburg, 2093). A maximum of three sweeps was used before the muscle was taken further into its range of motion. Each sweep started at the acromion process and moved upward along the ipsilateral neck, over the mastoid and ending in the region behind the ear and slightly over the temple. For TP2 the head was placed

more laterally and the sweeps stretched from the acromion to the base of the occiput. The sweeps were performed at a rate of around 15cm/sec and the spray was kept at approximately fifteen centimeters from the skin. The process was repeated a maximum of three times or until full muscle length was achieved in the trapezius. As recommended by Travell and Simons (1983 :65), at the end of each treatment the patient was asked to actively move their neck through flexion, extension, lateral flexion and rotation.

For the stretch and ice group it was important to keep the skin dry during the stroking. This was achieved by freezing water in polystyrene cups, peeling back the sides of the cup so as to expose the ice and then using a plastic bag to cover the ice during the stroking. This method, as recommended by Travell and Simons (1992:9), helped to maintain a high rate of change in skin temperature during the stroking. The patient was seated as in the stretch and spray group with the fingers placed under the chair. The head was then passively placed in the appropriate position, namely slightly forward and to the opposite side for TP 1 and to the opposite side for TP 2. The ice was stroked from the acromion to the occiput for TP2 and to the temporal region for TP1 and at a rate of 10cm/second. A maximum of three parallel strokes was performed at which point the muscle was taken passively by the researcher further into its stretch range of motion. This process was repeated a maximum of three times or until full muscle length was achieved in the trapezius. As recommended by Travell and Simons (1983 :65), at the end of each treatment the patient was asked to actively move their neck through flexion, extension, lateral flexion and rotation.

3.5 MEASUREMENTS

Four sets of data per patient were collected. Each set comprised of subjective and objective data. The subjective data were collected using written communication by filling in three questionnaires. These were the Numerical Rating scale-101 (Appendix E), the CMCC Neck Disability Index (Appendix F),

and the Short Form McGill Pain Questionnaire (Appendix G). These questionnaires provided valuable information regarding the various aspects of the patient's pain. Each patient was required to complete these questionnaires at the first, third, fifth and one month follow up consultations. At the same consultations an algometer was used to obtain an objective measurement, in kilograms per square centimeter, of the pain tolerance over each trigger point. If the patient was being treated for more than one active trigger point then an average score was obtained by adding the results of each individual trigger point and then dividing by the number of trigger points.

The Short Form McGill Pain Questionnaire has been shown to be useful in providing researchers with valuable information regarding sensory, affective and evaluative aspects of the patient's pain (Melzack 1987). This questionnaire is especially useful when there is a limited amount of time available to collect the data. The short form McGill questionnaire is comprised of fifteen pain descriptors, which can in turn, be separated into two groups. Descriptors one through to eleven describe the sensory dimensions of the pain. Descriptors twelve through to fifteen represent the affective dimension of the pain. Each pain descriptor is scored on a scale of zero to three, where the maximum score of three represents "severe" pain and a minimum score of zero represents no pain. The scores were then calculated by the researcher as a percentage of the highest possible score for all fifteen pain descriptors.

The CMCC Neck Disability Index was used to obtain valuable information regarding the extent to which a patient's lifestyle becomes functionally impaired due to their pain (Vernon and Mior 1991). The questionnaire is divided into ten separate sections. Each section carries a maximum score of five. The patient's scores were then calculated as a percentage of a maximum score of fifty. If a specific section was omitted then the score was calculated out of the maximum number of points (i.e. fifty) less five for each section omitted.

The numerical rating scale-101 was used to assess the severity of the patient's pain. The validity and reliability of this questionnaire was demonstrated by Jenson et al. (1986). The pain was assessed by writing a number on the scale between zero and 100, where zero equals no pain and 100 represents the worst pain. The patient then indicated on a 10cm line when he feels the least pain and on a separate 10cm line when he feels the worst pain. A score was calculated by measuring the distance from zero to the patients mark. The values from both lines were added and then divided by two and then expressed as a percentage.

The objective data was obtained using the Wagner FDK20 force dial algometer (Appendix H) (P.O. Box 1217, Greenwich, CT, 06836, USA. Tel.: 203 869 9861). This was used to record the minimum pressure required to induce pain or discomfort. Readings were taken at the first, third, fifth and one month follow up consultations. The method of using the algometer was similar to that used by Anderson (1998) and was as follows: -

- Place the gauge at 90 degrees vertical to the skin and over the area of maximum tenderness
- The patient is asked to say "yes" when they first feel pain or discomfort
- The pressure is gradually increased at a rate of 1kg/sec
- The reading in kg/cm² is then recorded on the algometer form.

The algometer was found by Fisher (1987) to be a reliable method of evaluating myofascial pain.

3.6 STATISTICAL ANALYSIS

All the data collected from the short form McGill pain questionnaire, numerical rating scale-101, CMCC Neck Disability Index and the algometer were statistically analyzed using the software package called Statgraphics Plus version 6 by Manugistics Inc.(2115 East Jefferson Street, Rockville, Maryland,

20852, USA). The two tests used were the Wilcoxon Paired Rank test (intra-group comparison) and the Mann-Whitney U test (inter-group comparison). These were chosen because non-parametric tests are required for a small sample group such as the 30 chosen for this research.

Use of the Wilcoxon signed rank test showed whether or not there was a significant level of improvement within each group. The null hypothesis stated that there would be no significant change in the objective and subjective findings for each group. The alternative hypothesis stated that there would be a significant change in the objective and subjective findings in each group. The intra-group comparisons were made between treatment 1 and treatment 3, between treatment 3 and treatment 5, between treatment 5 and the one month follow-up, and treatment 1 and the one month follow-up.

The Mann-Whitney U test was used to compare the stretch and spray group to the stretch and ice group and thus to determine if there was a significant difference with respect to the subjective and objective data recorded at the first, third, fifth and one month follow-up treatments. The null hypotheses being that the medians of the differences calculated between treatment 1 and treatment 3, between treatment 3 and treatment 5, between treatment 5 and the one month follow-up, and treatment 1 and the one month follow-up, were equal for both groups i.e. No significant difference. The alternative hypothesis being that there was a significant difference between each other.

A 5% level of significance was used for both the Wilcoxon signed rank test and the Mann-Whitney U test. Power analysis is then used to determine the power of each test and to determine the chance of a Type II error. Power analysis results of each test used will be supplied in the relevant tables.

The data will be presented in tables in order to allow for easier interpretation of the results.

CHAPTER FOUR

RESULTS

CHAPTER 4

4.1 INTRODUCTION

This chapter deals with the results obtained from the research.

The sample size per group is small ($n_1 = 15$, $n_2 = 15$); hence non-parametric methods were used for statistical analysis. These tests are the Wilcoxon Signed Rank test for intra-group comparisons and the Mann-Whitney-U test for inter-group comparisons. Data was collected at four consultations (beginning, middle, end and follow up) and was in the form of algometer readings and patient questionnaires (Short Form McGill Pain questionnaire, CMCC Neck Disability Index and Numerical Pain Rating Scale-101).

The power of a statistical test is a measure of how sensitive the test is. The power of a test depends on the size of the sample, the accuracy of the measurements involves in the study and the level of significance of the study, β . The smaller the power of a test, the larger becomes the likelihood of a Type II error i.e. accepting a null hypothesis. Therefore results closest to one indicate a smaller chance of a Type II error occurring and visa versa for results closer to zero.

The power of non-parametric tests is usually low; thereby indicating that results obtained from non-parametric tests are not necessarily reliable as a decision-making tool.

The tables in this chapter display the median, mean, standard deviation, standard error and the results from power analysis.

4.1.2 ABBREVIATIONS

Group 1= Stretch and ice group

Group 2= Stretch and spray group

S.E. = Standard Error

S.D. = Standard deviation

P-value = The observed significance level of the test

H_0 = The null hypothesis

H_1 = The alternate hypothesis

CMCC = CMCC neck Disability Index questionnaire

NRS-101 = Numerical Pain Rating Scale-101 questionnaire

SFMG = Short Form McGill Pain questionnaire

4.2 DEMOGRAPHIC DATA

Age and Sex Percentages:

Table 1: The age distribution within the sample of 30.

AGE	GROUP 1	GROUP 2	TOTAL
20 – 29	73.3%	66.6%	70%
30 – 39	26.6%	26.6	26.6%
40 – 49	0	6.6%	3.3%
50 – 59	0	0	0

Table 2: The gender distribution within the sample of 30

SEX	GROUP 1	GROUP 2	TOTAL
MALE	40%	40%	40%
FEMALE	60%	60%	60%

4.1 INTRA-GROUP ANALYSIS USING WILCOXON SIGNED RANK TEST

Wilcoxon's sign ranked test was used to compare four related consultations in each of the four clinical procedures in the study. In each case, the null hypothesis states that there is no significant improvement between the four related samples in the experiment, at the α level of significance. The alternate hypothesis states that there is a significant improvement.

The null hypothesis is rejected at the α level of significance if $P \leq \alpha/2$ where P is the observed significance level or P-value. Otherwise the null hypothesis is accepted at the same level.

