THE RELATIVE EFFECTIVENESS OF PROPRIOCEPTIVE NEUROMUSCULAR FACILITATIVE STRETCHING AS COMPARED TO STATIC STRETCHING IN THE TREATMENT OF ACTIVE MYOFASCIAL TRIGGER POINTS.

by

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I, Tarryn Clair Mac Dougall,
do hereby declare
that this dissertation
represents my own work
both in conception and execution.

Tarryn Clair Mac Dougall — 12.08.99 Date

Approved for final submission

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DEDICATION

This dissertation is dedicated to my husband Mark, whose patience, encouragement and support has been invaluable.

Thank you for the thousands of hours that you patiently helped with all the frustrations.

Thanks also to Mom, Dad and Gayle who always kept me smiling.

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To Dr B. Nook, thanks for all your help and advice. Your passion for Chiropractic has been an inspiration to me.

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ABSTRACT

The purpose of this study is to determine the relative effectiveness of (Contract-Relax-Agonist-Contract) CRAC stretching, a component of Proprioceptive Neuromuscular facilitated (PNF) stretching, as opposed to static stretching in the treatment of active myofascial trigger points of the shoulder girdle and neck muscles.

This was a randomised clinical trial consisting of two groups. Group A received static stretching as their treatment protocol and Group B received PNF (CRAC) as their treatment protocol. Each group consisted of fifteen people between the ages of 18 and 55 who were randomly allocated to their respective groups. It is hypothesised that PNF (CRAC) stretching would be relatively more effective than Static stretching in the treatment of active myofascial trigger points of the shoulder girdle and neck muscles. Subjects diagnosed with active myofascial trigger points in the Trapezius, Infraspinatus and Rhomboid muscles were included in the study.

The treatment regime consisted of a course of five treatments spread over a period of two weeks and then a one - month follow up consultation. Subjective and objective measurements were taken at the first, fifth and follow up consultations. Subjective data consisted of the Short Form McGill Pain Questionnaire, the CMCC Neck Disability Index and the Numerical Pain Rating Scale -101. The objective data was collected by means of algometer and goniometer measurements.

This data was used to perform statistical analysis using the non-parametric Wilcoxin signed-rank test and the Mann Whitney unpaired test to compare intra-group and inter-group data respectively, at a 95% confidence level.

From the results of the Wilcoxin signed rank tests, it was revealed that within both groups there was significant subjective and objective improvement during the treatment program. This improvement was, however, not maintained after the one - month follow - up period. According to the Mann Whitney U tests, there was no significant difference between the two groups at any stage of the study which implies that both treatment methods are equally effective in the treatment of active myofascial trigger points of the shoulder girdle and neck muscles. There was therefore no significant statistical difference between the two groups.

This study suggests that both static and PNF (CRAC) stretching are effective in the treatment of active myofascial trigger points. However there is no clinical statistical difference between these two treatments. Further studies with a larger sample size are needed to clearly evaluate the use of stretching in the treatment of active myofascial trigger points.

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DEFINITION OF TERMS

Active myofascial trigger points: A focus of hyper-irritability in a muscle or it's fascia that is symptomatic with respect to pain. This point refers a pain pattern at rest or in motion that is specific for the involved muscle. It is always tender on palpation and prevents full muscle lengthening, weakens the muscle, refers pain on direct compression, mediates a local twitch response of muscle fibres when adequately stimulated and often produces specific referred autonomic phenomena in it's pain reference zone. (Travell and Simons, 1983:1)

Latent myofascial trigger point: A focus of hyper-irritability in a muscle or it's fascia that is clinically quiet with respect to spontaneous pain, it is painful only when palpated. It may have all the characteristics of an active trigger point from which it can be distinguished. (Travell and Simons, 1983:2)

Reference zone: A specific region of the body at a distance from the trigger point where phenomena that it causes are evident. (Travell and Simons, 1983:4)

Static stretching: A method of stretching in which the muscle is slowly elongated to tolerance (comfortable stretch, just short of pain) and the position is held for thirty seconds with the muscle in this greatest tolerated length. (Grana and Kalenak, 1991:253)

Contract-Relax-Agonist-Contract (CRAC): This is a form of PNF stretching. The muscle is placed on a stretch and the agonist contracted for eight seconds against resistance. This causes the antagonist to reflexively relax. The stretch is released and the antagonist contracts and the stretch position is increased. This process is repeated three times. (Grana and Kalenak, 1991:253)

Subjective changes: Changes that are personally perceived by the patient, i.e. how they feel with regard to pain and disability.

Objective changes: Changes that are noted by the researcher, i.e. physical changes noted by means of algometer and goniometer readings in this study.

Goniometer: A 180^0 or 360^0 protractor with a mobile arm that is used to measure the amount that of movement that occurs in a particular area of the body or joint.

Algometer: An instrument that measures pain pressure threshold (in kilograms per centimetre squared) by recording the amount of pressure that is applied to a trigger point in order to reach a certain level of pain perception.

Jump Sign: A general pain response of a patient who winces, may cry out, may withdraw in response to pressure applied to a pressure point. (Travell and Simons, 1983:5)

Twitch Response: A transient contraction of a group of muscle fibres that contains an active myofascial trigger point. (Travell and Simons, 1983:5)

CHAPTER ONE

Introduction

CHAPTER ONE

INTRODUCTION

Skeletal muscle collectively constitutes 40% or more of the total body weight, is the single largest organ and is the prime mover of all joints (Gatterman 1990:112-3). Travell and Simons (1983:5) supports this, adding that approximately 400 individual muscles are all potential areas of trigger point occurrence. According to Fomby et al. (1997) trigger points are most commonly found in the axial muscles especially those that maintain posture.

Reaves et al. (1986) states that the importance of pain and dysfunction originating from active myofascial trigger points is gaining increased recognition by researchers and clinicians. Travell and Simons (1983:1-29) concluded that myofascial pain associated with active myofascial trigger points are one of the most common painful muscular syndromes. The prevalence and severity of pain in an university internal medicine setting suggests that regional myofascial pain may be an important cause of pain complaints in the practice of general internal medicine (Skootsky 1989).

Active myofascial trigger points affect virtually everyone at some time and frequently individuals with inadequate treatment find themselves with muscular dysfunction, impairment and or disability (Auleciems 1995). Yet considering the number of people affected with active myofascial trigger points and the magnitude of it's personal and social consequences, surprisingly little research is available (Bruce 1995).

The current recommended treatment of active myofascial trigger points is to inactivate the trigger point and thereby eliminate the cause of referred and local pain. This is achieved by various methods such as dry needling, ischaemic compression, deep massage, heat, electrical stimulation and stretching (Travell and Simons 1983:1-29).

Pain relief is achieved by reducing muscle tension, allowing the muscle to relax and thereby reducing the tension on the active myofascial trigger point (Osternig et al. 1987). According to Auleciems (1995), the importance of stretching is a vital ingredient in the relief of active myofascia trigger points as stretching lengthens the taught band of muscle fibres allowing the sarcomeres to return to the usual length and therefore the return of metabolic equilibrium. Stretching is also recommended as it is easy to perform and has few associated risks (Taylor et al. 1990). Travell and Simons (1983:1-29) claim that stretching is essential in the treatment of active myofascial trigger points as it reduces the likelihood of the patients developing trigger points again in the affected muscle as well as rendering the latent trigger point less prone to activation.

According to McAtee (1993:11) PNF stretching has been shown to be very effective in gaining increased muscle relaxation and lengthening in 57% of the studies he reviewed. Basmajan and Nyberg (1993) state that the use of PNF techniques as an adjunct to soft tissue mobilisation, facilitates elongation in shortened muscles. According to Lewit and Simons (1984), the results of applying PNF to patients with active myofascial trigger points confirm that this technique was remarkably effective in relieving symptoms characteristic of active myofascial trigger points. They found that PNF not only abolishes trigger points in a muscle, but also relieves painful ligaments.

To date, there have been no studies comparing the relative effectiveness of PNF stretching and static stretching in the treatment of active myofascial trigger points. This study will attempt to reveal the most effective stretching technique.

CHAPTER TWO

Review of Related Literature

CHAPTER TWO

2.0 REVIEW OF RELATED LITERATURE

2.1 PREVALENCE AND INCIDENCE OF TRIGGER POINTS

According to Reeves et al. (1986), the importance of pain and dysfunction originating from active myofascial trigger points is gaining increased recognition by clinicians and researchers as it is one of the most common painful muscular syndromes. This is supported by Sola and Williams (1956) who state that myofascial pain is probably the most common pain problem faced by physicians. Ashburn and Fine (1990) state that Rheumotologists report myofascial trigger point pain syndrome as the most common diagnosis made in their ambulatory practice.

Skootsky et al. (1989) examined 172 patients presenting to a university primary care general internal medicine practice. They concluded that of 54 patients whose reasons for visits included pain, 16 (30%) satisfied criteria for a clinical diagnosis of myofascial pain. This is further supported by Auleciems (1995) who found that myofascial trigger points accounted for 50% of the cases of pain in patients presenting to chronic pain treatment centres. In his study of 200 asymptomatic air-force recruits, evidence of latent trigger points were found in 54% of the women and in 45% of the men. Referred pain from an active myofascial trigger point was demonstrated in 5% of the cases.

Bruce (1995) found that 85% of 283 consecutive admissions to comprehensive pain centres were diagnosed with primary organic myofascial pain syndrome. He believes that myofascial pain

syndrome constitutes the largest group of unrecognised and under-treated acute and chronic medical problems and is the most commonly overlooked cause of disability in a clinical practice.

In a retrospective study by Simons (1988), of 296 patients referred to dental clinics for chronic head and neck pain of at least six - month duration, the primary diagnosis was myofascial trigger point pain in 55.4% of the patients. Simons also found in this study that amongst 61 consecutive consultations or follow-up patients in an internal medical practice, 10% of the 61 patients, and 31% of these patients who complained of pain, had myofascial trigger point pain as a primary cause.

2.2 AETIOLOGY OF TRIGGER POINTS

According to Sola and Williams (1956), the most common predisposing factor of myofascial trigger points is acute or chronic stress or any physiological or organic stress. An acute strain due to sudden overload of a muscle or chronic repetitive strain of a muscle can produce an active trigger point that can cause referred pain (Simons 1988). Gatterman (1990:285) believes that it is repeated micro-trauma to the muscle that is the developing factor for myofascial trigger points. Early in the course of the disorder the patient may be able to identify an injury or incident responsible for initiating the persistent pain. In chronic cases, however, this is not always possible

Ashburn and Fine (1990) states that trigger points often appear after surgery or trauma. According to Rubin (1981), factors besides trauma such as viral or bacterial infections, immobilisation and psychological stress may precipitate or perpetuate myofascial trigger points. Sola (1984) states that numerous conditions attribute to the development of myofascial trigger

points. These include genetic factors, personality, physical conditioning, and physiological state (previous injury or hormonal balance) while the triggering stresses include physical factors (disease or fatigue injury) and mental factors (fatigue and anxiety).

Micro-trauma and muscle overload may result in myofascial trigger point formation through the release of calcium from the sarcoplasmic reticulum. High calcium levels cause continued contraction of the sarcomeres and increased demand for ATP resulting in local hypoxia. The disabled calcium pump sustains this contraction cycle (Auleciems1995).

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

Ashburn and Fine (1990) found that in a histological examination of muscle biopsy from trigger point patients has revealed areas of fibre degeneration, proliferation of nuclei and fatty infiltration. On microscopic examination of muscle biopsy specimens, Brendenstrup et al. (1957) found mast cell degeneration and platelet aggregation in muscle fibres from trigger point areas.

2.3 PERPETUATING FACTORS

According to Simons (1988), perpetuating factors of myofascial trigger points may be mechanical or systemic and usually prior to activation cause no pain. Rosen (1993) describes numerous other perpetuating factors such as gross changes in nutrition, metabolism, intrinsic and extrinsic changes to a muscle as well as neurological or vascular factors. Injuries, viral or bacterial infections, immobilisations, psychogenic stresses and other environmental factors can precipitate these syndromes which may occur in any of the voluntary muscles of the human body and thus lead to a multitude of myofascial pain syndromes (Rubin 1981).

Travell and Simons (1983: 103-164) highlighted several groups of perpetuating factors.

1) Mechanical stresses: skeletal asymmetry, poor posture, poorly designed furniture, muscle abuse and prolonged joint or muscle immobilisation.

2) Nutritional deficiencies: Vitamin B1. B6, B12, C, Folic acid, Calcium, Potassium, Iron ie.: elements that are needed for normal muscle metabolism.

3) Endocrine and other metabolic inadequacies: Hypometabolism due to hypothyroidism, hyperuremia and hypoglycemia. This includes anything that impairs muscle metabolism such as anaemia and hypoxia.

4) Psychological factors: Tension incurred through stress, and anxiety or depression.

5) Chronic infections: Bacterial, Viral or Parasitic.

6) Others: Allergies, sleep disorders, radiculopathies, fatigue and cold, damp weather.

Fomby et al. (1997) points out that the treatment for myofascial trigger points fails because underlying problems go untreated, thus the physician should pay more special attention to these factors. Rubin (1981) states that it is desirable to correct faulty body mechanics, systemic deficiencies and stress factors in order to avoid recurrent myofascial trigger point activity. This is supported by Travell and Simons (1983:17-18) who stated that these factors must be taken into account and corrected or eliminated to ensure effective treatment of the condition.

2.4 SYMPTOMS

Auleciems (1995) states that trigger points are painful on compression, cause characteristic referred pain tenderness and cause autonomic phenomena such as sweating, pilomotor erection or proprioceptive disturbances. The patient may also experience stiffness, limitation of motion, tremors and weakness of muscle areas associated with active myofascial trigger points (Sola 1956).

Gatterman (1990:437) describes the pain associated with myofascial pain syndrome as dull, aching and varying in intensity from mild discomfort to severe and incapacitating. Referred pain caused by active myofascial trigger points does not follow segmental or neurological patterns, but is specific for each individual muscle. (Travell and Simons 1983:14)

In a review of chronic pain syndrome literature, Ashburn and Fine (1990) found that 70-90% of patients with myofascial trigger points experienced sleep disturbances with a loss of non-REM delta sleep. Mood alterations and depression are also common problems which are further supported by Bruce who found anxiety, frustration, hypochondriasis and anger emerging in patients with active myofascial trigger points.

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

1) Trigger points may be activated directly by acute overload, overwork, fatigue, direct trauma and by chilling or indirectly by other trigger points, arthritic joints, visceral disease and by emotional stress.

2) Any of the perpetuating factors may increase trigger point irritability from a latent to an active level.

3) Phenomena (other than pain), such as localised sweating, vasoconstriction, lacrimation, salivation, pilomotor activity and proprioceptive disturbances may also be caused by active myofascial trigger points.

4) Clinical features of trigger point activity usually outlast the precipitating event.

5) Active myofascial trigger points vary in intensity at any given time.

6) Muscle stiffness and weakness may be the result of the activity of the trigger points.

2.5 SIGNS

Ashburn and Fine (1990) describes trigger points as soft tissue regions that either spontaneously, or through the application of direct pressure, cause radiating pain, paraesthesias or autonomic phenomena.

On palpation a trigger point is a spot of exquisite tenderness found within a taut band of muscle fibres (Simons 1988). This taut band of muscle fibres is palpable within shortened or weak muscles (Bruce 1995). Trigger points usually occur longitudinally along the axis of the muscle at sites that are reproducible from one patient to another (Fomby et al. 1997). According to Mance et al. (1986) there are three types of hardening felt on palpation of trigger points: nodular, spindle shaped and rope-like.

Gatterman (1990:295) as well as Travell and Simons (1983:13-17) list signs characteristic of active myofascial trigger points on patient examination:

1) Increased pain by active/passive stretching of the muscle in which the trigger point is present.

2) Reduced stretch range of motion.

3) Restricted isometric contraction of the affected muscle with increased pain.

4) The muscle exhibits a weakened maximum contraction force.

5) Deep tenderness and dysaethesia are commonly referred by active myofascial trigger points to the zone of referred pain.

6) Disturbances of non-sensory function are sometimes induced in the pain referral zone. These include increased vasomotor activity (pallor during stimulation of the trigger point, rebound hyperemia following it's activation), lacrimation, coryza, sudomtor activity and pilomotor activation (goose- flesh).

7) Muscle adjacent to active myofascial trigger points may also feel tense to palpation.

8) A trigger point is found in a palpable band as a well defined area of intense tenderness.

9) A jump sign is usually elicited.

10) Snapping palpation of an active trigger point frequently produces a local twitch response.

11) Pressure on an irritable trigger point usually causes or increases pain in the referred pain zone of the trigger point.

12) The skin of some patients exhibit Dermographia or Panniculosis in the area overlying the active trigger point.

Simons (1988) lists the following autonomic phenomena associated with active myofascial trigger points:

1) They tend to cause increased temperature changes of the skin over the active trigger point.

2) Trigger points in parts of the Trapezius muscle refer pilomotor activity down the arm, while the Sternocleidomastoid muscles refer tearing of the eye and coryza homolaterally.

3) Constant pressure on the upper Trapezius' trigger points can induce a reduction in the pulsations of the temporal artery bilaterally while the pain lasts.

2.6 DIAGNOSIS

Even though recent studies have provided diagnostic criteria for myofascial pain syndrome, the use of diagnostic measures is still controversial and confusing (Bruce 1995). According to Ashburn and Fine (1990), no laboratory studies for the diagnosis of myofascial pain syndrome are available. Simons (1988) states that myofascial pain syndrome is best identified by a thorough history and physical examination. He also adds that laboratory and imaging studies are only usefu to rule out other diseases, to identify perpetuating factors and, more recently, to substantiate the diagnosis. He describes thermography as a promising tool for substantiating the diagnosis of active myofascial trigger points, where areas of "hotspots" (areas of increased temperature) of the skin over active myofascial trigger points are evident. Auleciems (1995) supports this by adding that thermography reveals disc-shaped hotspots 5 – 10 millimetres in size over active myofascial trigger points. Auleciems (1995) also states that laboratory and imaging studies are useful to help

rule out other aetiologies and to identify perpetuating factors. For patients with trigger points unresponsive to treatment, serum vitamin levels, blood chemistry panels, complete blood counts, sediment rates and thyroid studies are useful to determine perpetuating factors.

Brendstrup et al. (1957) studied 12 muscle biopsy specimens and, on chemical analysis, found that potassium concentration in fibrotic muscle was on average 5% lower than in control groups with normal muscle fibres. He also found that chloride and hexosamine concentrations were on average 50% higher in fibrotic muscle as compared to normal muscle fibres.

To accurately diagnose myofascial trigger points, a thorough history and examination are essential. The history should include a detailed pain history, including when and how the pain started, the exact location of the pain, what the pain feels like, history of trauma, and over-use or concurrent illness (Fomby et al. 1997). Typically, the pain is described as dull in nature, resulting from acute over-load, over-work, fatigue or direct trauma. The onset may be sudden or arise some time after the initiating event (Travell and Simons 1983:13).

On examination, the two findings that are generally useful in making a diagnosis of active myofascial trigger points are an exquisite spot tenderness at the trigger point and a palpable band of taut muscle fibres running through the trigger point (Simons 1988). According to Kosek et al. (1993), the use of pressure algometry is a semi-objective method of determining pressure pain thresholds and Fisher (1987) states that the use of algometry readings has been successfully used in clinical practice for the diagnosis of active myofascial trigger points. He conducted a study in which normal algometery values were established in 24 males and 9 females at 9 different sites frequently affected by trigger points - including trapezius, infaspinatus, supraspinatus, teres major,

lumbar paraspinal (2 sites), gluteal and pectoral muscles. The deltoid was used as a reference fo normal muscle sensitivity. The reaction to different treatment modalities such as physiotherapy and analgesics were assessed. After properly administering trigger point injections, pressure measurements increased by 4kg/cm^2. Failure to increase pressure tenderness measurements indicated that the injection was incomplete and that the procedure should be completed.

2.7 TREATMENT

Auleciems (1995) found that when effectively managed, active myofascial trigger points have an excellent prognosis and although myofascial trigger point pain syndrome is usually not curable, it is well controllable. Rosen (1993) points out that failed treatment and misdiagnosis can have a devastating impact on patients. According to Sola (1984), treatment is aimed at elimination or desensitisation of the hypersensitive trigger point and he states that for many years, injections with saline and local anaesthetics yielded a favourable response. Uncomplicated myofascial trigger point pain syndrome is highly responsive to simple and appropriate treatment which should Include a full understanding of the patient and any contributing factors (Bruce 1995).

Wereje and Brorsson (1995) state that these pain syndromes are often resistant to therapy and do not always respond to systemic pharmacological treatment. In their randomised controlled trial involving injections of sterile water and saline in the treatment of chronic myofascial trigger points, they found that the sterile water injections were substantially more painful and demonstrated no better outcome than the saline injections. It is the opinion of Ashburn and Fine (1990) that with narcotic and analgesic medical treatment alone, there is little change of symptoms and 90% of patients are still symptomatic after 3 years. A combination of medical therapy, trigger point

injections and physical therapy however can dramatically decrease pain complaints and improve the overall function of limbs. Fomby et al. (1997) supports this by saying a combination of therapy is necessary to obtain pain relief and full functional recovery. Treatment should begin with the least invasive and least traumatic approaches.

Travell and Simons (1983:263-275) list useful modalities such as stretch, stretch and spray, stretch with ice/heat, deep massage, ischaemic pressure, electrical stimulus and injections. Bruce (1995) states that the two most common techniques of treatment include spray and stretch technique and trigger point injections. In a randomised study by Skootsky et al. (1989), of the14 patients used, 12 received stretch and spray techniques and 2 received trigger point injections as their treatment. It was found that the mean pain intensity measurements, using the visual analogue scale, decreased significantly from 54.7 (pre-treatment) to 26.1 (post treatment) in all patients.

2.8 STATIC STRETCHING

Static stretching is a technique of stretching applied to a specific muscle group to lengthen the muscle just short of causing pain (Taylor et al.1990). This is achieved by slowly elongating the muscle to tolerance (comfortable stretch, short of pain) and the position is held within the muscle at this greatest tolerance length (Bandy and Irion 1994).

In a randomised, controlled study by Bandy and Irion (1994), in which hamstring flexibility was measured, 57 patients were randomly allocated into 4 groups. Three of the groups were stretched 5 times a week for 15, 30, 60 seconds respectively and the fourth group was a control group. The

results showed that stretching for 30 and 60 seconds was more effective at increasing hamstring flexibility than 15 seconds or no stretching. In addition, no significant difference existed between stretching for 30 seconds and 1 minute. Therefore the suggested stretching time for optimal muscle lengthening is 30 seconds. The study did not include determining the number of times the stretch should be performed as one of its objectives. Taylor et al. (1990) performed a controlled study using rabbit Extensor Digitorum Longus and Tibialis Anterior musculo-tendon units to evaluate the biomechanical effects of stretching. Experimental techniques simulating cyclic stretching and static stretching resulted in sustained muscle-tendon elongation, suggesting that greater flexibility can result if these techniques are used in a clinical setting. They also found that a minimum number of 4 stretch repetitions resulted in the greatest elongation achieved.

Rubin (1981) states that stretching is important in the prevention of active myofascial trigger points as it restores and maintains the normal resting length of the affected muscle. Stretching reduces muscle tension, allowing sarcomeres to return to their usual length. This returns metabolic equilibrium to the affected muscle and relieves multiple trigger points in a muscle group.

According to Taylor et al. (1990), stretching is recommended as it reduces muscle soreness following activity and has been put forward as a way to enhance one's general well-being.

2.9 PNF STRETCHING

PNF (CRAC) is a form of stretching that uses an isometric contraction prior to the stretch to achieve greater gains than from static stretching along (McAtee 1993:2). This type of stretching consists of three phases. The first is to place the muscle to be stretched in a stretch position and

have it contracted against resistance for 8 seconds. This phase causes fatigue to the muscle allowing it to relax and stretch. The second phase is to contract the antagonist. This initiates a neurophysiological principle called 'reciprocal inhibition' to produce muscle stretching. The third phase is to put the muscle on a passive stretch. These procedures are repeated three times (Nook 1997). Louis and Osternig (1987) state that PNF stretching techniques are often used to induce increased joint motion and muscle relaxation. However, according to Lewit and Simons (1984), PNF's applicability to the relief of active myofascial trigger points has been generally overlooked.

McCarthy et al. (1997) did a study to determine the effects of PNF (CRAC) stretching procedures on active range of motion of the cervical spine in the transverse plane. Forty asymptomatic male volunteers were equally divided into either a stretch or control group. The stretch group performed stretching twice a day for seven days. The results showed that there was significantly increased active cervical spine range of motion by the seventh day of the study as compared to the control group who continued daily life with no stretching. In a study by Louis and Osternig (1987), CRAC stretching produced 89-110% greater hamstring EMG activity (P<0,005) and 9-13% more knee range of motion than contract-relax and stretch-relax techniques on 30 patients.

Sadey et al. (1982) conducted a study comparing a control group to separate groups of ballistic, static and PNF stretching of the shoulder, trunk and hamstring muscles. The PNF group was the only group to have flexibility increases (10.6°) greater than the control group (3.4°) with the hamstring (9.4°) improving more than the trunk (5.2° decrease).

Lewit and Simons' (1984) study involved 244 patients with 351 muscle or muscle groups which are commonly associated with myofascial pain syndromes. The patients were all treated using PNF (CRAC) stretching techniques and were scored as having either immediate or lasting relief (3 months or more). The patients were all treated twice a week. The results showed that 94% experienced immediate relief, 63% experienced lasting relief and 23% experienced lasting relief o point tenderness of the sites treated.

2.10 COMPENDIUM OF MUSCLES

2.10.1 The Trapezius Muscle (The coat hanger muscle)

This is the large, flat, triangular muscle attaching from the pectoral girdle to the skull and vertebral collar. It's origin is the medial third of the superior nuchal line, external occipital protuberance, ligamentum nuchae and the spinous processes of C7 to T12 vertebrae. The superior fibres insert into the lateral third of the clavicle; middle fibres into the acromion and spine of the scapula, and inferior fibres to the base of the scapular spine.

Action: Elevate, retract and rotate the scapula

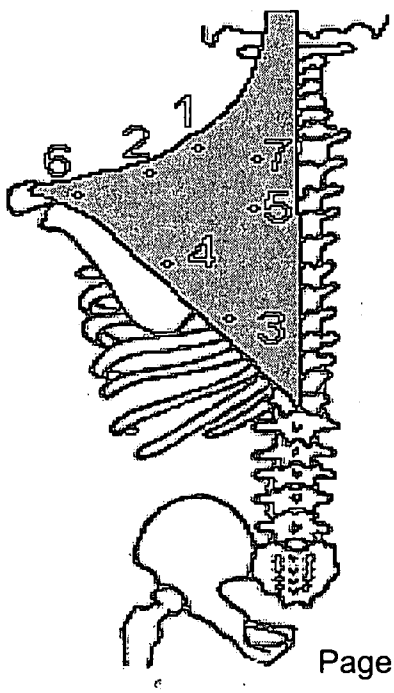
Innervation: Accessory nerve and C3/C4. (Moore 1985:530)

The upper trapezius fibres have two common trigger points, namely: trigger point one (TP1) and two (TP2). TP1 is located in the upper free border of the muscle. It consistently refers pain unilaterally cranially to the postero-lateral border of the neck to the mastoid process and when intense to the side of the head, the temple and behind the orbit of the eye. TP2 is located in the

deeper fibres posterior to TP1. It refers pain slightly posterior to the cervical reference zone of TP1.

The lower trapezius fibres contain trigger points three and four (TP3 and TP4). TP3 is found close to where the lower fibres cross the medial border of the scapula, or at or below the inferior zone of the scapula. The zone of pain referral is the upper cervical region and mastoid as well as the acromion and the suprascapula region where it is felt as an annoying ache. TP4 is palpated overlying the medial end of the infraspinatus muscle. It produces a steady burning pain medial to the vertebral border of the scapula.

Trigger points five, six and seven (TP5, TP6 and TP7) are superficially located in the middle fibres of the trapezius. TP5 is located about 1cm medial to the scapula attachment of the levator scapula muscle. It refers pain medially between itself and the spinous processes of C7 and T1 vertebrae. TP6 is found near the acromion and is felt as an aching pain on top of the shoulder. TP7 is the most superficial, existing in an area over and above the medial supraspinus fossa. It produces a shivery sensation with pilomotor activity on the lateral aspect of the homolateral arm and sometimes thigh (Travell and Simons 1983:183-196).



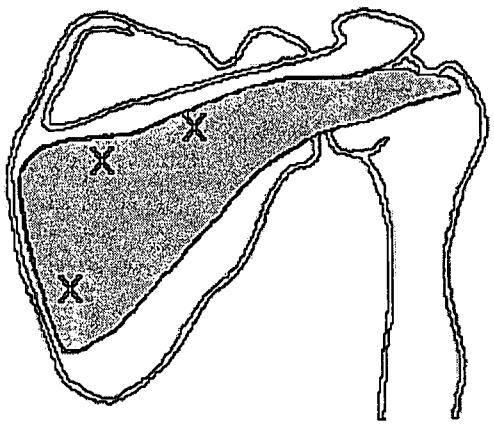
2.10.2 Infraspinatus Muscle (The shoulder joint pain)

The Infraspinatus muscle originates in the Infraspinatus fossa of the scapula, a space which it alone occupies. It inserts into the greater tuberosity of the humerus.

Action: Laterally rotate the upper arm and also to stabilise the shoulder joint.

Innervation: Suprascapular nerve- C5and C6. (Moore 1985:669)

The most common trigger point in this muscle lies cuadal to the scapular spine and at the junction of the medial and second quarter of this spine. The second lies caudal to the midpoint of the scapular spine. Pain is referred from these trigger points to the front of the shoulder and is often felt deep within the joint. The pain may spill over down the arm to the radial side of the forearm (Travell and Simons 1983: 377-385).



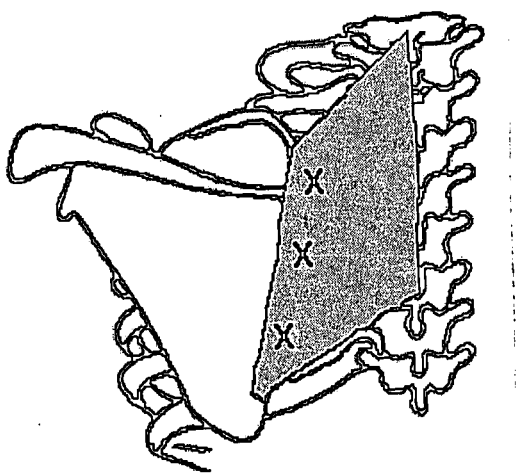
2.10.3 Rhomboid Major and Minor Muscles

These two muscles may not be distinguishable from each other and appear as parallel bands originating from the spinous processes of C7 and T1 (Rhomboid minor) and T2 to T5 (Rhomboid major). They insert into the medial border of the scapular, the minor muscle at the root of the scapular spine, the major part below it (Moore, 1985:665).

Action: Retract scapular and rotate the scapular to depress the glenoid cavity. It also fixes the scapular to the thoracic wall.

Innervation: Dorsal scapular nerve- C4 and C5.

Flat palpation with the scapular spine protracted is used to locate trigger points in the muscle. Deep palpation of the ropey bands containing the trigger points will elicit pain referral, although a local twitch response may be difficult to perceive since the muscle lies deep to the trapezius. The zone of pain referral is along the medial border of the scapular between this muscle and the paraspinal muscles (Travell and Simons, 1983:425-429).



CHAPTER THREE

Materials and Methods

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 INTRODUCTION

This study was designed as a comparative, randomised, clinical trial. The objective of the study was to compare two treatment groups (PNF (CRAC) stretching Vs Static stretching) to assess for intra and inter-group improvement. On conclusion of the treatment protocols, an inter-group statistical analysis was performed to determine whether one treatment protocol was more effective than the other.

3.2 THE SUBJECTS

Advertisements were placed around the Technikon campus inviting patients to enrol in a clinical trial involving the treatment of neck and mid-back pain. Any patient with neck, mid-back or shoulder pain was considered a possible candidate. These patients were then screened and further investigations took place only if the researcher deemed the candidate suitable for the study. The screening procedure involved questioning the patient on the pattern of referred pain, palpation of the relevant zones for muscle spasm, twitch response, jump sign and/or referred pain

3.3 INCLUSION CRITERIA

1) Patients between the ages of 18-55.

2) Only patients diagnosed with active myofascial trigger points of the neck and shoulder girdle muscles. Specifically the trapezius, infraspinatus and rhomboid muscles were considered. No other trigger points were addressed.

3) Patients had to have at least one active trigger point in any of the muscles listed. Only the muscles containing the active myofascial trigger point were treated.

4) The patient's condition had to comply with all 8 criteria for the diagnosis of active myofascial trigger points as described by Travell and Simons (1990:18-19).