4.3.1 OBJECTIVE FINDINGS FOR GROUP 1 (STRETCH AND ICE)

Table 3: The results of the Wilcoxon's signed rank test comparing the algometer readings between treatments one and three for GROUP 1.

STRETCH AND ICE --- GROUP 1									
	TREATMENT 1				P-Value	TREATMENT 3			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
ALGO-METER	4	3.91	0.16	0.61	0.1213	4.5	4.1	0.2	0.78
POWER		ALGOMETER		0.1059					

For the algometer readings, the null hypothesis is accepted and one can conclude that at a 95% confidence level, there was no significant objective improvement between the first and the third treatment.

Table 4: The results of the Wilcoxon's signed rank test comparing the algometer readings between treatments three and five for GROUP 1.

STRETCH AND ICE---GROUP 1									
	TREATMENT 3				P-Value	TREATMENT 5			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
ALGO-METER	4.5	4.1	0.2	0.78	0.0093	4.7	4.66	0.18	0.69
POWER			ALGOMETER		0.5725				

For the algometer readings, the null hypothesis is rejected and one can conclude that at a 95% confidence level, there was significant objective improvement between the third and the fifth treatment.

Table 5: The results of the Wilcoxon's signed rank test comparing the algometer readings between treatment five and the one month follow up for GROUP 1.

STRETCH AND ICE--- GROUP1									
	TREATMENT 5				P-Value	ONE MONTH			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
ALGO-METER	4.7	4.66	0.18	0.69	0.2888	4.5	4.54	0.16	0.64
POWER			ALGOMETER		0.665				

For the algometer readings, the null hypothesis is accepted and one can conclude that at a 95% confidence level, there was no significant objective improvement between the fifth treatment and the one month follow up.

Table 6: The results of the Wilcoxon's signed rank test comparing the algometer readings between treatments one and five for GROUP 1.

STRETCH AND ICE--- GROUP 1									
	TREATMENT 1				P-Value	TREATMENT 5			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
ALGO-METER	4	3.91	0.16	0.61	0.0098	4.7	4.66	0.18	0.69
POWER			ALGOMETER		0.8611				

For the algometer readings, the null hypothesis is rejected and one can conclude that at a 95% confidence level, there was significant objective improvement between the first and the fifth treatment.

Table 7: The results of the Wilcoxon's signed rank test comparing the algometer readings between treatment one and the one month follow up for GROUP 1.

STRETCH AND ICE--- GROUP 1									
	TREATMENT 1				P-Value	ONE MONTH			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
ALGO-METER	4	3.91	0.16	0.61	0.0388	4.5	4.54	0.16	0.64
POWER			ALGOMETER		0.7589				

For the algometer readings, the null hypothesis is accepted and one can conclude that at a 95% confidence level, there was no significant objective improvement between the first treatment and the one month follow-up.

4.3.2 SUBJECTIVE FINDINGS FOR GROUP 1 (STRETCH AND ICE)

Table 8: The results of the Wilcoxon's signed rank test comparing the Short Form McGill Pain questionnaire, Numerical Rating Scale-101 and CMCC Neck Disability Index readings between treatments one and three for GROUP 1.

STRETCH AND ICE--- GROUP 1									
	TREATMENT 1				P-Value	TREATMENT 3			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
SFMG	13.3	16.99	2.7	10.46	0.0032	6.6	8.21	1.51	5.83
CMCC	22	21.6	1.67	6.47	0.0003	12	11	1.42	5.52
NPRS-101	42.5	44.16	2.47	9.57	0.3017	40	67.67	2.88	11.16

POWER	SFMG	0.7823
	CMCC	0.9952
	NPRS-101	0.9999

For the Short Form McGill pain questionnaire and CMCC Neck Disability Index the null hypothesis is rejected and one can conclude that at a 95% confidence level, there was significant improvement between treatments one and three.

For the Numerical Pain Rating scale-101 the null hypothesis is accepted and one can conclude that at a 95% confidence level, there was no significant improvement between treatments one and three.

Table 9: The results of the Wilcoxon's signed rank test comparing the Short Form McGill Pain questionnaire, Numerical Rating Scale-101 and CMCC Neck Disability Index readings between treatments three and five for GROUP 1.

STRETCH AND ICE --- GROUP 1									
	TREATMENT 3				P-Value	TREATMENT 5			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
SFMG	6.6	8.21	1.51	5.83	0.2202	6.6	6.34	1.123	4.352
CMCC	12	11	1.42	5.52	0.0077	8	7.93	1.13	4.38
NPRS-101	40	67.67	2.88	11.16	0.0019	30	26.8	2.52	9.78

POWER	SFMG	0.1532
	CMCC	0.3609
	NPRS-101	1.000

For the Numerical Pain Rating Scale-101 and CMCC Neck Disability Index the null hypothesis is rejected and one can conclude that at a 95% confidence level, there was significant improvement between treatments three and five.

For the Short Form McGill pain questionnaire the null hypothesis is accepted and one can conclude that at a 95% confidence level, there was no significant improvement between treatments three and five.

Table 10: The results of the Wilcoxon's signed rank test comparing the Short Form McGill Pain questionnaire, Numerical Rating Scale-101 and CMCC Neck Disability Index readings between treatment five and the one month follow up for GROUP 1.

STRETCH AND ICE --- GROUP 1									
	TREATMENT 5				P-Value	ONE MONTH			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
SFMG	6.6	6.34	1.123	4.352	0.0233	2.	4.7	0.98	3.81
CMCC	8	7.93	1.13	4.38	0.0455	6	6.73	0.86	3.39
NPRS-101	30	26.8	2.52	9.78	0.0433	20	20.13	1.77	6.86

POWER	SFMG	0.1771
	CMCC	0.1221
	NPRS-101	0.5451

For the Numerical Pain Rating Scale-101 and CMCC Neck Disability index the null hypothesis is accepted and one can conclude that at a 95% confidence level, there was no significant improvement between treatment five and the one month follow up.

For the Short Form McGill pain questionnaire the null hypothesis is rejected and one can conclude that at a 95% confidence level, there was significant improvement between treatment five and the one month follow up.

Table 11: The results of the Wilcoxon's signed rank test comparing the Short Form McGill Pain questionnaire, Numerical Rating Scale-101 and CMCC Neck Disability Index readings between treatments one and five for GROUP 1.

STRETCH AND ICE--- GROUP 1									
	TREATMENT 1				P-Value	TREATMENT 5			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
SFMG	13.3	16.99	2.7	10.46	0.0005	6.6	6.34	1.123	4.352
CMCC	22	21.6	1.67	6.47	0.0003	8	7.93	1.13	4.38
NPRS-101	42.5	44.16	2.47	9.57	0.0014	30	26.8	2.52	9.78

POWER	SFMG	0.9388
	CMCC	1.000
	NPRS-101	0.9958

For the Short Form McGill pain questionnaire, Numerical Pain Rating Scale-101 and CMCC Neck Disability index the null hypothesis is rejected and one can conclude that at a 95% confidence level, there was significant improvement between treatments one and five.

Table 12: The results of the Wilcoxon's signed rank test comparing the Short Form McGill Pain questionnaire, Numerical Rating Scale-101 and CMCC Neck Disability Index readings between treatment one and the one month follow up for GROUP1.

STRETCH AND ICE --- GROUP 1									
	TREATMENT 1				P-Value	ONE MONTH			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
SFMG	13.3	16.99	2.7	10.46	0.0005	2.	4.7	0.98	3.81
CMCC	22	21.6	1.67	6.47	0.0003	6.6.73	0.86	3.39	
NPRS-101	42.5	44.16	2.47	9.57	0.0003	20	20.13	1.77	6.86

POWER	SFMG	0.9829
	CMCC	1.000
	NPRS-101	1.000

For the Short Form McGill pain questionnaire, Numerical Pain Rating Scale-101 and CMCC Neck Disability index the null hypothesis is rejected and one can conclude that at a 95% confidence level, there was significant improvement between treatment one and one month follow up.

4.3.3 OBJECTIVE FINDINGS FOR GROUP 2 (STRETCH AND SPRAY)

Table 13: The results of the Wilcoxon's signed rank test comparing the algometer readings between treatments one and three for GROUP 2.

STRETCH AND SPRAY --- GROUP 2									
	TREATMENT 1				P-Value	TREATMENT 3			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
ALGO-METER	2.95	3.21	0.2	0.76	0.7728	2.9	3.03	0.32	1.23

POWER	GROUP	0.0730
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For the algometer readings, the null hypothesis is accepted and one can conclude that at a 95% confidence level, there was no significant objective improvement between the first and the third treatment.

Table 14: The results of the Wilcoxon's signed rank test comparing the algometer readings between treatments three and five for GROUP 2.

STRETCH AND SPRAY—GROUP 2									
	TREATMENT 3				P-Value	TREATMENT 5			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
ALGO-METER	2.9	3.03	0.32	1.23	0.0161	3.5	3.67	0.47	1.85
POWER		GROUP			0.1908				

For the algometer readings, the null hypothesis is rejected and one can conclude that at a 95% confidence level, there was significant objective improvement between the third and the fifth treatment.

Table 15: The results of the Wilcoxon's signed rank test comparing the algometer readings between treatment five and the one month follow up for GROUP 2.

STRETCH AND SPRAY--- GROUP2									
	TREATMENT 5				P-Value	ONE MONTH			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
ALGO-METER	3.5	3.67	0.47	1.85	0.0268	3.5	3.87	0.44	1.71
POWER		GROUP			0.0592				

For the algometer readings, the null hypothesis is accepted and one can conclude that at a 95% confidence level, there was no significant objective improvement between the fifth and the one month follow up.

Table 16: The results of the Wilcoxon's signed rank test comparing the algometer readings between treatments one and five for GROUP 2.

STRETCH AND SPRAY--- GROUP 2									
	TREATMENT 1				P-Value	TREATMENT 5			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
ALGO-METER	2.95	3.21	0.2	0.76	0.4226	3.5	3.67	0.47	1.85
POWER			GROUP		0.1317				

For the algometer readings, the null hypothesis is accepted and one can conclude that at a 95% confidence level, there was no significant objective improvement between the first and the fifth treatment.

Table 17: The results of the Wilcoxon's signed rank test comparing the algometer readings between treatments one and the one month follow up for GROUP 2.

STRETCH AND SPRAY--- GROUP 2									
	TREATMENT 1				P-Value	ONE MONTH			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
ALGO-METER	2.95	3.21	0.2	0.76	0.1814	3.5	3.87	0.44	1.71
POWER			GROUP		0.2513				

For the algometer readings, the null hypothesis is accepted and one can conclude that at a 95% confidence level, there was no significant objective improvement between the first treatment and the one month follow up.

4.3.4 SUBJECTIVE FINDINGS FOR GROUP 2 (STRETCH AND SPRAY)

Table 18: The results of the Wilcoxon's signed rank test comparing the Short Form McGill Pain questionnaire, Numerical Rating Scale-101 and CMCC Neck Disability Index readings between treatments one and three for GROUP 2.

STRETCH AND SPRAY--- GROUP 2									
	TREATMENT 1				P-Value	TREATMENT 3			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
SFMG	11.1	12.24	2.5	9.69	0.1490	6.6	8.4	1.46	5.65
CMCC	20	19.87	1.96	7.58	0.1213	12	14.33	2.71	10.51
NPRS-101	40	36.47	4.76	18.42	0.0960	35	28.57	5.10	19.74

POWER	SFMG	0.2391
	CMCC	0.3493
	NPRS-101	0.1858

For the Short Form McGill pain questionnaire, CMCC Neck Disability Index and the Numerical Rating Scale-101 the null hypothesis is accepted and one can conclude that at a 95% confidence level, there was no significant improvement between treatments one and three.

Table 19: The results of the Wilcoxon's signed rank test comparing the Short Form McGill Pain questionnaire, Numerical Rating Scale-101 and CMCC Neck Disability Index readings between treatments three and five for GROUP 2.

STRETCH AND SPRAY --- GROUP 2									
	TREATMENT 3				P-Value	TREATMENT 5			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
SFMG	6.6	8.4	1.46	5.65	0.5464	6.6	6.52	1.05	4.05
CMCC	12	14.33	2.71	10.51	0.0025	8	6.8	1.51	5.85
NPRS-101	35	28.57	5.10	19.74	0.1489	25	23.33	4.38	11.95

POWER	SFMG	0.1649
	CMCC	0.6458
	NPRS-101	0.1296

For the Short Form McGill pain questionnaire and the Numerical Rating Scale-101 the null hypothesis is accepted and one can conclude that at a 95% confidence level, there was no significant improvement between treatments three and five.

For the CMCC Neck Disability Index the null hypothesis is rejected and one can conclude that at a 95% confidence level, there was significant improvement between treatments three and five.

Table 20: The results of the Wilcoxon's signed rank test comparing the Short Form McGill Pain questionnaire, Numerical Rating Scale-101 and CMCC Neck Disability Index readings between treatment five and the one month follow up for GROUP 2.

STRETCH AND SPRAY --- GROUP 2									
	TREATMENT 5				P-Value	ONE MONTH			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
SFMG	6.6	6.52	1.05	4.05	0.6830	4.4	5.72	1.22	4.71
CMCC	8	6.8	1.51	5.85	0.4496	8	8.13	1.87	7.23
NPRS-101	25	23.33	4.38	11.95	0.1489	15	22.83	6.53	25.29

POWER	SFMG	0.0746
	CMCC	0.0805
	NPRS-101	0.0505

For the Short Form McGill pain questionnaire, CMCC Neck Disability Index and the Numerical Rating Scale-101 the null hypothesis is accepted and one can conclude that at a 95% confidence level, there was no significant improvement between treatment five and one month follow up.

Table 21: The results of the Wilcoxon's signed rank test comparing the Short Form McGill Pain questionnaire, Numerical Rating Scale-101 and CMCC Neck Disability Index readings between treatments one and five for GROUP2.

STRETCH AND SPRAY --- GROUP 2									
	TREATMENT 1				P-Value	TREATMENT 5			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
SFMG	11.1	12.24	2.5	9.69	0.0098	6.6	6.52	1.05	4.05
CMCC	20	19.87	1.96	7.58	0.0005	8	6.8	1.51	5.85
NPRS-101	40	36.47	4.76	18.42	0.0015	25	23.33	4.38	11.95

POWER	SFMG	0.5243
	CMCC	0.9985
	NPRS-101	0.6056

For the Short Form McGill pain questionnaire, CMCC Neck Disability Index and the Numerical Rating Scale-101 the null hypothesis is rejected and one can conclude that at a 95% confidence level, there was significant improvement between treatments one and five.

Table 22: The results of the Wilcoxon's signed rank test comparing the Short Form McGill Pain questionnaire, Numerical Rating Scale-101 and CMCC Neck Disability Index readings between treatment one and the one month follow up for GROUP2.

STRETCH AND SPRAY --- GROUP 2									
	TREATMENT 1				P-Value	ONE MONTH			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
SFMG	11.1	12.24	2.5	9.69	0.0388	4.4	5.72	1.22	4.71
CMCC	20	19.87	1.96	7.58	0.0005	8	8.13	1.87	7.23
NPRS-101	40	36.47	4.76	18.42	0.0161	15	22.83	6.53	25.29

POWER	SFMG	0.6152
	CMCC	0.9853
	NPRS-101	0.3613

For the Short Form McGill pain questionnaire the null hypothesis is accepted and one can conclude that at a 95% confidence level, there was no significant improvement between treatments one and the one month follow up.

For the CMCC Neck Disability Index and the Numerical Rating Scale-101 the null hypothesis is rejected and one can conclude that at a 95% confidence level, there was significant improvement between treatment one and one month follow up.

4.4 INTER-GROUP ANALYSIS USING MANN WHITNEY U TEST

The Mann-Whitney unpaired two-tailed test was used to compare groups 1 and 2 with respect to each variable of interest. In each case, the null hypothesis states that there is no significant difference between groups 1 and 2 with respect to the variable in charge, at the $\alpha = 0.05$ level of significance. The alternate hypothesis states that there is a significant difference.

The decision rule states that the null hypothesis is rejected at the α level of significance if $P \leq \alpha/2$ where P is the observed significance level or P-value. Otherwise, the null hypothesis is accepted at the same level.

4.4.1 ANALYSIS OF OBJECTIVE FINDINGS:

Table23: Comparison of group 1 and 2 using the Mann-Whitney u test to analyze results collected from the algometer at the first, third, fifth and one month consultations.

	ALGOMETER								
	GROUP 1 -- STRETCH & ICE				P-Value	GROUP 2- STRETCH & SPRAY			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
TREATMENT 1	4	3.91	0.16	0.16	0.0052	2.95	3.21	0.2	0.76
TREATMENT 3	4.5	4.1	0.2	0.78	0.0140	2.9	3.03	0.32	1.23
TREATMENT 5	4.7	4.66	0.18	0.69	0.0305	3.5	3.67	0.47	1.85
ONE MONTH FOLLOW-UP	4.5	4.54	0.16	0.64	0.0656	3.5	3.87	0.44	1.71

POWER	TREATMENT 1	0.9200
	TREATMENT 3	0.7846
	TREATMENT 5	0.4583
	ONE MONTH FOLLOW-UP	0.2687

For the comparison of treatments one and three between the two groups, the null hypothesis is rejected which indicates that at $\alpha=0.05$ significance level there is a significant difference between group 1 and group 2.

The null hypothesis is accepted for treatment five and the one-month follow up, which indicates that at $\alpha=0.05$ significance level there is no significant difference between group 1 and group 2.

4.1.2 ANALYSIS OF SUBJECTIVE FINDINGS:

Table24: Comparison of group 1 and 2 using the Mann-Whitney u test to analyze results collected from the Short Form McGill Pain Questionnaire at the first, third, fifth and one month consultations.

SHORT FORM MCGILL PAIN QUESTIONAIRRE									
	GROUP 1 -- STRETCH & ICE				P-Value	GROUP 2- STRETCH & SPRAY			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
TREATMENT 1	13.3	16.99	2.7	10.46	0.1322	11.1	12.24	2.5	9.69
TREATMENT 3	6.6	8.27	1.51	5.83	0.7974	6.6	8.4	1.46	5.65
TREATMENT 5	6.6	6.34	1.123	4.352	0.9830	6.6	6.52	1.05	4.05
ONE MONTH FOLLOW-UP	2	4.7	0.98	3.81	0.5334	4.4	5.72	1.11	4.71

POWER	TREATMENT 1	0.2286
	TREATMENT 3	0.8800
	TREATMENT 5	0.0513
	ONE MONTH FOLLOW-UP	0.0926

The null hypothesis is accepted for all instances, which indicates that at $\alpha= 0.05$ significance level there is no significant difference between group 1 and group 2.