- History of rapid onset during or shortly following acute over-load stress, or a history of gradual onset with chronic over-load of the affected muscle.
- A pattern of referred pain from the trigger point that is characteristic for that muscle in which it is found.
- Weakness of the affected muscle with associated restriction in it's stretch range of motion.
- A taut palpable band in the affected muscle.
- Intense focal tenderness of the taut band to applied pressure.
- A local twitch response on snapping palpation of the trigger point.
- Reproduction of characteristic pain patterns by needling or palpation of the trigger point.
- Elimination of the clinical presentation by specific trigger point therapy.

Patients had to comply with all of these criteria to be included in the study.

3.4 EXCLUSION CRITERIA

1) Any patient suffering with a local or systemic pathology as determined by the examination was excluded from the study.

2) Any patient suffering from neck or shoulder pain caused by muscles other than those included in the study was excluded.

3) Patients were not allowed to take any kind of anti-inflammatory medications or receive any other form of manual therapy during the two- week period of treatment or before the one month follow up consultation.

4) Any patient not complying with the above requirement was excluded from the study.

3.5 THE SAMPLE GROUP

A sample of thirty patients who were all diagnosed as having active myofascial trigger points in the required muscles, were randomly divided into two groups of fifteen by means of random allocation Fifteen pieces of paper were inscribed with "PNF" and fifteen were inscribed with "static". The thirty pieces of paper were folded so as to disguise the inscription and were placed in a box, which was adequately shaken so as to mix them up. The pieces were then drawn out one at a time and recorded next to a list of numbers 1-30. The patients were then allocated to a type of stretching according to the point at which they entered the program.

The treatment schedule used was similar to that used by Jones (1995) and Sola (1981) and comprised 5 treatments over a period of two weeks. Patients who passed the initial screening tes and inclusion criteria underwent a detailed case history (Appendix A), physical examination (Appendix B), and a cervical spine regional examination (Appendix C).

After this consultation, if the patient was still deemed suitable for the study, a series of five treatments in a period of two weeks were scheduled. A follow up consultation was then scheduled for one month following the fifth treatment.

At the first consultation, each patient was required to fill out a patient consent form (Appendix E) granting the researcher permission to use them in the study. In addition this ensured that each patient was given a full description of the study and their role therein.

3.6 MEASUREMENTS

3.6.1 Subjective Measures

At the initial consultation as previously mentioned, the case history, physical examination and cervical spine regional examination were performed. The active trigger points in each muscle were recorded on the Algometer form (Appendix D), making their relocation easier and more accurate for subsequent treatments. This form served as a record to show which trigger points were found and on which side the trigger points were found.

The patient was also obliged to fill out a short form McGill Pain Questionnaire (Appendix F), the Numerical Pain Rating Scale -101 (Appendix G) and the CMCC Neck Disability Index (Appendix H). These three forms subjectively assessed various aspects of the patient's pain.

The subjective data was collected by means of the short form McGill Pain Questionnaire as described by Melzack (1987). This questionnaire provided information regarding the sensory, affective and evaluative dimensions of the patients' pain. The short form McGill Pain Questionnaire was developed for use where information regarding pain is required quickly. The questionnaire is divided into two sections. The first section consists of eleven adjectives describing the sensory dimensions of pain. The second section consists of four adjectives that describe the affective dimension of pain. A score of 0 to 3 was given for each adjective depending on whether the pain was ranked as "none", "mild", "moderate" or "severe" respectively. The option "none" carried a nil score while "severe" carried a score of three.

The patients progress was monitored using the Numerical Pain Rating Scale - 101. This test was chosen because of the ease at which could be administered and scored. This rating scale's validity and reliability, when providing subjective information about the levels of pain perceived by the patient, was established by Jensen et al. (1986). The patient was asked to mark off a point on a 10cm line, between 0 and 100 when the pain was at its worst. Likewise this was repeated on a second identical line when the pain was at its least with "0" indicating no pain and "100" indicating most severe pain. The two values from the "worst" pain to the "least" pain were added together and divided by two to show a percentage of one hundred and an average pain level experienced by the patient.

The CMCC Neck Disability Index was used to show subjective information regarding the extent to which the patients lifestyle was affected by the pain experienced. This questionnaire was developed by Vernon and Mior (1991) and, in a study of its reliability and validity, it was found to demonstrate a high degree of test - retest reliability and internal consistency. The CMCC Neck Disability Index consists of ten sections dealing with different aspects of the patients' lifestyle. Each section had six options, with the first scoring "0" and the next five increasing progressively by a value of 1 to a maximum of "5". All the scores were added together and were expressed as a percentage of the maximum score (50).

These questionnaires were completed at the initial, fifth and one month follow up consultations so that any improvements in the condition could be recorded and assessed. At treatments two, three, and four, no subjective measurements were recorded; only the allocated treatment was conducted.

3.6.2 Objective Measures

Algometer and goniometer measurements were used as objective data to assess changes in the patients' condition during the treatment period and one month after the final treatment.

At the initial consultation, algometer readings were carried out on the active myofascial trigger points and the cervical range of motion was measured by using the goniometer. These measurements were repeated at the fifth and one month follow – up consultations.

The reliability of the algometer as a tool for the diagnosis of myofascial trigger points, as well as the assessment of the treatment results, has been documented by Fischer (1987). The algometer used in this study was the FDK20 force dial used by Wagner instruments (P.O. Box 1217, Greewich, CT, 06836, U.S.A. tel: 203 869 9861). The algometer was supplied by Activator Methods Inc.

The algometer uses kg/cm^2 to show pressure threshold (pain tolerance) over each active trigger point. This method has been proven reliable by Fischer (1987) who stated that changes in patient's pressure threshold, under standard clinical conditions, could be regarded as reliable data. The more active the trigger point, the more sensitive the reading. Therefore with increased pressure threshold, an improvement in the level of pain intensity over the trigger point is demonstrated.

Steps of algometer reading:

- The dial was set to 0 (zero).
- The 1cm rubber disc was placed over the active myofascial trigger point.
- The patient was told to express the point at which pain is perceived.
- Pressure was applied and then increased at a rate of 1kg/second as recommended by Fischer (1987).
- Pressure was no longer applied once the patient expressed the point at which pain was perceived.
- The reading of kg/cm^2 was recorded.

The cervical range of motion instrument (CROM) used was the Performance Attained Associates Model.

Steps of CROM reading:

- The patient was seated in a chair.
- The plastic frame was placed on the nose- bridge and ears and was secured by Velcro.
- The 3 orthogonally arranged dials were checked to ensure that they were set to 0 (zero).
- Flexion, extension and lateral flexion was assessed by gravity-dependant goniometers, while rotation was assessed with a compass goniometer in conjunction with a magnetic yolk.
- Flexion was measured by asking the patient to place their chin to their chest.
- Extension was measured by asking the patient to put their head as far back as possible.
- Lateral flexion was measured by asking the patient to put their ear to their shoulder.
- Rotation was measured by asking the patient to look over their shoulder.

3.7 INTERVENTION

Group A received static stretching as their treatment protocol and Group B received PNF (CRAC) stretching. The patients were not required to perform any stretching at home - all stretching was performed by the researcher during the treatments.

Static stretching of the muscle containing the active trigger point was performed by slowly elongating the muscle to the point of tolerance (comfortable stretch, just short of pain) and this muscle stretch was held for a period of 30 seconds (Bandy and Irion 1994). Stretching positions used were those described by Travell and Simons (1983:183-425). (Appendix I)

The PNF technique used was the contract-relax-antagonist-contract technique (CRAC). This type of stretching is performed by placing the involved muscle on a stretch. The patient then contracts

the muscle against the researcher's resistance until fatigue. This period is held for 8 seconds. The patient then relaxes the muscle briefly. The antagonist contracts to increase the stretch position and the researcher statically stretches the muscle further. Once again, the researcher holds this stretch and the patient repeats the contraction phase. This cycle is repeated three times. Stretching positions used were those described by Nook (1997). (Appendix J)

3.8 STATISTICAL PROCEDURES

The sample size was limited to 30 patients with 15 patients in each group. As the sample size was small, non-parametric tests were used to do the analysis.

3.8.1 Wilcoxin Signed Rank Test

The Wilcoxon Signed Rank test shows any statistically significant changes within group 1 and group 2 between treatments 1 and 5, 1 and follow-up and 5 and follow-up.

T X 1	Vs T X 5	Shows changes over the treatment period.
T X 1	Vs FU	Shows changes over the period between initial treatment and the one month follow up.
T X 5	Vs FU	Shows changes between the last treatment and the one month follow up. This relates to the possibility of relative longevity of the treatment.

Hypothesis Testing and the Decision Rule:

H^{o} : There is no significant difference

H^{1} : There was a significant difference

H^{o} (null hypothesis) stated that there was no significant difference between treatment 1 and 5, 1 and follow-up and 5 and follow-up.

H^{1} stated that there would be a significant difference between the treatment intervals stated above.

$\alpha = 0.05$ = level of significance

For a two-tailed test:

Reject H^{o} if $P \leq \alpha / 2 = 0.025$

Accept H^{o} if $P > \alpha / 2 = 0.025$

P was the observed significance level.

3.8.2 Mann Whitney Unpaired Tests

This test is used to make comparisons between 2 experimental groups which were treated as being independent of one another. The purpose was to determine whether or not there was a significant difference between the 2 groups at $\alpha / 2 = 0.025$ level of significance with respect to goniometer readings, the numerical pain rating scale 101, the Short Form McGill Pain Questionnaire, the CMCC neck disability index and the algometer readings.

Hypothesis testing and decision rule:

The null hypothesis (H^o) stated that there was no significant difference between the 2 groups with respect to variable interest. The alternative hypothesis (H^1) stated that there was a significant difference between the two groups.

H^o: $\mu 1 = \mu 2$.

H^1: $\mu 1$ and $\mu 2$ were significantly different from each other.

$\alpha = 0.05$ = level of significance.

For a two-tailed test:

Reject H^o if $P \leq \alpha / 2 = 0.025$

Accept H^o if $P > \alpha / 2 = 0.025$

Note P was the observed significance level.

3.8.3 Summary Statistics

The summary statistics include the mean, standard deviation and standard error to support the results from the Wilcoxon signed rank test and the Mann Whitney U test. Power analysis was performed to determine the likelihood of a Type II error occurring (accepting a false null hypothesis).

If the two statistical tests calculated a significant difference between the two groups, the mean was used to identify the superior group. The reliability of the mean was then measured using the standard deviation which measures the spread of data around the mean. The larger the value, the

larger the spread of values and hence the less reliable the data. The standard error was used to measure the reliability of the mean used in the statistical tests.

As the Mann Whitney U test and the Wilcoxon Signed Rank test used the median within the calculations, the mean was used to compliment the results, increasing the reliability of the statistical analysis.

3.8.4 Diagrammatic Representation of Data

Bar charts and tables will be constructed to represent the major findings of the study, giving summary to results obtained from the Mann Whitney U test and Wilcoxon Signed Rank test. Bar charts will be made using the Microsoft Excel 97 SR - 1 software package and the tables will be constructed using Microsoft Word 97 SR - 1 software package. The demographic data used from the patients' files will be displayed using pie charts and tables produced in Microsoft Excel.

CHAPTER FOUR

Results

CHAPTER FOUR

4.0 THE RESULTS

4.1 INTRODUCTION

This chapter covers the results obtained from the statistical analysis of the data collected from the following measurement criteria:

Objective Measurements:

- Algometer readings
- Goniometer readings

Subjective Measurements:

- Short form McGill Pain Questionnaire
- Numerical Pain Rating Scale –101
- CMCC Neck Disability Index

KEY FOR ABBREVIATIONS

S.D: Standard deviation

S.E: Standard error

S: Significant

N.S: Non-significant

4.2 NON-PARAMETRIC PAIRED HYPOHESIS TESTS (WILCOXIN SIGNED RANK TEST)

4.2.1 Subjective Data

TABLE 4.1 Statistical results of the subjective findings comparing consultation 1 and 5 in Group A

Group A – Static Stretching

	Consultation 1					Consultation 5			
	MEAN	MEDIAN	S.D.	S.E.	P-VALUE	MEAN	MEDIAN	S.D.	S.E.
CMCC	21.18	24.46	13.09	3.38	**0.001** *s*	17.36	14	15.27	3.94
McGILL	22.11	26.09	13.56	3.5	**0.001** *s*	11.83	8.46	10.28	2.65
NPRS 101	47.86	49.66	14.32	3.69	**0.016** *s*	32.7	35	17.27	4.45

POWER		
	CMCC	0.2514
	McGILL	0.8792
	NPRS 101	0.8069

The null hypothesis is rejected when comparing the results of the first and fifth consultations in Group A, as there was a statistically significant difference for all three questionnaires. This indicates that there was a subjective improvement as a result of the static stretching.

The power value for the CMCC test is significantly lower than the other two tests, indicating that there is an increased likelihood of a Type II error occurring with this test.

TABLE 4.2 Statistical results of the subjective findings comparing consultation 5 and the follow-up consultation (F) in Group A

Group A – Static Stretching

	Consultation 5					Consultation F			
	MEAN	MEDIAN	S.D.	S.E.	P-VALUE	MEAN	MEDIAN	S.D.	S.E.
CMCC	17.36	14	15.27	3.944	0.077 *ns*	13.23	12	12.74	3.29
McGILL	11.83	8.46	10.28	2.65	0.751 *ns*	11.17	8.37	11.52	2.97
NPRS 101	32.7	35	17.27	4.45	0.113 *ns*	25.16	25	17.73	4.5

POWER		
	CMCC	0.1063
	McGILL	0.0526
	NPRS 101	0.1975

The null hypothesis is accepted as there was no statistically significant difference between the fifth and final consultation in Group A. This indicates that there was no significant improvement during the follow-up period. Power analysis revealed that all three figures are low, indicating that there is an increased likelihood of a Type II error.

TABLE 4.3 Statistical results of the subjective findings comparing consultation 1 and the follow-up consultation (F) in Group A

Group A – Static Stretching

	Consultation 1					Consultation F			
	MEAN	MEDIAN	S.D.	S.E.	P-VALUE	MEAN	MEDIAN	S.D.	S.E.
CMCC	24.46	22	13.09	3.38	**0.009** *s*	13.23	12	12.74	3.29
McGILL	26.09	22.11	13.56	3.50	**0.009** *s*	11.17	8.37	11.52	2.97
NPRS 101	49.66	45	14.32	3.69	**0.016** *s*	25.16	25	17.73	4.58

POWER		
	CMCC	0.629
	McGILL	0.8792
	NPRS 101	0.9782

The null hypothesis is rejected for Group A as there was a statistically significant difference in the data from the three questionnaires from the first and follow-up consultations. This indicates that there was a subjective improvement as a result of the static stretching.

The power values for the McGill and NPRS-101 questionnaires, are significantly higher than of the CMCC questionnaire. This indicates that there is little likelihood of a Type II error occurring in these two questionnaires.

TABLE 4.4 Statistical results of the subjective findings comparing consultation 1 and consultation 5 in Group B

Group B – CRAC

	Consultation 1					Consultation 5			
	MEAN	MEDIAN	S.D.	S.E.	P-VALUE	MEAN	MEDIAN	S.D.	S.E.
CMCC	19.6	20	9.65	2.49	**0.001 *s***	5.9	4	7.58	1.95
McGILL	20.85	17.49	11.54	2.98	**0.009 *s***	8.08	7.56	6.92	1.78
NPRS 101	45	45	10.39	2.68	**0.009 *s***	24.83	25	20.45	5.28

POWER		
	CMCC	0.9845
	McGILL	0.9422
	NPRS 101	0.9071

The null hypothesis is rejected for all three questionnaires when comparing the results of the first and fifth consultations in Group A as there was a statistically significant difference between them. This indicates that there was subjective improvement from this form of treatment between the first and fifth consultation.

The power values for all three questionnaires are high indicating that there is little likelihood of a Type II error.

TABLE 4.5 Statistical results of the subjective findings comparing consultation 5 and the follow-up consultation (F) in Group B

Group B - CRAC

	Consultation 5					Consultation F			
	MEAN	MEDIAN	S.D.	S.E.	P-VALUE	MEAN	MEDIAN	S.D.	S.E.
CMCC	5.9	4	7.58	1.95	0.22 *ns*	6	0.5	9.39	2.42
McGILL	8.08	7.56	6.92	1.78	1 *ns*	12.31	9	20.83	5.38
NPRS 101	24.83	25	20.45	5.28	0.38 *ns*	22.53	25	17.78	4.59

POWER		
	CMCC	0.0501
	McGILL	0.1064
	NPRS 101	0.0605

The null hypothesis is accepted for the comparison of the fifth and follow-up consultations in Group B as there was no statistically significant difference. This indicates that there was no significant improvement in the subjective measurements during the one month follow-up period.