Table25: Comparison of group 1 and 2 using the Mann-Whitney u test to analyze results collected from the CMCC Neck Disability Index at the first, third, fifth and one month consultations.

CMCC NECK DISABILITY INDEX									
	GROUP 1 – STRETCH & ICE				P-Value	GROUP 2- STRETCH & SPRAY			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
TREATMENT 1	22	21.6	1.67	6.47	0.6579	20	19.87	1.96	7.58
TREATMENT 3	12	11	1.42	5.52	0.6895	12	14.33	2.71	10.57
TREATMENT 5	8	7.93	1.13	4.38	0.5279	8	6.8	1.51	5.85
ONE MONTH FOLLOW-UP	6	6.73	0.86	3.39	0.8834	8	8.13	1.87	7.23

POWER	TREATMENT 1	0.0955
	TREATMENT 3	0.1730
	TREATMENT 5	0.2027
	ONE MONTH FOLLOW-UP	0.0963

The null hypothesis is accepted for all instances, which indicates that at $\alpha= 0.05$ significance level there is no significant difference between group 1 and group 2.

Table26: Comparison of group 1 and 2 using the Mann-Whitney u test to analyze results collected from the Numerical Pain Rating scale-101 at the first, third, fifth and one month consultations.

NUMERICAL PAIN RATING SCALE-101									
	GROUP 1 - STRETCH & ICE				P-Value	GROUP 2- STRETCH & SPRAY			
	Median	Mean	S.E.	S.D		Median	Mean	S.E.	S.D.
TREATMENT 1	42.5	44.16	2.47	9.57	0.2398	40	36.47	4.76	18.44
TREATMENT 3	40	67.67	2.88	11.16	0.0664	35	28.57	5.16	19.74
TREATMENT 5	30	26.8	2.52	9.78	0.5308	25	23.33	4.38	16.95
ONE MONTH FOLLOW-UP	20	20.13	1.77	6.86	0.3675	15	22.83	6.53	25.23

POWER	TREATMENT 1	0.2727
	TREATMENT 3	1.000
	TREATMENT 5	0.0975
	ONE MONTH FOLLOW-UP	0.0657

The null hypothesis is accepted for all instances, which indicates that at $\alpha= 0.05$ significance level there is no significant difference between group 1 and group 2.

CHAPTER FIVE

DISCUSSION

5.1 INTRODUCTION

The results obtained from the Short Form McGill Pain questionnaire, Numerical Rating Scale-101, CMCC Neck Disability Index and the algometer will be discussed in this chapter.

The results of the intra-group analysis will be discussed first, followed by an interpretation of the inter-group analysis. The former is used to assess the effectiveness of each group in the treatment of myofascial syndrome, whilst the latter is used to compare the relative effectiveness of the two treatment groups. This ultimately shows, which, if either, would be a better treatment for myofascial trigger points.

Thirty-four people applied to take part in the research program. Only 32 of them complied with the criteria for admissibility as set out in chapter 3. Of the 32 patients who started with the treatments in the research program, only 30 completed the full set of five treatments and a one-month follow-up consultation. The remaining two were "dropped off" the study as both of them received another form of treatment during the course of the trial. Those additional treatments could have affected the results of the study.

The demographic data indicates that the myofascial syndrome of the upper trapezius is most common in the twenty to thirty year old age group (Table 1). The decrease in prevalence of trigger points after the age of forty-nine is supported by Friction et al. (1985), their reason for this being that after the age of forty-nine a decrease in muscle activity and a decrease in muscle stress can be expected.

Of the fifteen patients in each group, four were male and eleven were female (Table 2). These results are supported by Yunus et al. (1981) who state that females are more commonly affected than males and that they range between the ages of twenty-five and forty years of age.

5.2 INTRA-GROUP INTERPRETATION

Group 1 = Stretch and Ice

Group 2 = Stretch and Spray

5.2.1 Subjective Data

This set of data was obtained through the use of three questionnaires, namely the Short Form McGill Pain questionnaire, Numerical Rating Scale-101 and CMCC Neck Disability Index.

5.2.1.1 Short Form McGill Pain Questionnaire

Group 1 showed no statistically significant improvement between treatment 3 and 5. However between treatment 1 and 3 and treatment 1 and 5 there was a statistically significant improvement with this progression extending through to the one month follow-up. (Tables 8,9,10). The power results were generally quite high between treatments 1 and 3, 1 and 5 and 1 and the one month follow up. This shows that the probability of missing possibly statistically significant results is quite low. (Tables 8,9,10,11).

These results show that group 1 responded well to the initial part of the treatment and stabilized towards the end. The improvement over the final one month could indicate that the ice and stretch treatment protocol is effective over a long term period.

Group 2 showed no statistically significant improvement between treatments 1 and 3 and 3 and 5. However over the whole treatment period (treatments 1 to 5), the results did show a statistically significant improvement. As could be expected there was no statistically significant difference between the last treatment and the one month follow-up. (Tables 18,19,20,21,22).

These results show that group 2 responded slowly to the treatment, but overall was an effective treatment. Due to the fact that the patients did not worsen over the last month, and that there was a general decrease in median values between the last treatment and the follow-up, could indicate that it is a good long-term treatment.

All the power results for group 2 were bellow 1 and generally quite weak. This shows that the chance of missing statistically significant results is possible i.e. Good chance of a Type II error occurring.

5.2.1.2 Numerical Rating Scale-101

For group 1 there was no statistically significant improvement between treatment 1 and 3. Between treatments 1 to 5, 3 to 5, and 1 and the one month follow-up, the results showed a statistically significant improvement. Thus a general improvement occurred over the treatment period for group 1. There was no statistically significant improvement over the final one month period. Generally the power results where quite high i.e. close to one. This shows that the probability of missing possibly statistically significant results is quite low. (Tables 8,9,10).

The results for group 1 show that in the initial phase of the treatment the patients response to the treatment was minimal, this is highlighted when one compares the median values for the first and third visits. However towards the latter stage of the treatment the patient responded well. The use of a control group would

have been effective in determining if the patients were responding to the ice and stretch or whether their improvement was merely following the natural course of healing. Again this treatment could be considered a good long term treatment as the patients did not worsen over the final month.

As with the Short Form McGill and CMCC Neck Disability Index, group 2 showed no statistically significant improvement between treatments 1 and 3. The remaining results showed a statistically significant improvement. As with group 1, there was no statistically significant improvement over the final one month period. The power results for group 2 were generally very weak which points out the high possibility of missing statistically significant results i.e. a good chance of a Type II error occurring.

As with group 1 the results for group 2 show that in the initial phase of the treatment the patient's response to the treatment was minimal, this is highlighted when you compare the median values for the first and third visits. However towards the latter stage of the treatment the patient responded well. Again this treatment could be considered a good long-term treatment, as the patients did not worsen over the final month. (Tables 18,19,20,21,22).

5.2.1.3 CMCC Neck Disability Index

For group 1, this questionnaire showed a statistically significant improvement between all treatments, and over the treatment period as a whole. As expected there was no statistically significant improvement over the final one month period. The power results were generally quite high between treatments 1 and 3, 1 and 5 and 1 and the one month follow up. This shows that the probability of missing possibly statistically significant results is quite low. (Tables 8,9,10,11).

have been effective in determining if the patients were responding to the ice and stretch or whether their improvement was merely following the natural course of healing. Again this treatment could be considered a good long term treatment as the patients did not worsen over the final month.

As with the Short Form McGill and CMCC Neck Disability Index, group 2 showed no statistically significant improvement between treatments 1 and 3. The remaining results showed a statistically significant improvement. As with group 1, there was no statistically significant improvement over the final one month period. The power results for group 2 were generally very weak which points out the high possibility of missing statistically significant results i.e. a good chance of a Type II error occurring.

As with group 1 the results for group 2 show that in the initial phase of the treatment the patient's response to the treatment was minimal, this is highlighted when you compare the median values for the first and third visits. However towards the latter stage of the treatment the patient responded well. Again this treatment could be considered a good long-term treatment, as the patients did not worsen over the final month. (Tables 18,19,20,21,22).

5.2.1.3 CMCC Neck Disability Index

For group 1, this questionnaire showed a statistically significant improvement between all treatments, and over the treatment period as a whole. As expected there was no statistically significant improvement over the final one month period. The power results were generally quite high between treatments 1 and 3, 1 and 5 and 1 and the one month follow up. This shows that the probability of missing possibly statistically significant results is quite low. (Tables 8,9,10,11).

The results show that group 1 improved significantly over the initial, and latter stages of the treatment with regards to the amount of disability the patients perceived. Again this treatment could be considered a good long-term treatment, as the patients did not worsen over the final month.