The power value for the McGill questionairre was high indicating that there is little likelihood of a Type II error. The power value for the CMCC and NPRS 101 questionnaires was low, indicating and increased likelihood of a Type II error.

TABLE 4.6 Statistical results of the subjective findings comparing consultation 1 and the follow-up consultation (F) in Group B

Group B - CRAC

	Consultation 1					Consultation F			
	MEAN	MEDIAN	S.D.	S.E.	P-VALUE	MEAN	MEDIAN	S.D.	S.E.
CMCC	19.6	20	9.65	2.49	**0.001** ***s***	5.9	0.5	9.39	2.42
McGILL	20.85	17.49	11.54	2.98	0.03 ***ns***	8.08	9	20.83	5.38
NPRS 101	45	45	10.39	2.68	**0.001** ***s***	24.83	25	17.78	4.59

POWER		
	CMCC	0.9633
	McGILL	0.2581
	NPRS 101	0.9814

The null hypothesis is rejected for the CMCC and NPRS 101 questionnaires for Group B as there was a statistically significant difference between the results of consultation one and the follow-up consultation. This indicates that there was subjective improvement between consultation one and the follow-up consultations for Group B. The null hypothesis is accepted for the McGill pain questionnaire as there was no statistically significant improvement.

The power values for the CMCC and NPRS-101 questionnaires are high, which indicates that there is little likelihood of a Type II error. The power values for the McGill questionnaire was low indicating an increased likelihood of a Type II error.

4.2.2.Objective Data

TABLE 4.7 Statistical results of the objective findings comparing consultation 1 and 5 in Group A

Group A – Static Stretching

	Consultation 1					Consultation 5			
GONIOMETER	MEAN	MEDIAN	S.D.	S.E.	P-VALUE	MEAN	MEDIAN	S.D.	S.E.
FLEXION	56	55	15.72	4.05	**0.007** ***s***	62.66	65	13.47	3.48
EXTENSION	48.66	50	18.17	4.69	**0.013** ***s***	55	50	18.51	4.78
(L) LAT FL	42	50	13.60	3.51	0.288 ***ns***	44	45	10.38	2.68
(R) LAT FL	34.3	35	11.31	2.92	0.22 ***ns***	39.6	40	13.68	3.53
(L) ROT	58.3	60	19.24	4.96	**0.02** ***s***	66	70	15.49	4
(R) ROT	55.66	60	20.25	5.22	**0.013** ***s***	63.3	70	18.77	4.84
ALGOMETER	2.28	2.3	0.45	0.11	**0.001** ***s***	3.19	3.2	0.62	0.16

POWER	
FLEX	0.2161
EXT	0.1426
(L) LAT	0.0701
(R) LAT	0.1934
(L) ROT	0.2038
(R) ROT	0.1715
ALGOM	0.9918

The null hypothesis is rejected for all objective measurements except left and right lateral flexion, when comparing the results of the first and fifth consultation of Group A, as there was a statistically significant difference between the results. This indicates that there was an objective improvement in Algometer and Goniometer measurements except for left and right lateral flexion.

The power of the goniometer readings is low, suggesting an increased likelihood of a Type II error occurring. The power value for the algometer readings is high, suggesting that there is little likelihood of a Type II error.

TABLE 4.8 Statistical results of the objective findings comparing consultation 5 and the follow-up consultation (F) in Group A.

Group A – Static Stretching

	Consultation 5					Consultation F			
GONIOMETER	MEAN	MEDIAN	S.D.	S.E.	P-VALUE	MEAN	MEDIAN	S.D.	S.E.
FLEXION	62.66	65	13.47	3.48	0.37 *ns*	64	65	16.05	4.14
EXTENSION	55	50	18.51	4.78	0.75 *ns*	57	60	18.1	4.67
(L) LAT FL	44	45	10.38	2.68	**0.02** *s*	49	50	10.55	2.72
(R) LAT FL	39.66	40	13.68	3.53	**0.013** *s*	47.66	50	11.78	3.04
(L) ROT	66	70	15.49	4	0.37 *ns*	68.33	70	13.31	3.43
(R) ROT	63.33	70	18.77	4.84	0.22 *ns*	66	70	16.71	4.31
ALGOMETER	3.19	3.2	0.62	0.16	**0.016** *s*	3.67	3.55	0.70	0.18

POWER		
	FLEX	0.0559
	EXT	0.0587
	(L) LAT	0.2337
	(R) LAT	0.3713
	(L) ROT	0.0692
	(R) ROT	0.0665
	ALGOM	0.4719

The null hypothesis is accepted for forward flexion, extension, left rotation and right rotation for the comparison of the fifth and follow-up consultation in Group A as there was no statistically significant difference. This indicates that there was no significant objective improvement during the follow-up period. The statistically significant difference recorded for the measurements of left lateral flexion, right lateral flexion and Algometer readings for the fifth and follow-up consultations

for Group A, rejects the null hypothesis and indicates that there was an objective improvement during this period for these ranges of motion.

TABLE 4.9 Statistical results of the objective findings comparing consultation 1 and the follow-up consultation (F) in Group A.

Group A – Static Stretching

	Consultation 1					Consultation F			
GONIOMETER	MEAN	MEDIAN	S.D.	S.E.	P-VALUE	MEAN	MEDIAN	S.D.	S.E.
FLEXION	56	55	15.72	4.05	**0.007** ***s***	64	65	16.05	4.14
EXTENSION	48.66	50	10.17	4.69	**0.002** ***s***	57	60	18.1	4.67
(L) LAT FL	42	40	13.6	3.51	0.07 ***ns***	49	50	10.55	2.72
(R) LAT FL	44.33	35	11.31	2.92	**0.0008** ***s***	47.66	50	11.78	3.04
(L) ROT	58.33	60	19.24	4.96	**0.013** ***s***	68.33	70	13.31	3.43
(R) ROT	55.66	60	20.25	5.22	**0.007** ***s***	66	70	16.71	4.31
ALGOMETER	2.28	2.3	0.45	0.11	**0.003** ***s***	3.67	3.55	0.70	0.18

POWER	
FLEX	0.2553
EXT	0.2193
(L) LAT	0.3203
(R) LAT	0.8624
(L) ROT	0.3311
(R) ROT	0.3028
ALGOM	0.999

The null hypothesis is accepted for left lateral flexion when comparing the first and follow-up consultations in Group A, as there was no statistically significant difference. This indicates that there was no objective improvement as a result of this form of treatment. The null hypothesis is rejected for all the other objective measurements when comparing the first and follow-up

consultations in Group A, as there was a statistically significant difference. This indicates that there was an objective improvement in Group A during this treatment period.

Again, the power value of the algometer reading is high, suggesting that there is little likelihood of a Type II error.

TABLE 4.10 Statistical results of the objective findings comparing consultation 1 and 5 in Group B.

Group B - CRAC

	Consultation 1					Consultation 5			
GONIOMETER	**MEAN**	**MEDIAN**	**S.D.**	**S.E.**	**P-VALUE**	**MEAN**	**MEDIAN**	**S.D.**	**S.E.**
FLEXION	56.66	60	14.35	3.7	0.18 ***ns***	64.66	70	11.87	3.06
EXTENSION	61	60	13.38	3.45	0.28 ***ns***	63.33	60	16.86	4.35
(L) LAT FL	44	40	13.12	3.38	**0.015** ***s***	51	50	14.78	3.81
(R) LAT FL	35.66	35	12.79	3.3	**0.0008** ***s***	48	50	13.98	3.61
(L) ROT	65	60	22.11	5.71	0.18 ***ns***	72.33	75	17.40	4.49
(R) ROT	61.33	70	18.46	4.76	**0.007** ***s***	71.66	75	16.86	4.35
ALGOMETER	2.14	2	0.6	0.15	**0.001** ***s***	3.35	3	1.51	0.39

POWER		
	FLEX	0.3521
	EXT	0.0726
	(L) LAT	0.2530
	(R) LAT	0.6794
	(L) ROT	0.1557
	(R) ROT	0.3293
	ALGOM	0.7878

The null hypothesis is accepted for flexion, extension and left rotation when comparing the first and fifth consultation in Group B, as there was no statistically significant difference. This indicates that there was no objective improvement as a result of this form of treatment. The null hypothesis is rejected for the left lateral flexion, right lateral flexion, right rotation and Algometer measurements when comparing the first and the fifth consultation in Group B, as there was a statistically significant difference. This indicates an objective improvement.

The power readings of the algometer are again significantly higher, indicating that there is little likelihood of a Type II error.

TABLE 4.11 Statistical results of the objective findings comparing consultation 5 and follow-up consultation (F) in Group B.

Group B - CRAC

	Consultation 5					Consultation F			
GONIOMETER	MEAN	MEDIAN	S.D.	S.E.	P-VALUE	MEAN	MEDIAN	S.D.	S.E.
FLEXION	64.66	70	11.87	3.06	0.04 *ns*	68.66	70	11.41	2.94
EXTENSION	63.33	60	16.86	4.35	0.07 *ns*	68.33	70	15.31	3.95
(L) LAT FL	51	50	14.78	3.81	0.22 *ns*	53.33	50	14.47	3.73
(R) LAT FL	48	50	13.98	3.61	0.13 *ns*	51.66	50	13.97	3.60
(L) ROT	72.33	75	17.40	4.49	0.13 *ns*	76.33	80	14.93	3.85
(R) ROT	71.66	75	16.86	4.35	0.37 *ns*	76	80	12.98	3.35
ALGOMETER	3.35	3	1.51	0.39	**0.016** *s*	3.78	3.65	1.32	0.34

POWER	
FLEX	0.1416
EXT	0.124
(L) LAT	0.0687
(R) LAT	0.1020
(L) ROT	0.0958
(R) ROT	0.1133
ALGOM	0.1221

The null hypothesis is rejected for the Algometer measurements as there was a statistically significant difference. This indicates an objective improvement in these measurements between the fifth and one month follow-up consultations. The null hypothesis is accepted for all the other ranges of motions' measurements as there was no statistically significant difference, indicating no objective improvement between the fifth and follow-up consultation.

TABLE 4.12 Statistical results of the objective findings comparing consultation 1 and follow-up consultation (F) in Group B.

Group B - CRAC

	Consultation 1					Consultation F			
GONIOMETER	MEAN	MEDIAN	S.D.	S.E.	P-VALUE	MEAN	MEDIAN	S.D.	S.E.
FLEXION	56.66	60	14.35	3.70	**0.02** ***s***	68.66	70	11.41	2.94
EXTENSION	61	60	13.38	3.45	**0.015** ***s***	68.33	70	15.31	3.95
(L) LAT FL	44	40	13.12	3.38	**0.02** ***s***	53.33	50	14.47	3.73
(R) LAT FL	35.66	35	12.79	3.30	**0.003** ***s***	51.66	50	13.97	3.60
(L) ROT	65	60	22.11	5.71	0.04 ***ns***	76.33	80	14.93	3.85
(R) ROT	61.33	70	18.46	4.76	**0.004** ***s***	76	80	12.98	3.35
ALGOMETER	2.14	2	0.6	0.15	**0.001** ***s***	3.78	3.65	1.32	0.34

POWER	
FLEX	0.6848
EXT	0.2607
(L) LAT	1
(R) LAT	0.9259
(L) ROT	0.3452
(R) ROT	0.6784
ALGOM	0.9853

The null hypothesis is rejected except for left rotation as there was a statistically significant difference for the comparison of the objective measurements of the first and follow-up consultation for Group B. This indicates an objective improvement due to the treatment administered.

The power value of the algometer is high, suggesting that this is a sensitive test and that there is little likelihood of a Type II error occurring. The power value for left and right lateral flexion is also high, but this is not consistent with measurements elsewhere.

4.3 NON-PARAMETRIC UNPAIRED HYPOHESIS TESTS (MANN-WHITNEY)

4.3.1. Subjective Data

TABLE 4.13 Statistical results comparing Group A and Group B in terms of the subjective measurements from the First Consultation.

	Group A - Static Consultation 1					Group B - CRAC Consultation 1			
	MEAN	MEDIAN	S.D.	S.E.	P-VALUE	MEAN	MEDIAN	S.D.	S.E.
CMCC	24.46	22	13.097	3.381	1 *ns*	19.6	20	9.656	2.493
McGILL	26.09	27.35	13.562	3.501	1 *ns*	20.85	17.47	11.548	2.981
NPRS 101	49.666	45	14.326	3.698	1 *ns*	45	45	10.394	2.683

POWER		
	CMCC	0.1922
	McGILL	0.1953
	NPRS 101	0.1589

There was no statistically significant difference between the subjective data of Group A and Group B at the initial consultation, leading to the acceptance of the null hypothesis and indicating that the two groups were similar in terms of disability and pain index at the beginning of the study.

TABLE 4.14 Statistical results comparing Group A and Group B in terms of the subjective measurements from the Fifth Consultation.

	Group A - Static Consultation 5					Group B - CRAC Consultation 5			
	MEAN	MEDIAN	S.D.	S.E.	P-VALUE	MEAN	MEDIAN	S.D.	S.E.
CMCC	17.36	14	15.278	3.944	1 *ns*	5.9	4	7.588	1.952
McGILL	11.834	8.46	10.280	2.654	1 *ns*	8.088	7.56	6.923	1.787
NPRS 101	32.7	35	17.27	4.459	1 *ns*	24.833	25	20.451	52.80

POWER	
CMCC	0.7083
McGILL	0.1953
NPRS 101	0.18707

The null hypothesis is accepted for the subjective measurements taken at the fifth consultation in both groups, as no statistically significant difference was evident between the groups. This indicates that both forms of treatment were equally effective.

The power CMCC value is significantly higher than the other two figures, indicating that there is little chance of a Type II error occurring with this test.

TABLE 4.15 Statistical results comparing Group A and Group B in terms of the subjective measurements from the Follow-up Consultation.

	Group A - Static Consultation F					Group B - CRAC Consultation F			
	MEAN	MEDIAN	S.D.	S.E.	P-VALUE	MEAN	MEDIAN	S.D.	S.E.
CMCC	13.233	12	12.743	3.29	1 *ns*	6	0.5	9.399	2.427
McGILL	11.178	8.37	11.528	2.976	1 *ns*	12.318	9	20.838	5.38
NPRS 101	25.166	25	17.739	4.58	1 *ns*	22.533	25	17.788	4.593

POWER	
CMCC	0.3914
McGILL	0.0533
NPRS 101	0.0661

The null hypothesis is accepted as there was no statistically significant difference between the follow-up consultations for the two groups. This indicates that both treatment protocol, in terms of subjective findings, had equal effect at the one month follow-up consultation.

The power value for all three questionnaires was low indicating an increased likelihood of a Type I error.

4.3.2 Objective Data

TABLE 4.16 Statistical results comparing Group A and Group B in terms of the objective measurements from the First consultation.

	Group A - Static Consultation 1					Group B - CRAC Consultation 1			
GONIOMETER	MEAN	MEDIAN	S.D.	S.E.	P-VALUE	MEAN	MEDIAN	S.D.	S.E.
FLEXION	56	55	15.720	4.059	0.642 *ns*	56.666	60	14.351	3.705
EXTENSION	48.666	50	18.172	4.692	0.029 *ns*	61	60	13.389	3.457
(L) LAT FL	42	40	13.601	3.511	1 *ns*	44	40	13.12	3.387
(R) LAT FL	34.333	35	11.317	2.922	1 *ns*	35.666	35	12.798	3.304
(L) ROT	58.33	60	19.241	4.968	1 *ns*	65	60	22.119	5.711
(R) ROT	55.666	60	20.254	5.229	0.456 *ns*	61.333	70	18.464	4.767
ALGOMETER	2.285	2.3	0.45	0.116	1 *ns*	2.147	2	0.609	0.157

POWER	
FLEX	0.0511
EXT	0.5269
(L) LAT	0.0665
(R) LAT	0.0589
(L) ROT	0.1297
(R) ROT	0.1153
ALGOM	0.1001

The null hypothesis is accepted as there was no statistically significant difference between Group A and Group B, indicating that the two groups were similar in terms of objective findings at the initial consultation.

The power values for all readings were low, indicating an increased likelihood of a Type II error.

TABLE 4.17 Statistical results comparing Group A and Group B in terms of the objective measurements from the Fifth consultation.