Group 2 showed no statistically significant improvement between treatments 1 and 3 and between the last treatment and the one month follow-up. There was a significant improvement over the whole treatment period, and between treatment 3 and 5. The power results showed a low possibility of accepting a Type II error with regards to the results between treatment 1 and 5 and 1 and the follow-up. The remaining power results were weak resulting in a high possibility of missing statistically significant results i.e. a good chance of a Type II error occurring. (Tables 18,19,20,21,22).

The results for group 2 show that in the initial phase of the treatment the patients response to the treatment was minimal. However towards the latter stage of the treatment the patients responded well. Again this treatment could be considered a good long-term treatment, as the patients did not worsen over the final month.

5.2.2 Objective Data

The algometer was used to collect the objective data for both groups 1 and 2.

For group1 there was no statistically significant improvement between treatment 1 and 3. There was a statistical improvement between treatment 3 and 5 and over the treatment period as a whole. There was no statistically significant improvement over the one month follow-up period for either group1 or group 2.

For group1 the power results were generally low resulting in a high probability of missing possibly statistically significant results. (Tables 3,4,5,6,7).

The results show that group 1 improved significantly over the initial, and latter stages of the treatment with regards to the amount of disability the patients perceived. Again this treatment could be considered a good long-term treatment, as the patients did not worsen over the final month.

Group 2 showed no statistically significant improvement between treatments 1 and 3 and between the last treatment and the one month follow-up. There was a significant improvement over the whole treatment period, and between treatment 3 and 5. The power results showed a low possibility of accepting a Type II error with regards to the results between treatment 1 and 5 and 1 and the follow-up. The remaining power results were weak resulting in a high possibility of missing statistically significant results i.e. a good chance of a Type II error occurring. (Tables 18,19,20,21,22).

The results for group 2 show that in the initial phase of the treatment the patients response to the treatment was minimal. However towards the latter stage of the treatment the patients responded well. Again this treatment could be considered a good long-term treatment, as the patients did not worsen over the final month.

5.2.2 Objective Data

The algometer was used to collect the objective data for both groups 1 and 2.

For group1 there was no statistically significant improvement between treatment 1 and 3. There was a statistical improvement between treatment 3 and 5 and over the treatment period as a whole. There was no statistically significant improvement over the one month follow-up period for either group1 or group 2.

For group1 the power results were generally low resulting in a high probability of missing possibly statistically significant results. (Tables 3,4,5,6,7).

For group 2 there was no statistically significant improvement between treatments 1 and 3, 1 and 5 and 1 and the one month follow up. The only statistically significant improvement was between treatment 3 and 5. Once again the use of a control group would have been effective in determining if the patients were responding to the treatment or whether their improvement was merely following the natural course of healing. There was no statistically significant improvement over the treatment period. The power results for group 2 were generally very weak which points out the high possibility of missing statistically significant results i.e. a good chance of a Type II error occurring. (Tables 13,14,15,16).

5.3 INTER-GROUP INTERPRETAION

5.3.1 Subjective Data

There was no statistically significant difference with regards to the three questionnaires (Short Form McGill, NRS-101 and CMCC Disability Index). Therefore neither group was statistically better than the other was. Generally the results of the power tests were very low and thus the chance of missing statistically significant results was high. (Tables 23,24,25).

5.3.2 Objective Data

A comparison of the two groups showed that at the first and third treatments there was a statistically significant difference in pain tolerance. The power scored relatively high, so the chance of accepting a type II error is low. It is possible that the patients in group 1 were more sensitive to pain or merely that their condition was more severe in nature prior to the treatment commencing, or visa versa for

group2. As the sample size was small, possibilities like this can affect the results in this way.

At treatments 5 there was no statically significant difference between the two groups and as could be expected both groups acted similarly over the one month follow up and with no statistically significant difference. Here the power score was weak and thus the chance of Type II error occurring is relatively high. (Table 22).

The results thus show that, in terms of trigger point tenderness, group 1 improved significantly more than group 2 in the initial phase of the treatment. This was however not the case for the remainder of the treatment and over the one month after the final treatment, in which both groups improved equally as well. These results do not correlate with the subjective findings in which all three questionnaires showed an equal rate of improvement. This may be due to the small sample size and the possibility of human error on the part of the researcher in which a number of factors could play a role: -

1. The algometer may not have been placed over the maximum area of tenderness. This is the most common cause or error (Fisher 1987).
2. The examiner may have varied the rate at which he applied the pressure of the algometer thus resulting in the recording of inaccurate results i.e. A high rate may results in a higher reading than if he were to perform the action slower.

5.4 ANSWERS TO OBJECTIVES

The first objective was to evaluate the effectiveness of the stretch and spray technique and stretch and ice technique in terms of subjective clinical findings in the treatment of active myofascial trigger points. As already mentioned, the subjective data was collected using the Short Form McGill Pain Questionnaire,

NRS-101 and CMCC Neck Disability Index. All were analyzed using the Wilcoxon Signed Rank Test. It was determined that over the treatment period both groups showed a significant improvement.

The second objective was to evaluate the effectiveness of the stretch and spray technique and stretch and ice technique in terms of objective clinical findings in the treatment of active myofascial trigger points. It was determined that over the treatment period both groups showed a significant improvement.

The third objective was to integrate the data of the first two objectives in order to determine which treatment is more effective in the treatment of active myofascial trigger points. These results were compared using the Mann-Whitney U test. All three subjective tests showed that there was no significant difference between the two groups over the whole treatment period. In terms of objective findings, the stretch and ice group showed a marked decrease in trigger tenderness, however this did not continue throughout the treatment. As three of the four tests showed no statistically significant difference, it can be concluded that there was no statistically significant difference between the two groups.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

It can be concluded that that neither the stretch and ice group nor the stretch and spray group were statistically significantly better than the other. With both groups being considered effective in the treatment of myofascial trigger points, the choice of one over the other must be found elsewhere. Certain factors such as cost effectiveness, convenience, and safety need to be considered for this decision.

The cost of the equipment is important to both the practitioner and the patient. For the stretch and ice treatment the cost is minimal, whereas in comparison the cost of the vapocoolant is considerably higher. The cost of the vapocoolant is however relative to the size of the area being sprayed and therefor can be cost effective when dealing with smaller referral areas.

Safety to the patient and the doctor is always important in deciding a treatment. Ethyl-chloride spray is potentially dangerous if it is used incorrectly and should only be used by a qualified practitioner and should never be given to the patient for home use. Although ice is safe and found in most homes, it is my opinion that the stretch and ice treatment should not be given to the patient for home use. This is due to the fact that incorrect application of the ice, and over stretching of the muscle can aggravate the condition and possibly do more harm than good. However it is recommended that patients perform a stretching routine at home.

In terms of patient comfort, it is in the researcher's opinion that the use of the vapocoolant was superior to that of the ice. The application of the vapocoolant was fast, non-messy, and generally better received than those patients who received stroking with a covered ice block. It is also in the researcher's opinion that the placebo effect was not used to its full potential with the ice as many of people did not consider it a serious treatment. It must be noted that certain

patients did find the vapocoolant to be too cold and in these patient it is recommended that the stretch with ice protocol should be used.

It is recommended that this study be repeated with a larger sample size in order to validate the results. It would also be recommended that a control group be included into the study design as it is possible that neither groups are effective.

As the stretch is the "action" part of the treatment, it would be recommended that further studies establish the most effective form of stretching. Two other forms would be PNF stretching or the post-isometric relaxation technique described by Lewit and Simons (1984).

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REFERENCE LIST

- Auleciems, L.M. 1995. Myofascial pain syndrome: a multidisciplinary approach. Nurse Practitioner, 20(4):18-28.
- Andersen, M. The relative effectiveness of Cryotherapy versus moist heat in the treatment of myofascial trigger points. Masters Degree in Technology Dissertation, Technikon Natal, Durban.
- Baldry, P.E. 1989. Acupuncture, Trigger Points and Musculoskeletal Pain. U.K., Churchill and Livingston. 295p. ISBN 0-443-04580-1.
- Basmajian, J.V. and Nyberg, R. 1993. Rational Manual Therapies. Williams and Wilkins. 484p. ISBN 0-683-00420-4
- Broome, R.J. 1996. The Therapeutic Efficacy of Invasive Needling Techniques in the Management of Myofascial Pain and Dysfunction Syndrome. Masters Degree in Technology Dissertation, Technikon Natal, Durban.
- Ellis, M. 1961. The relief of pain by cooling the skin. British Medical Journal: 250-252.
- Ernst, E. and Fialka, V. 1994. Ice freezes pain? A review of the clinical effectiveness of analgesic cold therapy. Pain. 9: 56-59.
- Fischer, A.A. 1987. Pressure Threshold Measurement for Diagnosis of Myofascial Pain and Evaluation of Treatment Results. Clinical Journal of Pain, 2(4): 207-214.
- Fishbain, D.A., Goldberg, M., Meagher, B.R., et al. 1986. Male and female chronic pain patients categorized by DSM-III psychiatric diagnostic criteria.

Pain, 76:181-197.

Forster, A. and Palastanga, N. 1985. Clayton's Electrotherapy: theory and practice. 95th ed. London, England: Balliere and Tindall. 248p. ISBN 0-7020-1100-2.

Friction, J.R. 1990. Myofascial pain syndrome: characteristics and epidemiology. Advances in pain research and therapy. 17:107-127.

Friction, J.R. 1994. Myofascial pain. In Coopman, W.J. Clinical Rheumatology pp. 857-880. Philadelphia: Balliere 1637p. ISBN 0-7216-1451-5.

Friction, J.R., Kroening, R., Haley, H. and Siegert, R. 1985. Myofascial pain syndrome of the head and neck: a review of the clinical characteristics of 164 patients. Oral Surg Oral med Oral Pathol, 60:615.

Frost, F.A., Jessen, B. and Siggaard-Andersen, J. 1980. A controlled double blind comparison of mepivacaine versus saline injection for myofascial pain. Lancet, 1:499-501.

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

Gatterman, M.I. 1990. Chiropractic Management of Spine Related Disorders. USA, Williams and Wilkens. 437p. ISBN 0-6830-3438-3.

Goldberg, D.L. 1987. Fibromyalgia syndrome- an emerging but controversial condition. Journal of American Medical Association. (20):2782-2787.

Graaff-Radford, S.B., Reeves, J.L. and Jaeger, B. 1987. Management of chronic

headache and neck pain: Effectiveness of altering factors perpetuating myofascial pain. Headache. 27:186-190.

Grant, A.E. 1964. Massage with ice in the treatment of painful conditions of the musculoskeletal system. Archives of physical medicine and rehabilitation (45):233-238.

Guyton, A.C. 1987. Human physiology and the mechanisms of disease. 4th ed. Philadelphia: W.B. Saunders Company. 703p. ISBN 0-7216-2114-7.

Hammeroff, S.R., Crago, B.R., Blitt, C.D., Womble, J. and Kanel, J. 1981. Comparison of bupivacaine, etidocaine, and saline for trigger point therapy. Anesth Analg 60:752-755.

Halkovich, M.S., Personius, M.A., Clamann, H.P., and Newton, R.A. 1981. Effect of Fluori-Methane Spray on Passive Hip Flexion. American Physical Therapy Association. 61: 185-189.

Han, S.C, Harrison, P. 1997. Myofascial pain syndrome and the trigger point management. Regional Anesthesia. (22):89-101.

Hong, C.Z., Chen, Y.C., Pon, C.H. and Yu, J. 1993. Immediate effects of various Physical Modalities on the pain threshold of active myofascial trigger points. Journal of Musculoskeletal Pain. 1(2):37-53.

Hutchings, T.A. 1998. The treatment of myofascial syndrome using transcutaneous electrical nerve stimulation: a comparison between two types of electrode placements. Masters Degree in Technology Dissertation, Technikon Natal, Durban.

Jaeger, B. and Reeves, J.L. 1986. Quantification of changes in myofascial trigger

point sensitivity with the pressure algometer following passive stretch. Pain. 27: 203-210.

Jenson. M.P., Karoly, P. and Braver, S. 1986. The measurement of clinical pain intensity: a comparison of 6 methods. Pain. 27:117-126.

Krause, W.J. 1986. Concise text of histology. Baltimore. Williams and Wilkens. 572p. ISBN 0-683-04785-X.

Landon, B.R. 1967. Heat or cold for the relief of low back pain. Physical Therapy, 47(12): 1126-1128.

Lewit, K. 1979. The needle effect in the relief of myofascial pain. Pain. 6:83-90.

Lewit, K. and Simons, D.G. 1984. Myofascial pain: relief by post-isometric relaxation. Archives of physical medicine and rehabilitation. 65(8):452-456.

Melzack, R. 1981. Myofascial trigger points: relation to acupuncture and mechanism of pain. Archives of Physical Medicine and Rehabilitation. 62: 114-117.

Melzack, R. 1987. The short-form McGill pain questionnaire. Pain. 30:191-197.

Mennel, J.M. 1976. Spray-Stretch for the Relief of Pain from Muscle Spasm and Myofascial Trigger Points. Journal of American Podiatry Assoc, 66:873-876.

Morgan, G.M. 1997. A study of the effectiveness of vitamin supplementation in dry needling and muscle stretching therapy in myofascial pain syndrome
Masters Degree in Technology Dissertation, Technikon Natal, Durban.

Murphy, G.J. 1989. Myofascial trigger points. Journal of clinical orthopaedics. 23(9):627-663.

- Nielsen, A.J. 1981. A case study: Myofascial pain of the posterior shoulder relieved by Spray and Stretch. Journal of Orthopedic sports physicians.3: 21-26.
- Olson, J.E. and Stravino, V.D. 1972. A review of cryotherapy. Physical Therapy, 52(8):840-853.
- Rubin, D. 1981. Myofascial trigger point syndromes: an approach to management. Archives of physical medicine and rehabilitation.62:107-110.
- Sandman, K.B. and Backstrom, C.J. 1984. Psychophysiological factors in myofascial pain. Journal of Manipulative and Physiological Therapeutics, 7(4):237-242.
- Simons, D.G. 1976. Muscle Pain Syndromes - Part I. American Journal of Physical Medicine, 54: 289-311.
- Sola, A.E. 1981. Myofascial trigger points therapy. Resident and staff physician. :38-44.
- Sola, A.E. and Kuitert, J.H. 1955. Myofascial trigger point pain in the neck and shoulder girdle: Report of 100 cases treated by injection of normal saline. Northwest Med, 55:980-984.
- Sola, A. E., Rondenberger, M.L. and Gettys, B.B. 1954. Incidence of Hypersensitive Areas in Posterior Shoulder Muscles. American Journal of Physical Medicine, 34: 585-590.
- Taylor, H. 1985. The Nuprin Report. New York, Lou Harris Associates

Till, D. 1969. Cold Therapy. Physiotherapy 55: 461-466.

Travell, J. 1954. Ethyl chloride spray for painful muscle spasm. Archives of Physical Medicine and Rehabilitation. 33: 291-298.

Travell, J.G., and Simons, D.J. 1983. Myofascial Pain and Dysfunction: The Trigger Point Manual. Volume 1. USA, Williams and Wilkens. 713p. ISBN 0-6830-8366/X.

Travell, J.G., and Simons, D.J. 1992. Myofascial Pain and Dysfunction: The Trigger Point Manual. Volume 2. USA, Williams and Wilkens. 607p. ISBN 0-6830-8267-8.

Vernon, H. and Mior, S. 1991. The neck disability index: A study of reliability and validity. Journal of Manipulative and Physical Therapies. 14(7): 409-415.

Wolfe, F, Smythe, H.A., Yunus, M.B., Bennett, R.M., Bombardier, C., Goldeberg, D.L., Tugwell, P, Campbell, S.M., Abeles, M., Clark, P, Fam, A.G., Farber, S.J., Fiechtner, J.J., Franklin, C.M., Gatter, R.A., Hamaty, D., Reynolds, W.J., Romano, T.J., Russell, I.J., Sheon, R.P. The American College of Rheumatology 1990. Criteria for classification of fibromyalgia: report of the multicenter criteria classification. Arthritis Rheum 33(2):160-172.

Yunus, M.B., Ahles, T.A., Aldag, J.C. and Masi, A.T. 1991. Relationship of clinical features with psychological status in primary fibromyalgia. Arthritis Rheum, 34(1):15-21.

Yunus, M.B., Kalyan-Raman, U.P., and Kalyan-Raman, K. 1987. Primary fibromyalgia syndrome and myofascial pain syndrome: clinical features and muscle pathology. Archives of physical and Medical Rehabilitation. 69:451-454.

Yunus, M., Masi, A.T., Calabro, J.J., Miller, K.A. and Feigenbaum, S.L. 1981.
Primary fibromyalgia(fibrositis): clinical study of 50 patients with matched
normal controls. Seminars in Arthritis and Rheumatism. 11(1):151-171.

Appendix A

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

CASE HISTORY

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

FOR CLINICIAN'S USE ONLY

Initial visit clinician: _____ Signature: _____

Case History:

Examination:		
Previous:	TN	Current: TN
	Other	Other
X-ray Studies:		
Previous:	TN	Current: TN
	Other	Other
Clinical path. lab.:		
Previous:	TN	Current: TN
	Other	Other

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 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. Family history:

Immediate family:

Age

Health

Cause of death

DM

Heart disease

TB

HBP

Stroke

Kidney disease

CA

Arthritis

Anaemia

Headaches

Thyroid disease

Epilepsy

Mental illness

Alcoholism

Drug addiction

Other

8. Psychosocial history:

Home situation

Daily life

Important experiences

Religious beliefs

9. Review of systems:

General

Skin

Head

Eyes

Ears

Nose/sinuses

Mouth/throat

Neck

Breasts

Respiratory

Cardiac

Gastro-intestinal

Urinary

Genital

Vascular

Musculoskeletal

Neurologic

Haematologic

Endocrine

Psychiatric.

PHYSICAL EXAMINATION

Underline abnormal findings in **PHD** and elaborate on back of relevant page, if necessary.
Mark "NAD" if normal.