	Group A - Static Consultation 5					Group B - CRAC Consultation 5			
GONIOMETER	MEAN	MEDIAN	S.D.	S.E.	P-VALUE	MEAN	MEDIAN	S.D.	S.E.
FLEXION	62.666	65	13.478	3.480	0.654 *ns*	64.666	70	11.872	3.065
EXTENSION	55	50	18.516	4.780	0.159 *ns*	63.333	60	16.867	4.355
(L) LAT FL	44	45	10.385	2.681	1 *ns*	51	50	14.784	3.817
(R) LAT FL	39.666	40	13.688	3.534	1 *ns*	48	50	13.989	3.612
(L) ROT	66	70	15.491	4	1 *ns*	72.333	75	17.409	4.495
(R) ROT	63.333	70	18.771	4.846	0.097 *ns*	71.666	75	16.867	4.355
ALGOMETER	3.199	3.2	0.624	0.161	1 *ns*	3.350	3	1.1511	0.390

POWER	
FLEX	0.0681
EXT	0.2280
(L) LAT	0.248
(R) LAT	0.3468
(L) ROT	0.1661
(R) ROT	0.2252
ALGOM	0.0625

The null hypothesis is accepted for the objective findings of both groups for the fifth consultation comparison, as there was no statistically significant difference in these readings. The power values for all readings were low indicating an increased likelihood of a Type II error.

TABLE 4.18 Statistical results comparing Group A and Group B in terms of the objective measurements from the Follow-up consultation.

	Group A - Static Consultation F					Group B - CRAC Consultation F			
GONIOMETER	MEAN	MEDIAN	S.D.	S.E.	P-VALUE	MEAN	MEDIAN	S.D.	S.E.
FLEXION	64	65	16.057	4.146	0.364 *ns*	68.666	70	11.412	2.946
EXTENSION	57	60	18.106	4.675	0.159 *ns*	68.333	70	15.314	3.954
(L) LAT FL	49	50	10.555	2.725	1 *ns*	53.333	50	14.474	3.737
(R) LAT FL	47.666	50	11.781	3.042	1 *ns*	51.666	50	13.972	3.607
(L) ROT	68.333	70	13.318	3.438	1 *ns*	76.333	80	14.936	3.856
(R) ROT	66	70	16.711	4.314	0.04 *ns*	76	80	12.983	3.352
ALGOMETER	3.679	3.55	0.704	0.181	1 *ns*	3.786	3.65	1.328	0.343

POWER		
	FLEX	0.1369
	EXT	0.4227
	(L) LAT	0.1408
	(R) LAT	0.1236
	(L) ROT	0.3111
	(R) ROT	0.4147
	ALGOM	0.0574

The null hypothesis is accepted for the objective findings of both groups for the follow-up consultation comparison, as there was no statistically significant difference in these readings. This indicates that no difference in the relative effectiveness of the two treatment groups exists.

The power values for all readings were low, indicating an increased likelihood of a Type II error.

4.4 DEMOGRAPHIC DATA

TABLE 4.19 Prevalence of Age

AGE INTERVALS	GROUP A	GROUP B
15-25	1 (3.33%)	5 (16.67%)
26-35	3 (10%)	2 (6.67%)
36-45	3 (10%)	2 (6.67%)
46-55	8 (26.67%)	6 (20%)

The average age (mean) for Group A was 44. The average age (mean) for Group B was 37.

TABLE 4.20 Gender Distribution

GENDER	GROUP A	GROUP B
MALES	3	4
FEMALES	12	11

The overall male : female Ratio was 1:3.3

TABLE 4.21 Race Distribution

RACE	GROUP A	GROUP B
AFRICAN	2 (6.67%)	2 (6.67%)
INDIAN	4 (13.33%)	1 (3.33%)
COLOURED	2 (6.67%)	0 (0%)
WHITE	6 (20%)	12 (40%)

4.5 DATA MEDIAN SCORES

See Chapter 5 for comments on Graphical comparisons

FIGURE 4.1 Graphical comparison of CMCC median scores for Groups A and B

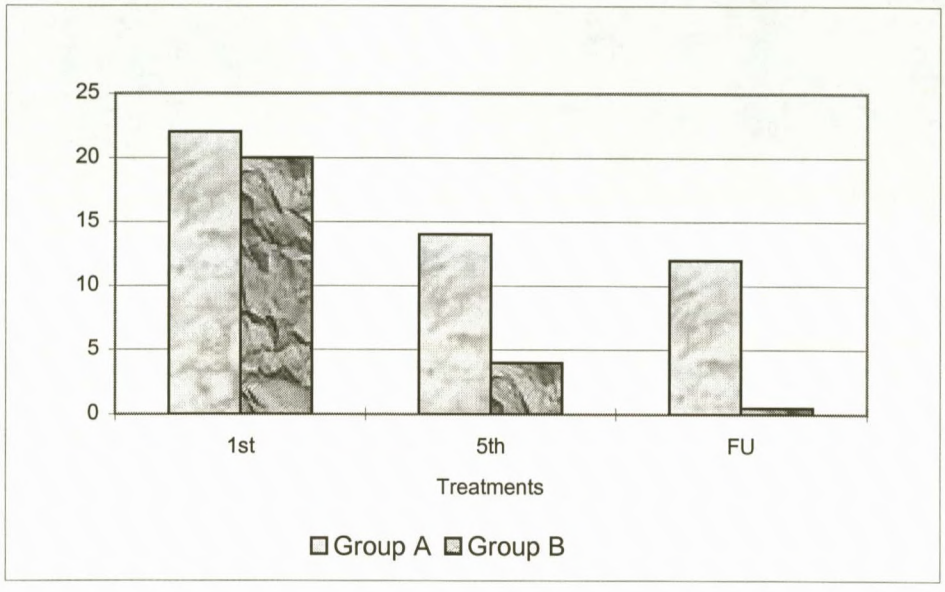


FIGURE 4.2 Graphical comparison of McGill median scores for Groups A and B

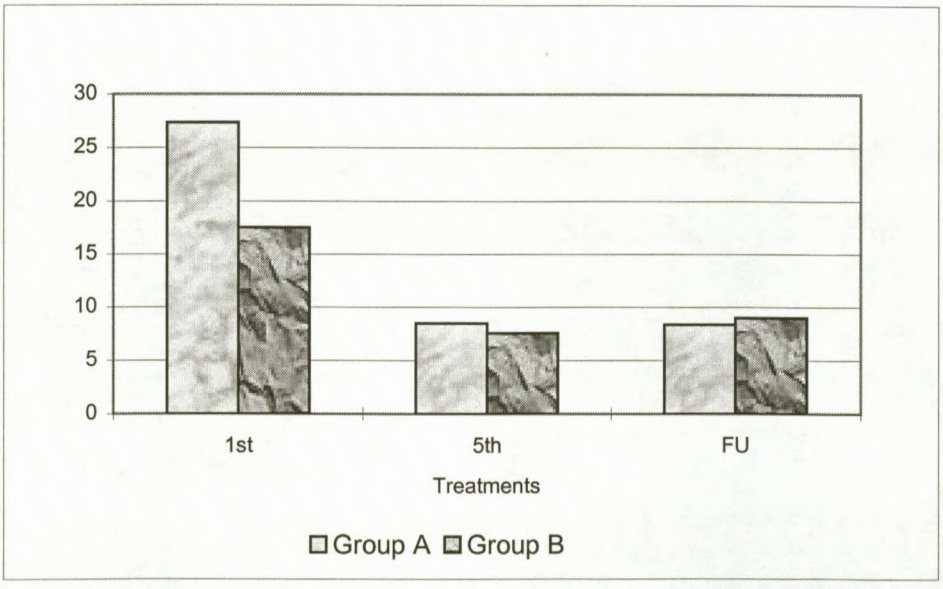


FIGURE 4.3 Graphical comparison of NRPS-101 median scores for Groups A and B

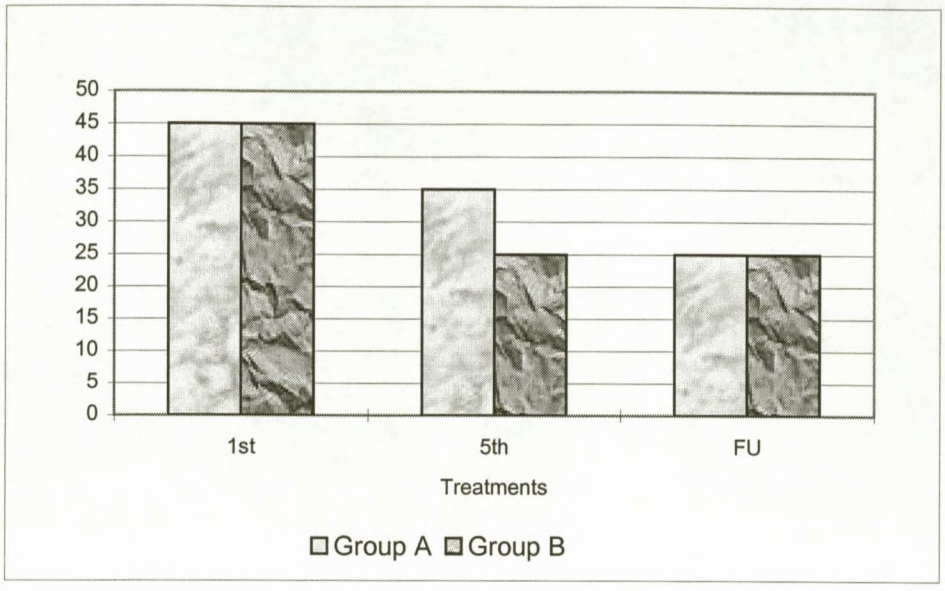


FIGURE 4.4 Graphical comparison of Flexion median scores for Groups A and B

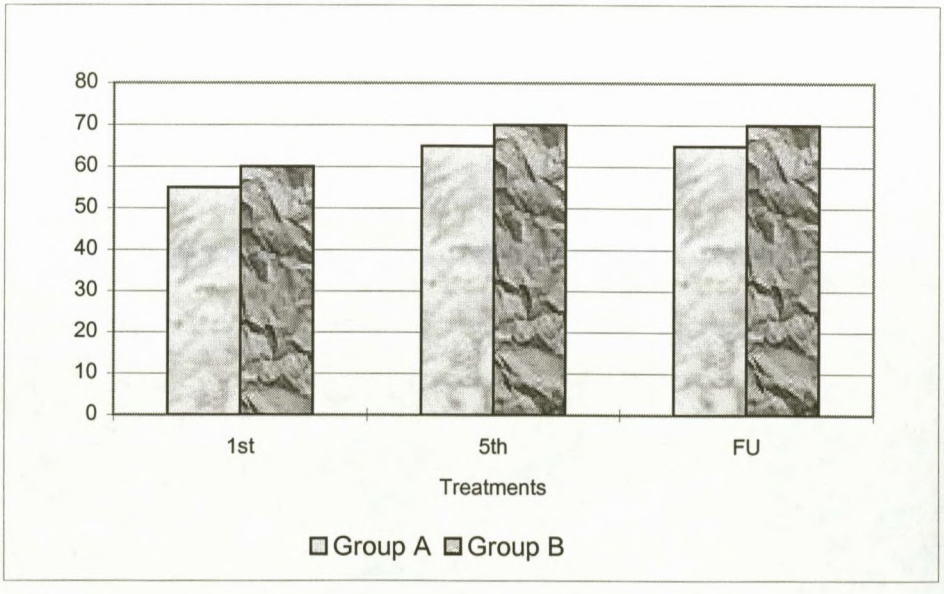


FIGURE 4.5 Graphical comparison of Extension median scores for Groups A and B

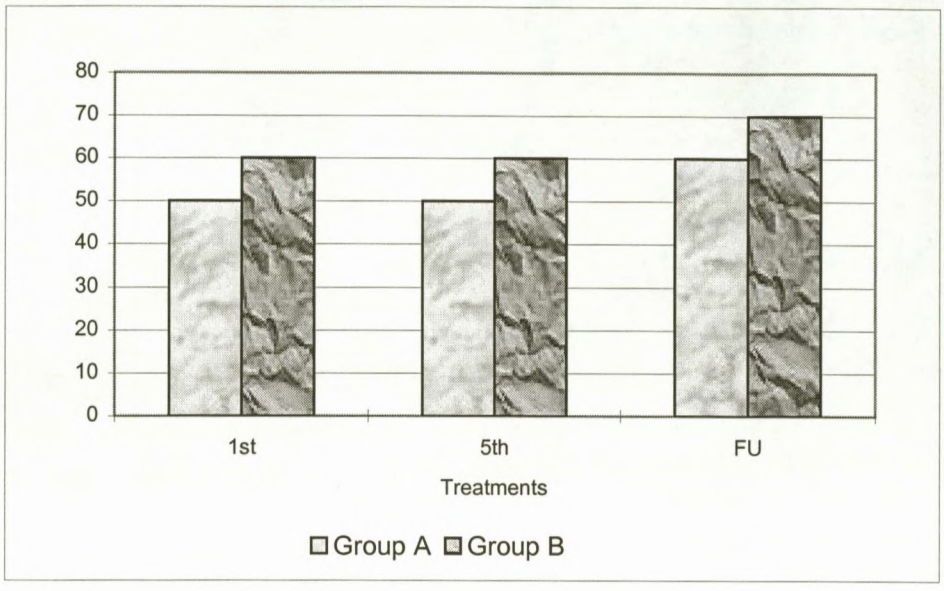


FIGURE 4.6 Graphical comparison of Right Rotation median scores for Groups A and B

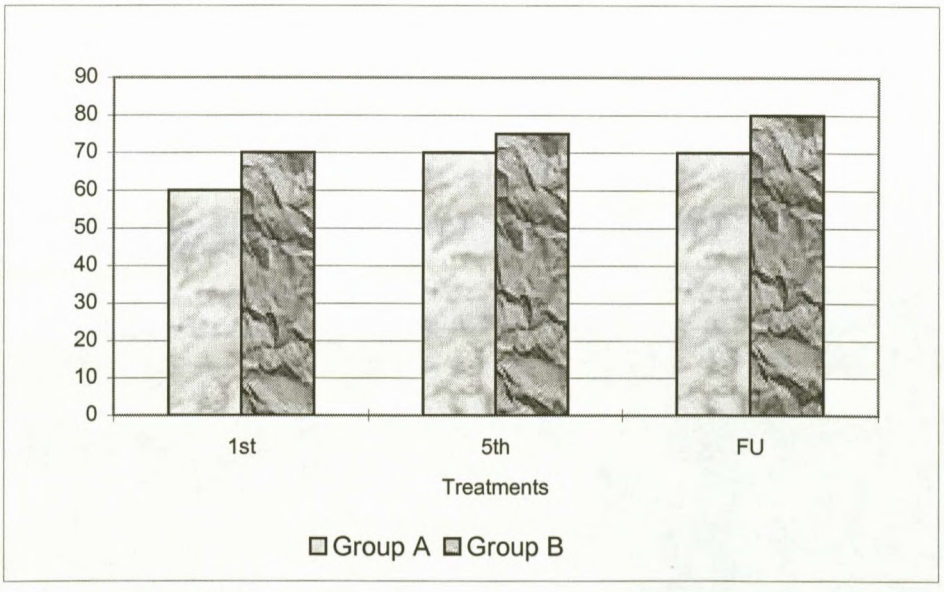


FIGURE 4.7 Graphical comparison of Left Rotation median scores for Groups A and B

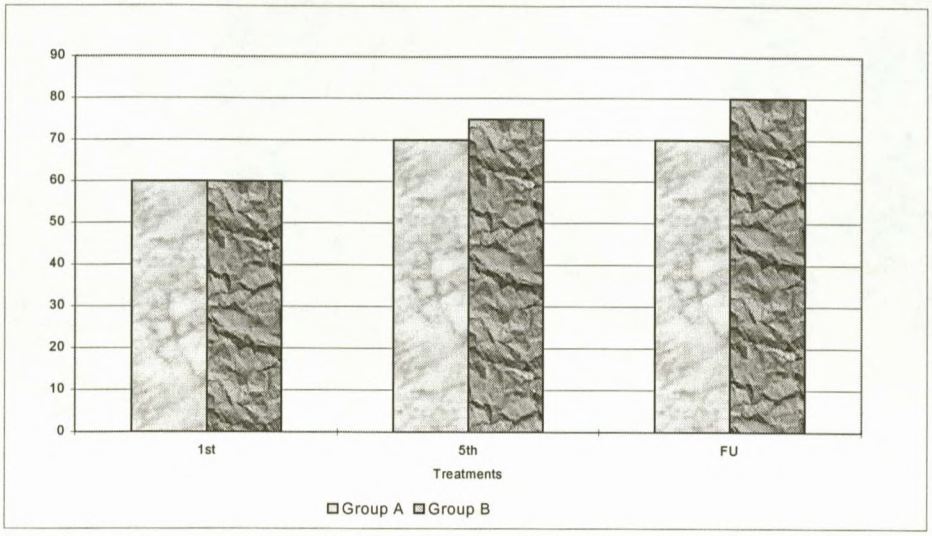


FIGURE 4.8 Graphical comparison of Right Lateral Flexion median scores for Groups A and B