Patient: _____ File # _____

Last name

First name

Clinician: _____ Signature: _____

Intern: _____ Signature: _____

Date: _____

Height: _____ Weight: _____ Temp: _____

Rates: Heart: _____ Pulse: _____ Respiration: _____

Blood pressure: Arms: L / 1 /

Legs: L / 1 /

General appearance:

vessels
general background
macula
vitreous
lens

Ears:

auricle
ear canal
drum
auditory acuity
Weber test
Rinne test

Nose:

external
internal
septum
turbinates
olfaction
Sinuses (frontal & maxillary):
tenderness
transillumination

Mouth and pharynx:

lips
buccal mucosa
gums and teeth
root
tongue
inspection
movement
taste
palpation
pharynx
inspection
□ 1

Throat:

posterior
size
swelling
scars
discoloration
hair line

musculoskeletal.

skin

symmetry

ROM - glenohumeral

scapulo-thoracic

acromioclavicular

elbow

wrist

Chest measurement

inspiration

expiration

Visual acuity

Breast examination:

Inspection:

skin

size

contour

nipples

arms overhead

hands against hips

leaning forward.

Palpation:

axillary lymph nodes.

HEADED EXAMINATION.

Spinal posture

Head

scalp

skull

face

skin

Eyes

conjunctiva

sclera

eyebrows

eyelids

lacrimal gland

nasolacrimal duct

alignment

corneal reflex

ocular movement

2
III 17 VI

2
III 17 VI

visual fields

accommodation

iris

pupils

red reflex

optic disc

ROM:

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

Flex.

L.Ext.

R.Ext.

L.lat.
flex.

R.lat.
flex.

Ext.

lymph nodes
trachea
thyroid
carotid arteries (thrills, bruit)

- ☐ V
- ☐ VII
- ☐ VIII (systagnus)
- ☐ IX
- ☐ XI
- ☐ XII -

Inspection
ROM
deviation
Palpation
crepitus
tenderness

Neurological:

Dermatomes

C5

C6

C7

C8

T1

Tendon reflexes

biceps

triceps

brachioradialis

Muscle strength

C5

C6

C7

C8

T1

Coordination:

point-to-point

dysidiadochokinesia

Thorax:

Chest:

Inspection:

skin

shape

respiratory distress

rhythm (respiratory)

depth

effort

intercostal/supraclavicular retraction

Palpation:

tenderness

masses

respiratory expansion

tactile fremitus

Percussion:

lungs (posterior)

diaphragmatic excursion

kidney punch

Auscultation:

breath sounds

vesicular

bronchial

adventitious sounds

crackles (rales)

wheezes (rhonchi)

voice sounds

broncophony

whispered pectoriloquy

egophony

Cardiovascular:

auscultation (aortic ~~murmurs~~)

Allen's test

SUPINE EXAMINATION

JVP

PMI

auscultation heart (L.lat.recumbent)

respiratory excursion

percussion chest (anterior)

breast palpation

The abdomen:

Inspection:

skin

umbilicus

contour

peristalsis

pulsations

hernias (umbilical/incisional)

Auscultation:

bowel sounds

bruit

Percussion:

general

liver

spleen

Palpation:

superficial reflexes

cough

light

rebound tenderness

deep

liver

spleen

kidneys

aorta

intra-/retro-abdominal wall mass

shifting dullness

fluid wave

Acute abdomen:

where pain began and now

cough

tenderness

guarding/rigidity

rebound tenderness

Rovsing's sign

psaos sign

obturator sign

cutaneous hyperaesthesia

rectal exam

Murphy's sign.

male genitals and hernias.

Inspection:

- skin
- prepuce
- glans
- meatus
- nits/lice
- scrotum
- inguinal/femoral bulges

Palpation:

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

Auscultation:

- scrotal mass.

Peripheral vasculature:

Inspection:

- skin
- nail beds
- pigmentation
- hair loss

Palpation:

- pulses - radial, brachial, femoral, popliteal, post.tibial, dorsalis pedis

- lymph nodes - epitrochlear, femoral (horizontal & vertical)
- temperature (feet & legs)

Manual compression test

Retrograde filling (Trendelenburg) test

Arterial insufficiency test

Musculoskeletal:

ROM

hip

flex. 90/120

ext. 15

abd. 45

add. 30

int rot 40

ext rot 45

knee

flex. 130

ext. 0/15

ankle

plantar flex 45

dorsiflex 20

inversion 20

eversion 20

leg length

Neurological:

dermatomes

L1

L2

L3

L4

L5

S1

muscle strength

hip flexion

knee extension

ankle dorsiflexion

plantar flexion

tendon reflexes

patellar

Achilles

plantar reflex

Rectal examination:

inspection

sacroscocygeal & perianal areas

Palpation

sphincter tone

tenderness

induration

nodules

prostate

seminal vesicles

Mental status

Appearance and behaviour:

level of consciousness

posture and motor behaviour

dress, grooming, personal hygiene

facial expression

affect

Speech and language:

quantity

rate

volume

fluency

aphasia (prn)

Mood

Thought processes (logical, relevant, organized)

Memory and attention:

orientation (time, place, person)

remote memory

recent memory

new learning ability

Higher cognitive functions:

information and vocabulary (general & specialised knowledge)

abstract thinking.



TECHNIKON NATAL CHIROPRACTIC DAY CLINIC.

REGIONAL EXAMINATION -- CERVICAL SPINE.

PATIENT: _____

FILE # : _____ DATE: _____

INTERN/RESIDENT: _____

SUPERVISING CLINICIAN : _____

OBSERVATION :

Posture
Swellings
Scars
Discoloration
Hair Line
Bony and soft tissue contours

Shoulder position:

Left =

Right =

Muscle spasm

Facial expression

RANGE OF MOTION:

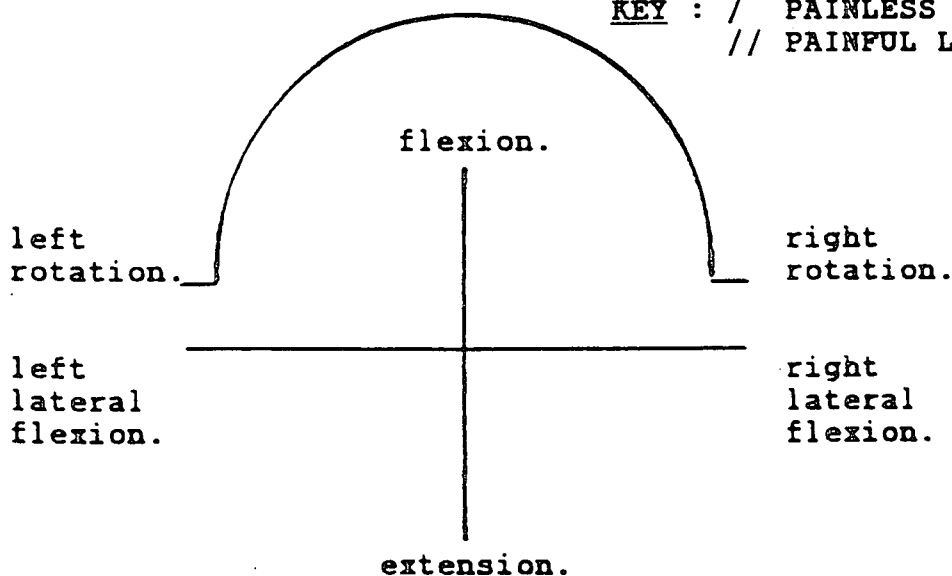
Flexion = 45 degrees.

Extension = 70 degrees.

L/R Rotation = 70 degrees.

L/R Lateral flexion = 45 degrees.

KEY : / PAINLESS LIMITATION.
// PAINFUL LIMITATION.



PALPATION : lymph nodes.
trachea.
thyroid gland.

ORTHOPAEDIC EXAMINATION :

Tenderness

Active MF Trigger Points :

SCM.
Trapezius.
Scaleni.
Levator Scapulae.
Posterior Cervical musculature.

Doorbell Sign

Kemp's Test

Cervical Distraction

Halstead's Test

Hyperabduction Test (Wright's)

Shoulder abduction Test

Dizziness rotation Test

Brachial Plexus Tension

Cervical Compression

Lateral Compression

Adson's Test

Costoclavicular Test

Eden's (traction) Test

Shoulder depression Test.

Lhermitte's Sign

O'Donoghue Manoeuvre

Remarks : _____

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 :

BLOOD PRESSURE.
CAROTIDS.
SUBCLAVIAN ARTERIES.
WALLENBERG'S TEST.

LEFT.**RIGHT.**

_____	_____
_____	_____
_____	_____
_____	_____

COMMENTS: _____**MOTION PALPATION :**

Jt. play		Left						Right						Jt. play	
P/A	Lat	Flx	Ext	LF	AR	PR		Flx	Ext	LF	AR	PR		P/A	Lat
							C0								
							C1								
							C2								
							C3								
							C4								
							C5								
							C6								
							C7								
							T1								
							T2								
							T3								
							T4								

Appendix D

INFORMED CONSENT FORM

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

TITLE OF RESEARCH PROJECT

NAME OF SUPERVISOR

NAME OF RESEARCH STUDENT

PLEASE CIRCLE THE APPROPRIATE ANSWER

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

PATIENT/SUBJECT* Name _____
(in block letters)

Signature _____

PARENT/GUARDIAN* Name _____
(in block letters)

Signature _____

WITNESS Name _____
(in block letters)

Signature _____

RESEARCH STUDENT Name _____
(in block letters)

Signature _____

Appendix E

NUMERICAL RATING SCALE -101 QUESTIONNAIRE

Patient Name : _____ File No. : _____ Date : _____

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 .