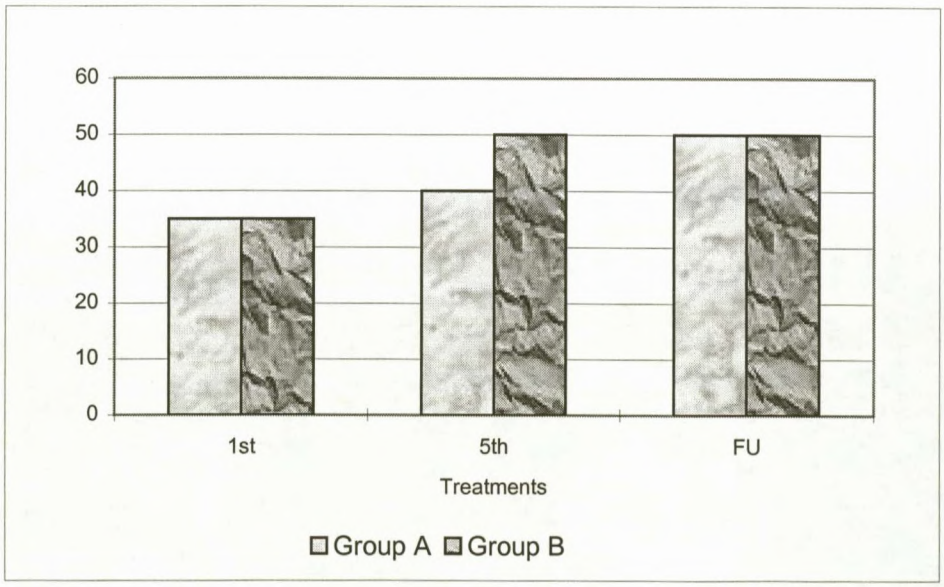


FIGURE 4.9 Graphical comparison of Left Lateral Flexion median scores for Groups A and B

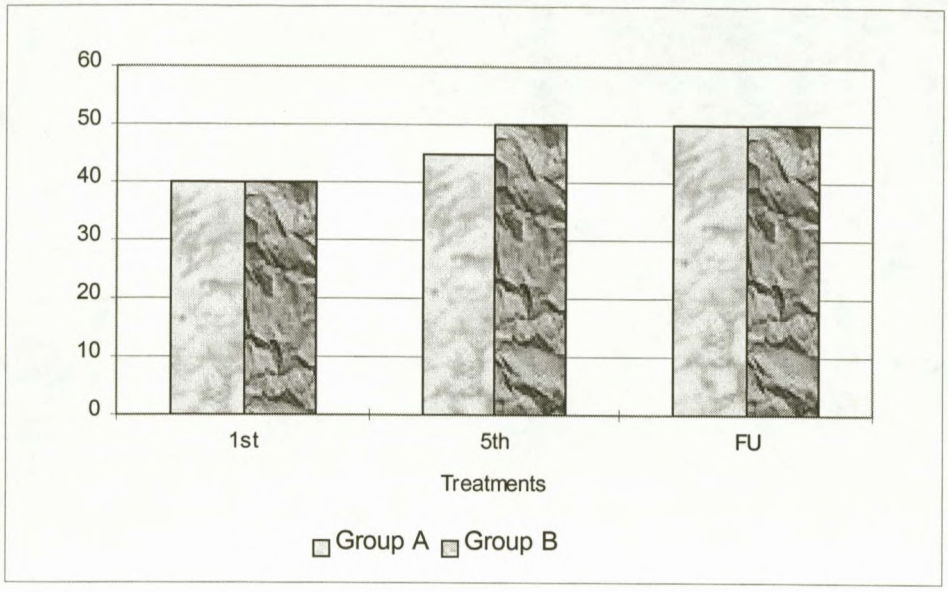
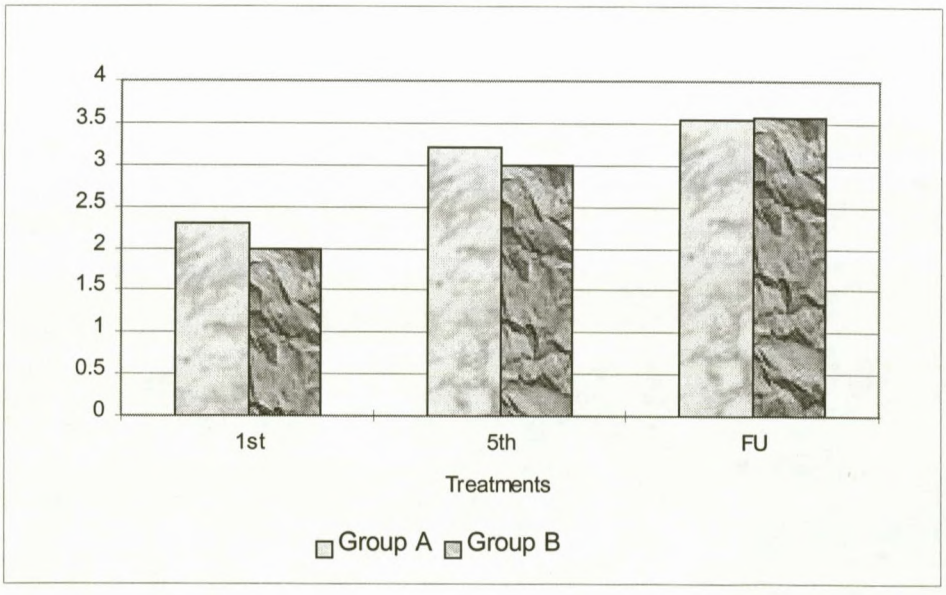


FIGURE 4.10 Graphical comparison of Pain Threshold [Algometer] Measurements for Groups A and B



CHAPTER FIVE

Discussion of Results

CHAPTER FIVE

5.0 DISCUSSION OF RESULTS

5.1 INTRODUCTION

This chapter involves the discussion of the results obtained from the subjective and objective data.

Intra- treatment comparison: The assessment of the subjective and objective intra-treatment of the first to fifth consultations represents the relative effectiveness of the treatment protocol. The comparison of the fifth to follow-up consultation whether the treatment relative effectiveness was maintained. The first to follow-up treatment period represents the long-term relative effectiveness of the treatment protocol and evaluates whether or not the condition has returned. This process was done with the data of both treatment groups.

Inter-treatment comparison: The comparison of the subjective and objective data of both groups from the first consultation exhibits any differences between the two groups in terms of their original signs and symptoms. The comparison of the results of the fifth consultation confirms which treatment protocol has been relatively more effective. The comparison of the follow-up

consultation results indicates which treatment protocol has been more relatively effective in maintaining a lasting result.

5.2 INTRA-GROUP COMPARISON

5.2.1 Subjective Data

5.2.1.1 The CMCC Neck Disability Index

Statistical analysis of the median values of the CMCC Neck Disability Index for the first to fifth consultation period depicted a significant improvement in Group A ($p = 0.001$) and Group B ($p = 0.001$) (Table 4.1 and 4.4, Figure 4.1). Power analysis (0.9845) of the CMCC test showed a little likelihood of a Type II error occurring in Group B for the first to the fifth consultation comparison (Table 4.4), whereas for Group A the power was 0.2514 indicating the likelihood of a Type II error.

In the comparison of the fifth and follow-up consultation, no significant improvement was revealed in both Group A ($p = 0.077$) and in Group B ($p = 0.22$) (Table 4.2 and 4.5). This indicates that the improvement was not maintained over the one month follow-up period. Power analysis for Group A (0.1063) and Group B (0.0501) indicates that there is an increased likelihood of a Type II error in both groups.

Analysis of the first to follow-up consultations showed a significant improvement in both groups, indicating that both groups improved over the course of the study and maintained a favourable relative long term response to treatment without re-occurrence of the condition in terms of disability (Table 4.3 and 4.6, Figure 4.1). Power analysis showed that there is little likelihood of a Type II error occurring in Group B (0.9633) as compared to Group A (0.629) in the first to follow-up consultation comparison (Table 4.6).

SUMMARY

The CMCC neck Disability Index is used to show subjective information regarding the extent to which the patient's lifestyle is affected by the pain experience. It is therefore evident that the pain experienced and it's effect on the patients daily activities was reduced in both groups between consultation 1 and 5 and consultation 1 and follow-up. This implies that both treatments were effective in reducing disability in daily life.

Power analysis of the first to fifth and the first to follow-up consultations showed that in Group B there was little chance of a Type II error.

5.2.1.2 The Short Form McGill Questionnaire

Statistical comparison of the first and fifth consultation for both groups shows a statistically significant improvement in both Group A ($p = 0.001$) and Group

B (p = 0.009) (Table 4.1 and 4.4, Figure 4.2). Power analysis of the first to fifth treatment comparison showed that there was little likelihood of a Type II error in Group A (0.8792) and group B (0.9422) (Table 4.1 and 4.4).

Comparison of the fifth and follow-up consultation, however, did not reveal a statistically significant difference in Group A (p = 0.751) and Group B (p = 1) (Table 4.2 and 4.5, Figure 4.2). This indicates that the improvement was not maintained over the one month period and / or, no additional improvement occurred.

Assessment of the median of Group A for the period between the first and follow-up consultations revealed a statistically significant difference. This indicates a decrease of pain perception in both Group A (p = 0.009). Group B (p = 0.03), however, did not show a statistically significant improvement. (Table 4.3 and 4.6, Figure 4.2). Power analysis showed that there is little likelihood of a Type II error occurring for Group A (0.8792) for the first to follow-up consultation comparison (Table 4.3) as compared to Group B (0.2581).

SUMMARY

The Short Form McGill Pain Questionnaire provides information regarding the sensory, affective and evaluative dimensions of pain experienced. In both groups, there was significant statistical improvement during consultation 1 to

5. No statistically significant improvement was observed over the consultation 5 to follow up period. There was a statistically significant improvement in Group A during consultation 1 to follow-up. This indicates that both groups experienced diminished pain perception during the treatment period, but, only Group A showed diminished pain perception throughout the course of the study.

Power Analysis reveals that there is little chance of a Type II error for both groups during the first to fifth consultation period but, only for Group A during the first to follow-up consultation.

5.2.1.3 The Numerical Pain Rating Scale -101

Comparison of the first and fifth consultations revealed a statistically significant difference in Group A ($p = 0.016$) and Group B ($p = 0.009$) indicating a decrease in the amount of pain experienced by the patients (Table 4.1 and 4.4, Figure 4.3). Power analysis showed that there is little likelihood of a Type II error occurring for both Group A (0.8069) and Group B (0.9071) in the first to fifth consultation comparison (Table 4.1 and 4.4).

Comparison of the fifth and follow-up consultations, however, did not reveal a statistically significant difference in Group A ($p = 0.113$) or Group B ($p = 0.38$). This indicates in both groups, the improvement was not maintained and / or no additional improvement occurred over the one month period (Table 4.2

and 4.5, Figure 4.3). Power analysis revealed that there is little likelihood of a Type II error in Group A (0.9782) and Group B (0.9814).

Analysis of the median values for the period from the first to the follow-up consultation revealed a statistically significant improvement in both Group A ($p = 0.016$) and Group B ($p = 0.001$) (Table 4.3 and 4.6, Figure 4.3). This indicates that both groups had a favourable response to their respective treatment protocol in terms of pain intensity measurement. Power analysis revealed that there is little likelihood of a Type II error occurring from the first to follow-up consultations for Group A (0.9782) and Group B (0.9814) (Table 4.3 and 4.6).

SUMMARY

The NPRS-101 is a questionnaire to monitor levels of pain perception experienced by patients. Both groups in the first to fifth consultation period showed significant statistical differences, indicating decreased pain perception. This is also evident in the first to follow up consultation period. Pain levels, therefore, were reduced as a result of both treatment protocols.

5.2.2 Objective Data

5.2.2.1 Cervical Range Of Motion

Comparison of the first to fifth consultation (Table 4.8) reveals a statistically significant improvement in Group A as follows:

flexion ($p = 0.007$)

extension ($p = 0.013$)

left rotation ($p = 0.02$)

right rotation ($p = 0.013$)

No statistically significant improvement occurred in Group A, as follows:

Left lateral flexion ($p = 0.288$)

Right lateral flexion ($p = 0.22$).

In Group B, a statistically significant difference was revealed as follows (Table 4.10):

left lateral flexion ($p = 0.015$)

right lateral flexion ($p = 0.0008$)

right rotation ($p = 0.007$)

No statistically significant difference was revealed as follows:

Flexion ($p = 0.18$)

extension ($p = 0.28$)

left rotation ($p = 0.18$)

Power analysis of all ranges of motion in both groups were low indicating an increased likelihood of a Type II error.

Analysis of the data from the fifth to the follow-up consultation (Table 4.8) reveals a statistically significant improvement in Group A as follows:

left lateral flexion ($p = 0.02$)

right lateral flexion ($p = 0.013$)

No statistically significant improvement was noted in the following:

Flexion ($p = 0.37$)

extension ($p = 0.75$)

right rotation ($p = 0.22$)

left rotation ($p = 0.37$)

All ranges of motion displayed no statistically significant improvement in Group B (Table 4.11). Power analysis for all ranges of motion on both groups was low indicating an increased likelihood of a Type II error.

Analysis of the data from the first to follow-op consultations revealed a statistically significant difference for all ranges of motion except left lateral flexion ($p = 0.07$) in Group A (Table 4.9). Comparison of the data for Group B revealed a statistically significant improvement in all ranges of motion (Table 4.12) except left rotation ($p = 0.04$). This indicates that there was improvement in ranges of motion in both groups from the initial consultation

through to the one -month follow-up consultation. Power analysis was high for right lateral flexion (0.8624) in Group A and for left lateral flexion (1) and right lateral flexion (0.9259) in Group B. There is therefore little likelihood of Type II errors in these ranges of motion.

SUMMARY

It appears that certain ranges of motion improved at various consultations. They are not, however, consistent throughout the treatment periods. In the first to follow-up consultations, range of motion appears to be improved in all but one direction in both groups. This shows that there was objective improvement over this period for both groups. Power analysis for all three treatment periods is low, indicating an increased likelihood of a Type II error.

5.2.2.2 Algometer Readings

Analysis of the algometer readings for the first and fifth consultations revealed a statistically significant difference in both Group A (p= 0.001) and Group B (p=0.016) (Table 4.7 and 4.10). Power analysis showed that there is little likelihood of a Type II error occurring when comparing the first to fifth consultations for both Group A (0.9918) and Group B (0.7878) (Table 4.7).

Analysis of the algometer readings for the fifth to follow-up period revealed a statistically significant difference for both Groups A (p = 0.016) and

B (p = 0.016) (Tables 4.8 and 4.11). This indicates that the improvement was maintained in both groups over the entire treatment period and one month follow up.

Analysis of the algometer readings for the period between the first to follow-up consultations revealed a statistically significant improvement in both Group A (p = 0.003) and Group B (p = 0.001) (Table 4.9 and 4.12). Power analysis showed that there was little likelihood of a Type II error occurring when comparing the first to follow-up consultations for both Group A (0.999) and Group B (0.9853) (Table 4.9 and 4.12).

SUMMARY

For all three treatment periods a statistically significant difference was noted for both groups. This indicates that objectively both groups improved.

5.3 INTER-GROUP COMPARISON

5.3.1 Subjective Data

5.3.1.1 The CMCC Neck Disability Index

The results of the measurements of the CMCC Neck Disability Index for the first consultation for both groups disclosed no statistically significant

difference in the degree of disability caused by the myofascial pain syndrome (Table 4.13). This implies that both treatment groups were similar in character in terms of disability. Power analysis (0.1922) showed that there was an increased likelihood of a Type II error at the first consultation.

Analysis of the data from the fifth consultation of both groups revealed no statistically significant difference ($p = 1$), indicating that both groups responded equally well to their respective treatment protocols (Table 4.14). Power analysis (0.7083) showed that there is little likelihood of a Type II error occurring for the fifth consultation for both Group A and Group B (Table 4.14).

Analysis of the follow-up consultation for both groups revealed no statistically significant difference ($p = 1$) between the groups (Table 4.15). This indicated that the long-term relative effectiveness was maintained equally well between the groups. No clinical significant difference was evident between the groups. Power analysis (0.3814) revealed that there was an increased likelihood of a Type II error occurring.

SUMMARY

As no statistically significant difference was evident between both groups at the three treatment periods, it is evident that no treatment protocol reduced pain and disability more effectively than the other protocol. Both treatments were therefore equally effective in reducing disability. Clinically, it appears

that Group A responded more effectively at the fifth and follow-up consultations, but statistically, no significant difference was evident (Figure 4.1).

5.3.1.2 The Short Form McGill Questionnaire

Comparison of the first consultation of both groups showed no statistically significant difference ($p = 1$), indicating that both groups were relatively homogenous with respect to pain perception (Table 4.13). Power analysis (0.1953) showed an increased likelihood of a Type II error.

Data analysis of the fifth consultation measurements revealed no statistically significant difference ($p = 1$) between the two groups (Table 4.14). A clinical difference was evident with Group A responding slightly better than Group B (Figure 4.2). Power analysis (0.1953) showed an increased likelihood of a Type II error.

The follow-up consultation measurement comparisons showed no significant statistical difference ($p = 1$), indicating that the relative effectiveness of the treatments were maintained in both groups (Table 4.15). Group A showed a slightly better clinical response than Group B (Figure 4.2). Power analysis (0.0533) revealed an increased likelihood of a Type II error.

SUMMARY

As no significant statistical difference is evident between the two groups at the three treatment periods, it is evident that both treatments were equally effective in reducing pain in respect to it's sensory, affective and evaluative dimensions.

5.3.1.3. The Numerical Pain Rating Scale -101

Statistical comparison of the first consultation of the two groups revealed no significant difference ($p = 1$) in the inceptive degree of pain intensity, denoting a similarity in nature in terms of pain intensity (Table 4.13).

Analysis of the NPRS-101 readings of the fifth treatment revealed no statistically significant difference ($p = 1$) between the two groups, indicating that both treatment protocols were equally effective (Table 4.14). Group B showed a slightly more clinically significant improvement when compared to Group A, depicting that maintenance of the treatments' relative effectiveness would be slightly better in Group B (Figure 4.3).

Results of data analysis of the follow-up consultation indicated similar results to those from the fifth consultation with no statistically significant difference ($p = 1$) being noted (Table 4.15). Both Group A and B had equal clinical

responses and thus the treatments' relative effectiveness was maintained well in both groups (Figure 4.3).

SUMMARY

It is evident that both treatments were equally effective in reducing the levels of pain experienced in both groups at the three treatment periods.

5.3.2 Objective Data

5.3.2.1 Cervical ROM

Comparison of the initial cervical range of motion measurements presented no statistically significant difference between the two groups, indicating that cervical range of motion of the two groups was similar at the beginning of the trial (Table 4.16). Power analysis revealed that for all ranges of motion, there is an increased likelihood of a Type II error.

Comparison of data from the fifth consultation reveals that there was no statistically significant difference between the two groups (Table 4.17). Thus it can be said that neither treatment protocol was more effective than the other in terms of range of motion. Power analysis revealed that for all ranges of motion, there is an increased likelihood of a Type II error.

Data analysis of the follow-up consultation revealed no statistically significant difference between the two groups, indicating that the treatments' relative effectiveness was maintained equally in both groups (Table 4.18). Power analysis revealed that for all ranges of motion, there is an increased likelihood of a Type II error.

SUMMARY

As no statistically significant difference was noted at any of the treatment periods, it can be said that both groups responded equally in terms of cervical range of motion. Power analysis was low at all three treatment periods which indicated that there is an increased likelihood of a Type II error.

5.3.2.2 Algometer Readings

No statistically significant difference ($p = 0.116$) was noted between the two groups with respect to data from the first consultation, indicating that the groups were similar in terms of initial pain threshold levels at the beginning of the trial (Table 4.16). Power analysis (0.1001) shows an increased likelihood of a Type II error.

Comparison of algometer readings for the fifth consultation revealed no statistically significant difference ($p = 1$) between the two groups, indicating that both groups responded equally well to their treatment protocol (Table

4.17). Clinically, Group A appears to show a better response to the treatment (Figure 4.10). Power analysis (0.0625) reveals an increased likelihood of a Type II error.

Follow-up consultation measurements again indicated no statistically significant difference ($p = 1$) and thus it can be concluded that the treatments' relative effectiveness was maintained equally in both groups (Table 4.18). Clinically, Group B showed a better maintenance of the treatments' relative effectiveness in terms of pain threshold levels (Figure 4.10). Power analysis (0.0574) revealed an increased likelihood of a Type II error.

SUMMARY

As no statistically significant difference was noted between the two groups at all three of the treatment periods, it can be said that both groups responded equally well to their treatments in terms of algometer readings.

5.4 DISCUSSION

5.4.1 Intra-group Hypotheses

It was hypothesised that there would be a significant improvement between treatment 1 and 5, between treatment 5 and follow-up and finally between

treatment 1 and follow-up in terms of subjective and objective clinical findings, showing that both treatment groups were effective.

The two hypotheses pertaining to improvement between treatment 1 and 5 and 1 and follow-up are rejected as there was significant improvement in terms of subjective and objective clinical findings. The hypothesis pertaining to the improvement between treatment 5 and the follow-up is accepted as there was no significant improvement in terms of subjective and objective clinical findings. Therefore it can be said that significant improvement occurred in both groups between the first and fifth and the first and follow-up consultations but no improvement occurred between the fifth and follow-up consultations in either groups.

It can be concluded that both treatment protocols were effective during the treatment period and that both groups did not maintain relative long- term effectiveness.

5.4.2 Inter-group Hypotheses

It was hypothesised that there would be a significant difference between the two groups with respect to the subjective and objective clinical findings, showing that one treatment protocol was more effective than the other.

When comparing Group A and Group B in terms of subjective and objective data, it can be seen that no statistically significant differences occurred at the initial, fifth and follow-up consultations. Clinically it was evident that Group A responded better at the fifth and follow-up consultations in terms of disability caused by pain (Figure 4.1). Group A also showed a slightly better improvement in terms of the sensory, affective and qualitative dimensions of pain at the fifth consultation (Figure 4.2). Group B, however, showed a slightly better improvement in terms of the above dimensions of pain at the follow-up consultation (Figure 4.2).

5.4.3 Power Analysis

According to Portney and Watkins (1993:351-352) the purpose of power analysis is to determine the probability that a Type II error (falsely accepting the null hypothesis) was committed when a non-significant finding resulted from the study. The probability of making a Type II error is denoted by beta (β). The closer the value of $1-\beta$ is to 1, the better the power of the study. A power of 0.8 represents a reasonable protection against a Type II error.

5.4.3.1 Intra-group Power Analysis

The power of intra-group analysis is high for the McGill Pain Questionnaire readings for consultation 1 to 5 (0.8792) and 1 to follow-up (0.8792) for Group

A, and is also high in consultation 1 to 5 (0.9071) for Group B. These values indicate little chance of a Type II error occurring.

The NPRS-101 readings are high for consultation 1 to 5 (0.8069) and 1 to follow-up (0.9782) for Group A, and 1 to 5 (0.9071) and 1 to follow-up (0.9814) for Group B. These values indicate little chance of a Type II error occurring.

The Power analysis of the CMCC questionnaires is high for Group B for consultation 1 to 5 (0.9845) and 1 to follow-up (0.9633), indicating little likelihood of a Type II error occurring.

Power analysis of the Algometer readings is high for Group A for consultation 1 to 5 (0.9918) and 1 to follow-up (0.999), and for Group B for consultations 1 to 5 (0.7878) and 1 to follow-up (0.9853). This indicates that there is a decreased likelihood of a Type II error occurring.

5.4.3.2 Inter-group Power Analysis

The Inter-group power analysis of subjective reading revealed a poor power for all measurements when comparing the first, fifth and follow-up consultations (Table 4.13, 4.14, 4.15). This indicates an increased likelihood of a Type II error occurring.

The objective readings comparing both groups also displayed a poor power for all algometer and cervical ROM measurements and all three consultations (Table 4.16, 4.17, 4.18).

In general, the power of this study was poor. According to Portney and Watkins (1993:351), when small sample sizes are used, as are often used in clinical research and which was the case in this study, it is expected that the power of the study will be substantially low. Portney and Watkins (1993:352) also mention that the clinical significance of a study could be greater than suggested by the statistical outcome if a poor power analysis exists.

CONCLUSIONS

Both groups showed improvement as a result of their respective treatments. Statistically, there is no significant difference between the two groups indicating that both forms of treatment are equally effective. Clinically, at various stages, Group A appeared to respond more effectively than Group B and, at other stages, Group B appeared to respond more effectively than Group A. It is the researcher's belief that with a larger sample size, a statistical difference between the two groups may become evident, revealing which of the two treatments is more effective.

5.5 LIMITATIONS OF THE STUDY

There are various reasons as to why the subjective measurements may have had their limitations in terms of the condition being treated and the treatment protocol being administered. The first such limitation is that the questionnaires were not designed purely for this condition or for these treatment protocols. In the future, questionnaires relating specifically to myofascial trigger point pain and its response to treatment should be designed and used.

The second such limitation is possible misunderstanding of the questionnaires by the patient which may have affected their response, and therefore the outcome of the results. Patients may have also recorded improvements that were beyond those actually felt in order to please the researcher.

There are also various reasons as to why the objective measurements may have been faulty. The first such reason is due to human error when recording calibrations and the possible risk of incorrect user methods. The second reason is the accuracy when re-finding active myofascial trigger points on subsequent visits. It is suggested that an independent examiner be included to ensure correct recording and calibration of equipment. It is also suggested that active myofascial trigger points be marked with indelible ink so that they can be easily located throughout the treatment.

The small sample size of this study is also a weakness, as this resulted in Type II errors occurring.

Another point to consider is the demographics of the study. There was a gender imbalance in the study with a far greater percentage of females taking part than males (33%). There was however, relatively equal distribution of males and females in each group (Table 4.20). A greater distribution may have given more representative results.

The age distribution was relatively acceptable when comparing the two groups and was good within each group, with a large group of patients being between the ages of 46-55 (Table 4.19).

5.6 COMPARISON OF THE RESULTS WITH OTHER STUDIES

Comparison to a study done by Morgan (1997).

The results of the study are compared to those of Morgan (1997) due to their similarity. The sample size, the condition treated, the muscles treated, the number of treatments were identical, except the treatments were spread over a three week period unlike this study in which the treatments were spread over a period of two weeks. Both studies had a one - month follow up consultation after the fifth treatment. Morgan (1997) compared the effectiveness of vitamin supplementation in dry needling and muscle stretching therapy in Myofascial Pain Syndromes. One significant difference

between the studies is that in Morgan's study, the patients stretched at the treatment and were required to stretch three times a day at home, holding the stretch for twenty seconds and repeating that three times each session.

Both groups in Morgan's study, as in this study, showed significant improvement over the treatment period, but this was not maintained over the follow up period. In both studies the comparison of the two treatment groups showed that there was no significant difference between the two groups.

Comparison with a study done by Hong et al. (1993).

Hong (1993) conducted a randomised, controlled study which involved 84 patients with myofascial pain syndrome and 24 normal subjects. The purpose of this study was to determine the immediate effectiveness of treatment on active myofascial trigger points with physical medicine modalities, including spray and stretch, hydrocollator superficial heat, ultrasound and deep pressure soft tissue massage. Only objective measurements were taken, involving algometer readings before and after the treatment. Three pain threshold readings were taken before the treatment and three pain threshold measurements were taken within 2 minutes after the treatment.

The study by Hong et al. (1993) differs from this study in that the patients only received one treatment compared to the five treatments that the groups in this study received. The sample sizes are similar with the average number of

people in the study done by Hong et al. (1993) being 18, compared to 15 in this study. The trapezius muscle was treated in both studies.

Hong et al. (1993) concluded from their results that all four physical medicine modalities studied are effective in increasing pain threshold of active myofascial trigger points immediately after treatment. They also found that deep pressure threshold was more effective than other modalities in increasing pain threshold levels, and stretch and spray was more effective than the thermotherapy (hydrocollator and ultrasound).

When comparing the median improvement of algometer readings (kg/cm2) for the last treatment with Hong et al.'s (1993) study it is evident that the stretching in this study is similar in results to the group receiving massage in Hong et al.'s (1993) study (medians =3 in both cases). Massage was far more effective than stretch and spray (median =1.4) in the study conducted by Hong et al. (1993).

CHAPTER SIX

Recommendations and Conclusions

CHAPTER SIX

6.0 RECOMMENDATIONS AND CONCLUSIONS

6.1 RECOMMENDATIONS

It is recommended that a larger sample size (e.g. 30 patients in each group) be used if this study is to be repeated. A small sample size makes accurate statistical analysis difficult. A larger sample size is recommended so that paired and unpaired t-tests can be performed, as sensitivity to subtle changes is greater and trends in the data would be more apparent. It is suggested that in future studies, stretching techniques for the treatment of active myofascial trigger points be compared to a control group to further establish which type of stretching is relatively more effective.

It is recommended that the duration of the condition and the amount of dysfunction be taken into account if this study is to be repeated. It is also recommended that patients with concomitant or associated complaints such as cervical facet syndrome be dismissed.

In future studies of this nature, certain factors need to be taken into account. These include the effect of gender, age and patient characteristics in the treatment of myofasciitis.

The experience and reliability of the examiner and the accuracy of the measurement parameters do need to be considered. It is recommended that the issue of patient blinding be considered, as well as the possible use of an independent examiner.

It is recommended that more advanced testing tools (e.g. thermography) for myofascial trigger point pain syndrome be included to provide a more accurate assessment of the condition. It is also recommended that specific questionnaires relating to myofascial pain syndromes be considered, so as to provide more accurate subjective data.

6.2 CONCLUSIONS

From the results it would appear that both groups responded equally well to their respective treatment protocols in the treatment of myofasciitis of the shoulder girdle and neck muscles. Significant improvement was noted between the first and fifth and the first and follow up consultations in both groups. The PNF stretching group showed a more significant clinical, but not statistical, response to treatment. It is possible that this treatment may maintain a more favourable response and that there may be less likelihood of the symptoms returning.

A statistically significant difference was evident between the two groups with regards to the algometer readings comparing the pain threshold levels at the

fifth consultation. There was a significant subjective statistical difference in the pain perception levels between the two groups at the fifth treatment, with the PNF stretching group showing less pain perception levels. With exception of the above, there was no other statistically significant difference between the two groups.

From the above it can be noted that both treatment protocols are reliable interventions in the treatment of active myofascial trigger points. It could be noted that clinically, but not statistically, the PNF stretching therapy may be a more effective treatment when compared to the static stretching in the treatment of active myofascial trigger points. This is evident from the statistically significant difference noted when comparing the algometer readings and subjective pain perception levels from the fifth consultations of patients from the PNF stretching group.

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APPENDICES

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: Current:

X-Ray Studies:
Previous: Current:

Clinical Path. lab:
Previous: Current:

Case Status:

PTT: Conditional: Signed Off: Final Sign out:

Recommendations:

Intern's Case History

1. Source of History:

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

3. Present Illness:

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

4. Other Complaints:

5. Past Medical History:

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

6. Current health status and life-style:

- Allergies
- Immunizations
- Screening Tests
- Environmental Hazards (Home, School, Work)
- Safety Measures (seat belts, condoms)
- Exercise and Leisure
- Sleep Patterns
- Diet
- Current Medication
- Tobacco
- Alcohol
- Social Drugs

7. Immediate Family Medical History:

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

8. Psychosocial history:

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

9. Review of Systems:

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

TECHNIKON NATAL

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

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

1. VITALS

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

2. GENERAL EXAMINATION

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

Urinalysis:

3. CARDIOVASCULAR EXAMINATION

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

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

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

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

Percussion: - borders of heart

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

4. RESPIRATORY EXAMINATION

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

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

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

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

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

5. ABDOMINAL EXAMINATION

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

Inspection
- Shape:
- Scars:
- Hernias:

Palpation
- Superficial:
- Deep = Organomegally:

- Masses (intra- or extramural)
- Aorta:

Percussion - Rebound tenderness:
- Ascites:
- Masses:

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

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

6. G.U.T EXAMINATION

External genitalia:
Hernias:
Masses:
Discharges:

7. NEUROLOGICAL EXAMINATION

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

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

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

Evidence of head trauma:

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

Cranial Nerves:

I Any loss of smell/taste:
Nose examination:

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

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

III Ocular Muscles:
Eye opening strength:

IV Inferior and Medial movement of eye:

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

b. Motor - Masseter:
- Jaw lateral movement:

c. Reflexes - Corneal reflex
- Jaw jerk

VI Lateral movement of eyes

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

b. Taste - Anterior two-thirds of tongue:

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

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

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

XII Inspection of tongue (deviation):

Motor System:

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

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

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

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

Sensory System:

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

b. Joint position sense
- Finger:
- Toe:

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

Cerebellar function:

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

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

8. SPINAL EXAMINATION:(See Regional examination)

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

9. BREAST EXAMINATION:

Summon female chaperon.