CMCC NECK DISABILITY INDEX

PATIENT NAME: _____ FILE #: _____ DATE: _____

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

Section 1 - Pain Intensity

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

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

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

Section 3 - Lifting

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

Section 4 - Reading

- ☐ I can read as much as I want to with no pain in my neck.
- ☐ I can read as much as I want to with slight pain in my neck.
- ☐ I can read as much as I want with moderate pain in my neck.
- ☐ I can't read as much as I want because of moderate pain in my neck.
- ☐ I can hardly read at all because of severe pain in my neck.
- ☐ I cannot read at all.

Section 5 - Headaches

- ☐ I have no headaches at all.
- ☐ I have slight headaches which come in-frequently.
- ☐ I have moderate headaches which come in-frequently.
- ☐ I have moderate headaches which come frequently.
- ☐ I have severe headaches which come frequently.
- ☐ I have headaches almost all the time.

Section 6 - Concentration

- ☐ I can concentrate fully when I want to with no difficulty.
- ☐ I can concentrate fully when I want to with slight difficulty.
- ☐ I have a fair degree of difficulty in concentrating when I want to.
- ☐ I have a lot of difficulty in concentrating when I want to.
- ☐ I have a great deal of difficulty in concentrating when I want to.
- ☐ I cannot concentrate at all.

Section 7 - Work

- ☐ I can do as much work as I want to.
- ☐ I can only do my usual work, but no more.
- ☐ I can do most of my usual work, but no more.
- ☐ I cannot do my usual work.
- ☐ I can hardly do any work at all.
- ☐ I can't do any work at all.

Section 8 - Driving

- ☐ I can drive my car without any neck pain.
- ☐ I can drive my car as long as I want with slight pain in my neck.
- ☐ I can drive my car as long as I want with moderate pain in my neck.
- ☐ I can't drive my car as long as I want because of moderate pain in my neck.
- ☐ I can hardly drive at all because of severe pain in my neck.
- ☐ I can't drive my car at all.

Section 9 - Sleeping

- ☐ I have no trouble sleeping.
- ☐ My sleep is slightly disturbed (less than 1 hr. sleepless).
- ☐ My sleep is mildly disturbed (1-2 hrs. sleepless).
- ☐ My sleep is moderately disturbed (2-3 hrs. sleepless).
- ☐ My sleep is greatly disturbed (3-5 hrs. sleepless).
- ☐ My sleep is completely disturbed (5-7 hrs. sleepless).

Section 10 - Recreation

- ☐ I am able to engage in all my recreation activities with no neck pain at all.
- ☐ I am able to engage in all my recreation activities, with some pain in my neck.
- ☐ I am able to engage in most, but not all of my usual recreation activities because of pain in my neck.
- ☐ I am able to engage in a few of my usual recreation activities because of pain in my neck.
- ☐ I can hardly do any recreation activities because of pain in my neck.
- ☐ I can't do any recreation activities at all.

Appendix G

SHORT - FORM MCGILL PAIN QUESTIONNAIRE

Patient : _____ File No : _____ Date : _____

	<u>None</u>	<u>Mild</u>	<u>Moderate</u>	<u>Severe</u>
Throbbing	0) _____	1) _____	2) _____	3) _____
Shooting	0) _____	1) _____	2) _____	3) _____
Stabbing	0) _____	1) _____	2) _____	3) _____
Sharp	0) _____	1) _____	2) _____	3) _____
Cramping	0) _____	1) _____	2) _____	3) _____
Gnawing	0) _____	1) _____	2) _____	3) _____
Hot-Burning	0) _____	1) _____	2) _____	3) _____
Aching	0) _____	1) _____	2) _____	3) _____
Heavy	0) _____	1) _____	2) _____	3) _____
Tender	0) _____	1) _____	2) _____	3) _____
Splitting	0) _____	1) _____	2) _____	3) _____
Tiring-Exhausting	0) _____	1) _____	2) _____	3) _____
Sickening	0) _____	1) _____	2) _____	3) _____
Fearful	0) _____	1) _____	2) _____	3) _____
Punishing-Cruel	0) _____	1) _____	2) _____	3) _____

FORCE DIAL

CERTIFICATE OF CALIBRATION

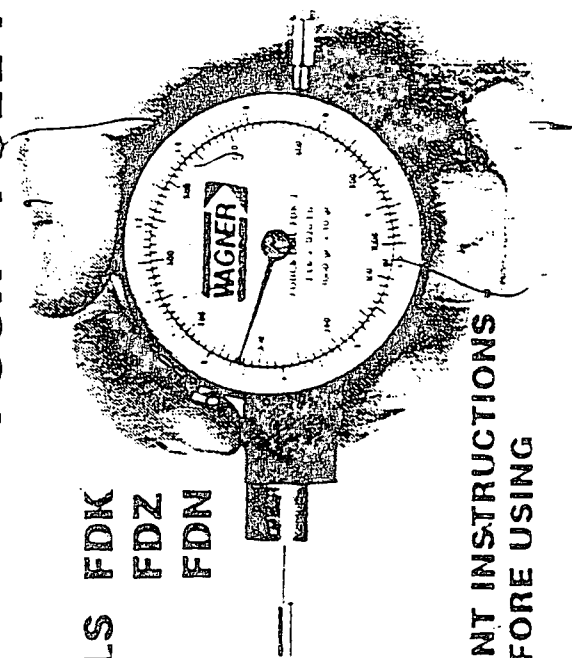
WAGNER INSTRUMENTS certifies that all
FORCE DIALS are calibrated at the factory to meet the
specified accuracy of $\pm 1\%$ of full scale, advertised in our
current catalog.

QUALITY CONTROL DIRECTOR

FORCE DIALTM

PUSH - PULL FORCE GAGE

MODELS FDK
FDZ
FDN



IMPORTANT INSTRUCTIONS
READ BEFORE USING

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

GENERAL

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

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

Lubrication of the FORCE DIAL is not recommended.

IMPORTANT

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

CALIBRATION

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

IMPLEMENT WEIGHT ADJUSTMENT

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

WEIGHT OF IMPLEMENTS:

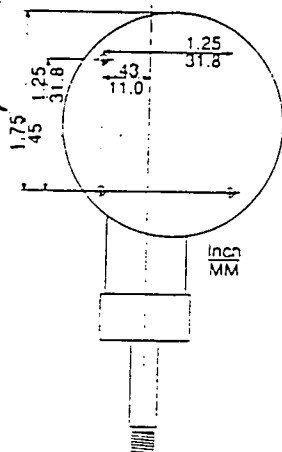
- Plunger: .015 LB/ 1/4 OZ/ 7 G
- Flat Tip: .004 LB/ 1/16 OZ/ 2 G
- Long Rod: .009 LB/ 5/32 OZ/ 4 G
- Pull Hook: .013 LB/ 7/32 OZ/ 6 G

ADJUSTMENT:

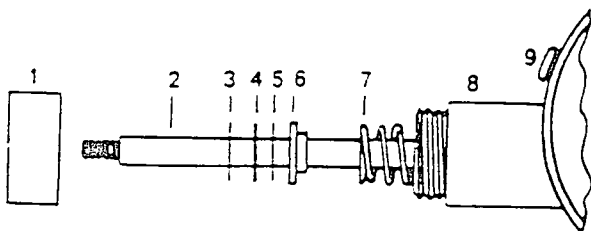
USE	WITH	+/-
Pushing Down	Plunger/Flat Tip	+9 G
Pushing Down	Plunger/Long Rod	+11 G
Pulling Down	Plunger/Flat Tip/Hook	+15 G
Pushing Up	Plunger/Flat Tip	-9 G
Pushing Up	Plunger/Long Rod	-11 G
Pulling Up	Plunger/Flat Tip/Hook	-15 G

MOUNTING

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



PARTS



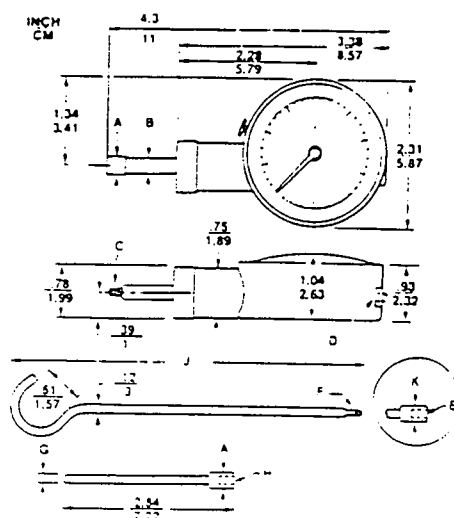
- | | | |
|--------------|-------------------------|-----------------|
| (1) Retainer | (5) Calibration Washers | (8) Case |
| (2) Plunger | (6) Plate | (9) Push Button |
| (3) Disc | (7) Spring | (10) Crystal * |
| (4) Clip | | (11) Pointer * |

ACCESSORIES: *

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

* Not shown in diagram.

DIMENSIONS



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

All dimensions are approximate.

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