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

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

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

Patient: _____ File: _____

Date: _____ Intern/Resident: _____

Clinician: _____ Sign: _____

OBSERVATION:

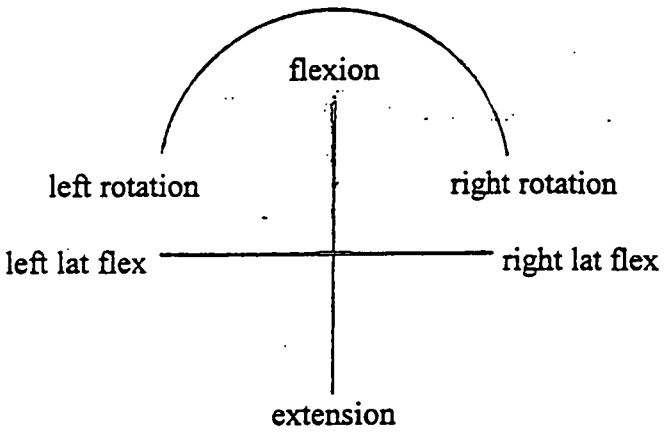
Posture
Swellings
Scars
Discolouration
Hair Line
Bony & Soft Tissue Contours

Shoulder position:
Left:
Right:
Muscle spasm
Facial expression

RANGE OF MOTION:

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

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



PALPATION:

Lymph Nodes
Thyroid Gland

Trachea

ORTHOPAEDIC EXAMINATION:

Tenderness
Trigger Points: SCM, Scalenii, Post Cervicals, Trapezius, Lev Scap

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

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

Dizziness rotation test
Brachial plexus tension

Lhermitte's sign

NEUROLOGICAL EXAMINATION:

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

VASCULAR:

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

MOTION PALPATION & JOINT PLAY:

Left: Motion Palpation:
Joint Play:

Right: Motion palpation:
Joint Play:

Basic Exam: Shoulder:
Case History:

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

Upper T horacics:
Motion Palpation:
Joint Play:

Basic Exam: Thoracic Spine:
Case History:

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

APPENDIX D

GONIOMETER AND ALGOMETER MEASUREMENTS

PATIENT'S NAME: _____

GONIOMETER MEASUREMENTS

	TREATMENT ONE	TREATMENT FIVE	FOLLOW UP
Flexion:			
Extension:			
R. Rotation:			
L. Rotation:			
R. Lat. Flexion:			
L. Lat. Flexion:			

ALGOMETER MEASUREMENTS

TRIGGER POINT	TREATMENT ONE	TREATMENT FIVE	FOLLOW UP

APPENDIX E

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_____ Signature_____
(in block letters)

PARENT/GUARDIAN* Name_____ Signature_____
(in block letters)

WITNESS Name_____ Signature_____
(in block letters)

RESEARCH STUDENT Name_____ Signature_____
(in block letters)

APPENDIX F

MEASUREMENT OF PAIN

SHORT-FORM McGILL PAIN QUESTIONNAIRE

RONALD MELZACK

PATIENTS NAME: _____ DATE: _____

	NONE	MILD	MODERATE	SEVERE
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) _____

NO PAIN ——— WORST POSSIBLE PAIN

P P I

0	NO PAIN	_____
1	MILD	_____
2	DISCOMFORTING	_____
3	DISTRESSING	_____
4	HORRIBLE	_____
5	EXCRUCIATING	_____

FIGURE 10.5. The short-form McGill Pain Questionnaire. Descriptors 1–11 represent the sensory dimension of pain experience and 12–15 represent the affective dimension. Each descriptor is ranked on an intensity scale of 0 = none, 1 = mild, 2 = moderate, 3 = severe. The Present Pain Intensity (PPI) of the standard long-form MPQ and the Visual Analogue Scale are also included to provide overall pain intensity scores. Copyright 1984 Ronald Melzack.

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 infrequently.
- ☐ I have moderate headaches which come infrequently.
- ☐ 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.

Patient name:_____ Res.No:_____ Date:_____

7.4 NUMERICAL RATING SCALE-101 QUESTIONNAIRE

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 only write number.

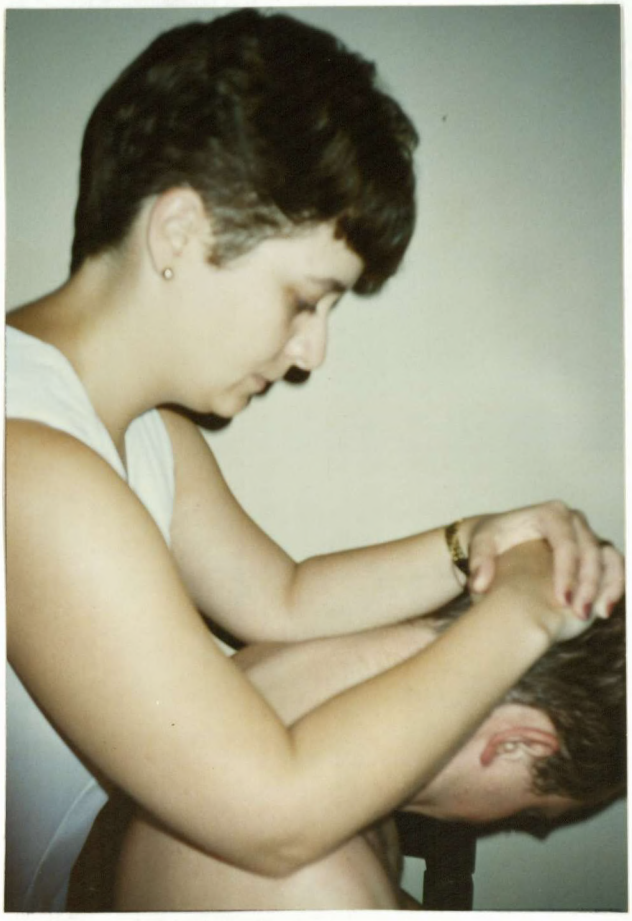
_____

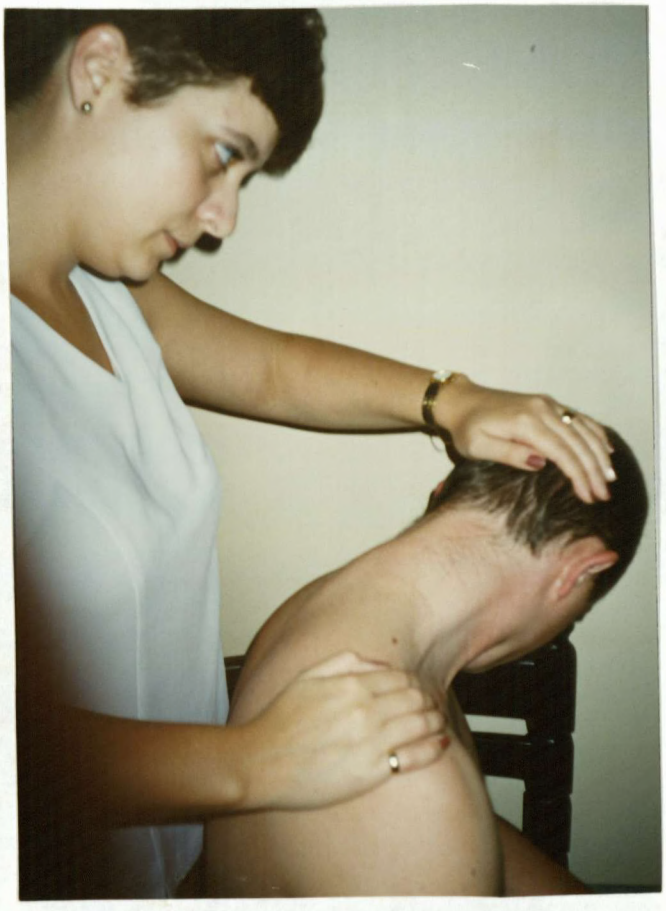
Please indicate on the line below, the number between 0 and 100 that best describes the pain you experience when it is at its least. A zero (0) would mean "no pain at all", and one hundred (100) would mean "pain as bad as it could be". Please only write number.

_____

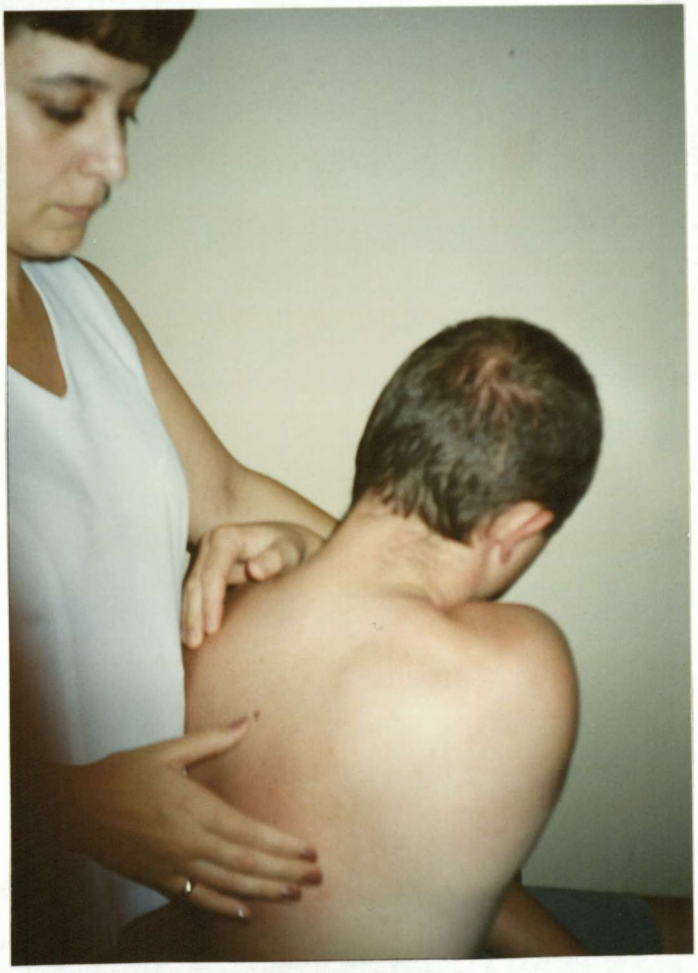
APPENDIX I

1) Static Stretch: Trapezius muscle





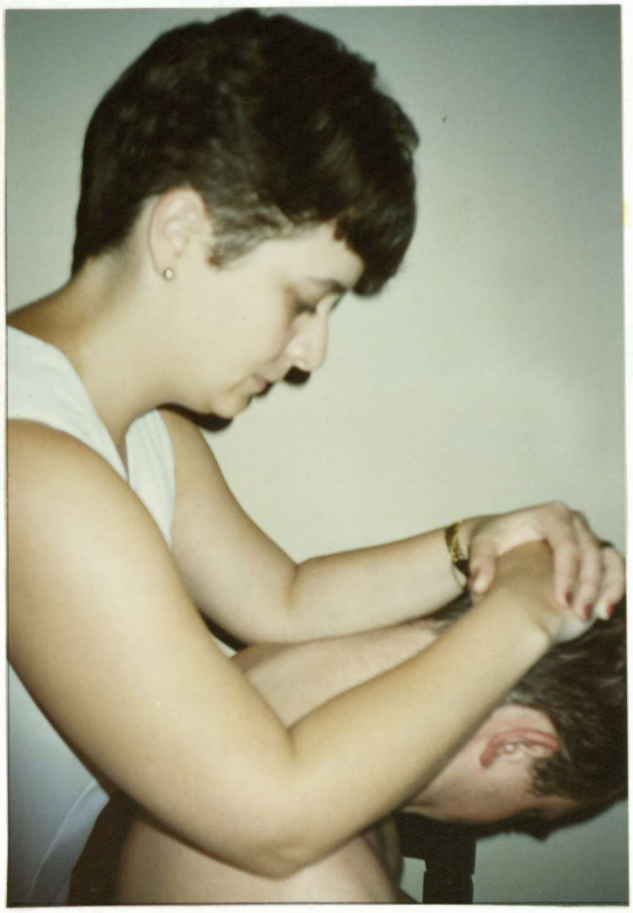
2) Static Stretch: Infraspinatus muscle

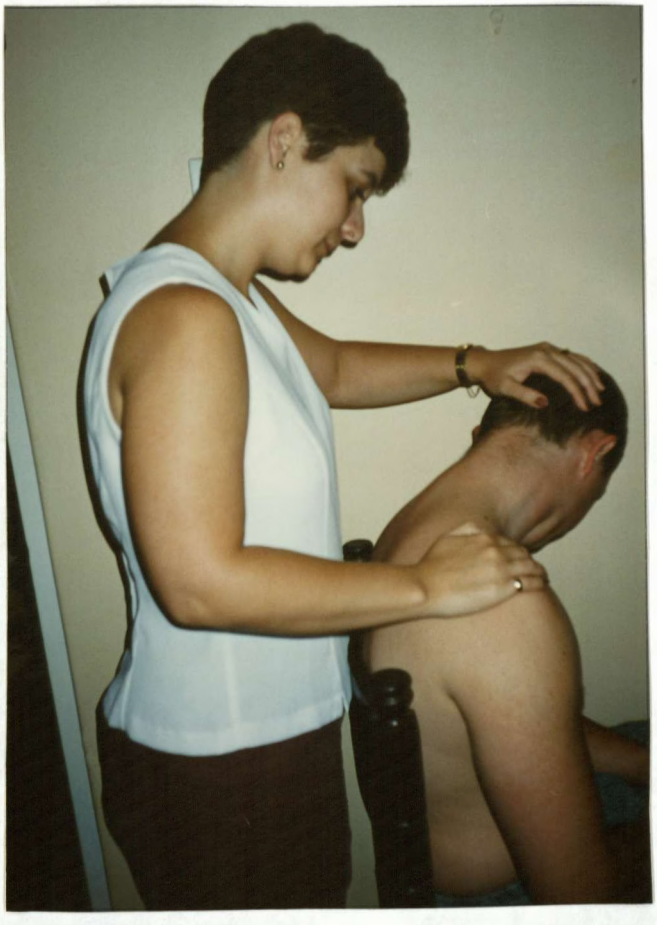


3) Static Stretch: Rhomboids

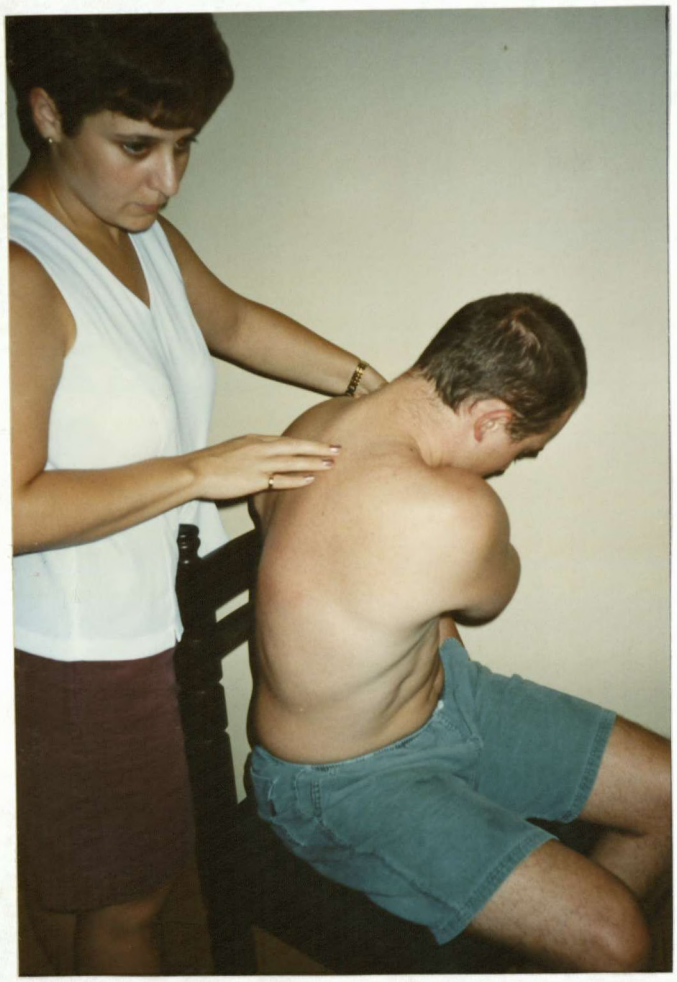
APPENDIX J

1) PNF Stretch: Trapezius muscle





2) PNF Stretch: Infraspinatus muscle



3) PNF Stretch: Rhomboids